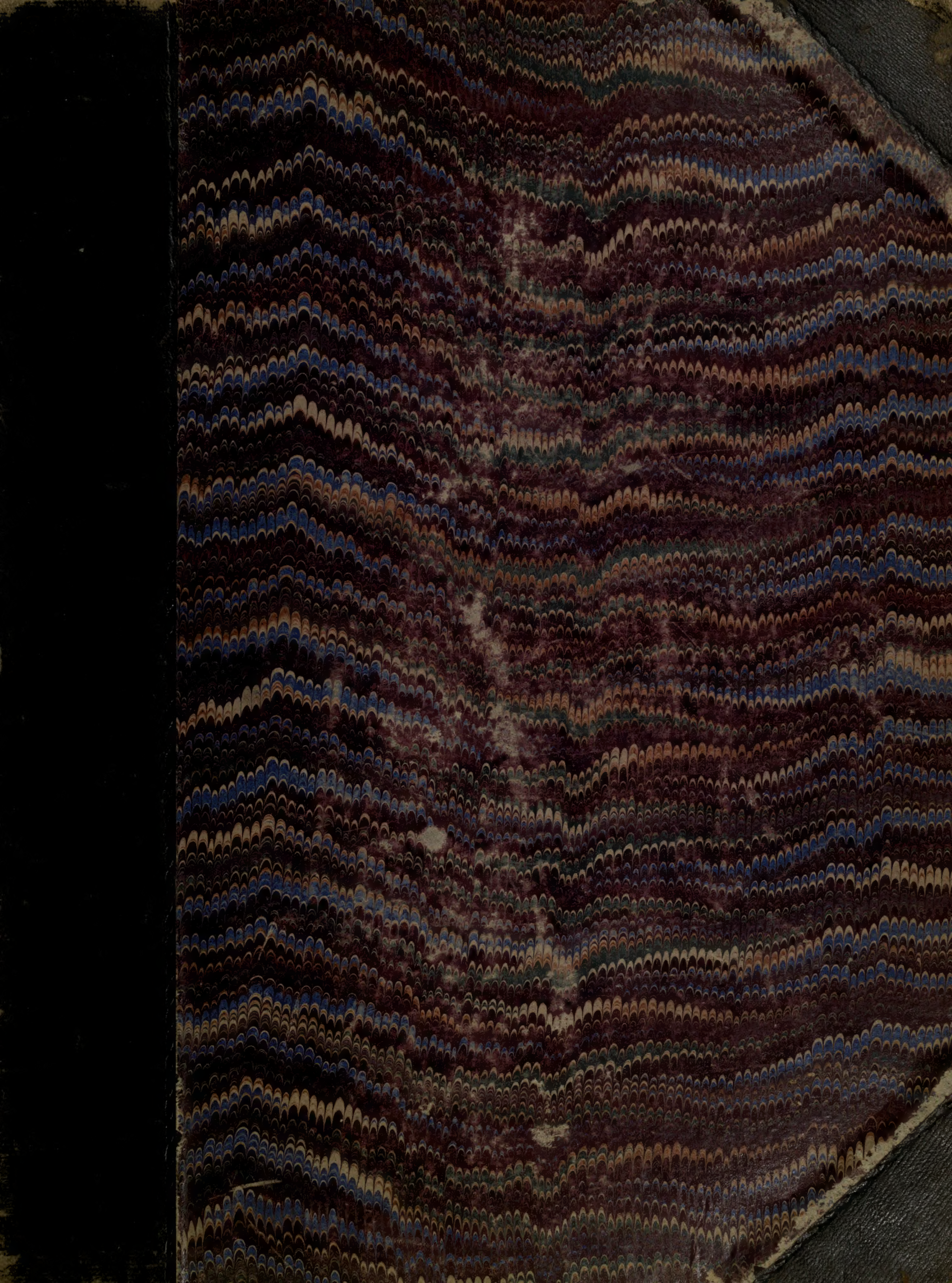

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THE ENGINEERING RECORD

ESTABLISHED 1877

BUILDING RECORD
AND THE SANITARY ENGINEER

Conducted by Henry C. Meyer.

VOLUME XLIV.

JULY—DECEMBER, 1901.

106834
20.12.10

100 WILLIAM STREET
NEW YORK.

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The abbreviation (I) signifies illustrated articles.

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THE ENGINEERING RECORD,
BUILDING RECORD AND THE SANITARY ENGINEER.

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Volume 44. NEW YORK, JULY 6, 1901. Number 1.

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Conservation of Water Supplies.

The reports of water boards and of societies interested in water-works subjects show that the conservation of water supplies is attracting wide attention. Future supplies, the purification of water, and the prevention of leakage and waste are being considered everywhere. Even boards of health have had the matter brought to their attention officially by projects of one community to enter watersheds belonging to another or by requests for permission to discharge unpurified sewage into streams from which water is drawn for drinking purposes. The trouble is so prevalent that it seems desirable to point out its essentially transitory nature. It arises in most cases from a failure to estimate accurately the probable total consumption. Figures were obtained too often from large cities where many people used well water and manufacturing stablishments had private supplies. Works planned on the basis of such figures were fairly certain to prove of inadequate capacity. The lavish provision of 150 gallons per capita has been recommended lately for both New York and Philadelphia, an excessive amount for a small place, although in small towns the needs for fire protection call for plants of large capacity relative to the normal draft. Insurance records bear frequent witness that many cities have works about as useful as a garden squirt for extinguishing fires. Fortunately science has shown how to make available at a low cost sources of supply which no one would think of using formerly, and the great developments in the meter business afford means of detecting the leakage and waste which result from careless habits formed when supplies were plentiful. We must certainly furnish more water per capita than was previously thought necessary, but we can obtain it from more sources and we can prevent its waste.

The Mechanical Plant of the Newark Free Public Library.

The Newark Free Public Library occupies a building recently opened to the public, in which there is a mechanical plant furnishing power, heat and light. The Library is a large one, quite interesting architecturally in its general arrangement; and its mechanical features are very complete, particularly for a building of its class. Power is required for a passenger elevator, for a number of book lifts and for various motors; heating is obtained by direct, indirect and direct-indirect steam radiation, including an elaborate combination plenum and exhaust system of air distribution for ventilation; and lighting is accomplished by a two-wire electric system, with an interesting scheme of connections in the book stacks.

There are two return tubular boilers, with space for a third, and two 100-kilowatt generating units, employing simple non-condensing Corliss engines. A system of dust collectors in the book stacks is a feature of the installation, as is also the use of practically the entire basement for the ducts of the ventilating system, these being suspended from the ceiling and affording excellent means of access for management of heating surface and dampers. The basement, consequently, is of more or less limited headroom in parts and it is also considerably cut up with numerous brick pillars, so that this use of it was possible; it possesses a cement floor and a well-lighted interior. Four disk fans take care of the air of the whole ventilating system. In lights there are over 2,250 of 16 candle-power.

The library building proper is a four-story structure of classic exterior and occupies about 102 x 137 feet ground space. The book stacks are located in what is practically a detached fire-proof building, accessible only through a comparatively indirect passage from the main building, so that windows were possible on all sides of both buildings. The book-stack building stands toward a rear corner and at the other rear corner is the power house, extending several feet above ground and under its own roof, which adjoins the main building. Altogether the library occupies a plot of ground about 102 x 220 feet in extreme dimensions. The main building encloses approximately 739,000 cubic feet of air and the book-stack building, which is about 40 x 60 feet in plan and carries six 7-foot stack stories, has roughly about 79,200 cubic feet of space.

The entrance into the building is at the center of the front into a vestibule, which opens into a large public hall rising through the building as a light shaft, giving space to a grand staircase in the first story, and surrounded at every story above by corridors behind arcades on all four sides. A plan of the ground floor herewith shows the disposition of two large rooms for children and for newspapers, at street level, the latter also with a direct side entrance. In the back part of the colonnaded light court is a passenger elevator, which serves all floors. The ground floor has also a bindery and bicycle, stock and other rooms. The back portion of the main building is extended about 30 feet through three stories, the end of this connecting with the book-stack building. In the top story, however, the building, instead of having the rear extension, is cut into about 32 feet, making a court about 32 x 48 feet which affords increased lighting facilities for the museum and stairways.

The rear extension on the ground floor is used principally as the station delivery, the library supplying a number of outlying branches which are served by wagons backing up to the station delivery room. Above this on the main floor is the main delivery room, which takes up the whole of that floor back of the light court, fitted up with book shelves at one side for works of fiction and on the other for works of biography, with the stacks arranged on the alcove plan and in two tiers; the space back of the delivery desk is provided with ready access at the back to the book-stack building. A half plan of the floor is given in an accompanying cut. The main reading room is located on this floor, extending across the entire front. Opposite the librarian's and the custodian's rooms is a room of their combined size set apart for catalogues.

The second floor, that is, the third story, has a separate large room for art books, and another for patents, as shown in an accompanying half plan; and there is a reference department of about 4,000 square feet floor area, with an official cataloguing room opening from it, symmetrical in position with the alcove portion of the reference room. The librarian has a private room on this floor directly opposite the patents room and there are rooms for the staff in the front corner. The extension on this floor is devoted in part to study rooms reached through the reference room. The third floor is shown in another drawing with the ventilating apparatus in the attic indicated in dotted line. It has a lecture room extending across the front with a stage at one end and ceiling skylights above. The rest of the floor is devoted to art galleries on one side and museums on the other.

The building is heated by direct, indirect and direct-indirect radiation, with steam supplied on a two-pipe system and circulated under gravity return. As usual, the exhaust of the electric-lighting engines is utilized, with provision for the additional supply of live steam at reduced pressure, when necessary. There are two boilers at present installed, of the horizontal return tubular type, with shells 66 inches in diameter and 16 feet long, containing 4-inch tubes. These are placed in a setting which is provided with hollow tile beneath the firebrick in the bridge wall, by which air may pass from the ash pit into the combustion chamber; and the gases are made to pass backward over the shell into a smoke connection at the rear. This is of hard-burned brick lined with firebrick and supported overhead on heavy iron bars built from the boiler setting into the powerhouse wall and connecting with a square brick chimney. The boilers are located in a room 24 x 34 feet with 6 feet firing space, opposite which is the coal storage space. This is under the rear court yard and coal is dumped directly into it through ordinary chutes.

The boilers feed a 10-inch header by copper bends 6 inches in diameter, rising from a dry pipe in each boiler and entering the header at the top. The header is carried on the boiler setting and passes into the engine room, pitching slightly in that direction and terminating in a curved elbow pointing downward and closed with a blank flange from which a drip pipe is taken to a steam trap. The engine room is 31 x 34 feet in plan and contains two generating units, pumps, and feed-water heater and the switchboard. The engines are Watts-Campbell Corliss engines of 16 x 30-inch cylinders, and each drives a Crocker-Wheeler generator of 100 kilowatts capacity to which it is directly connected, running at a speed of 120 revolutions per minute. The engines are provided with two fly-ball governors, the second one serving to shut off steam to the cylinder at an increase of 10 per cent. in the speed. The average steam pressure carried at present is 85 pounds. The fly-wheel in each case is 10 feet in diameter and is mounted between crank and generator. A 7-inch pipe for the engines is taken from the top of the steam main, passing to a point overhead between the engine cylinders where it subdivides into an inverted Y breaking into two 5-inch pipes, one for each engine. The exhaust is carried under the floor in trenches to the feed-water heater.

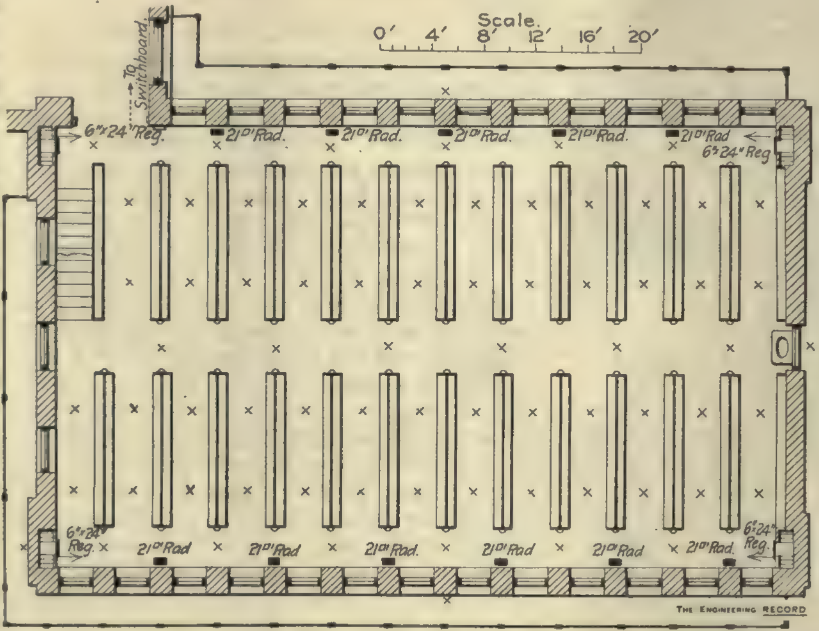
The low-pressure steam piping system, for heating, is, as stated, a two-pipe one with the mains in the basement. The exhaust steam pipe at the feed heater rises from the trench toward the ceiling, where it branches into two 10-inch pipes extending in opposite directions, one leading to a free exhaust riser to the atmosphere alongside the brick smoke chimney, fitted with the usual back-pressure valve, which provides an escape of an excess of exhaust steam during the heating season, and the other branch feeding the heating system. This it does at a cross, the second arm of the cross receiving an 8-inch pipe which brings live steam, reduced in pressure, from the boilers, and the third and fourth, 6 and 12 inches in diameter, being the heating mains, the former for the main tempering coils, in connection with the plenum system, and the book stack building, and the latter for the rest or the main building.

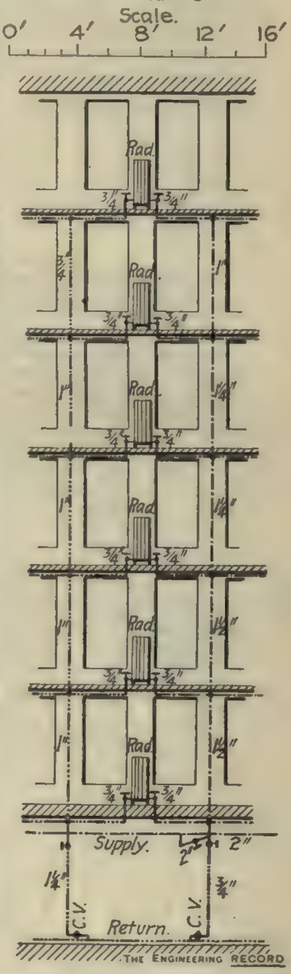
Steam mains and returns are located in the basement, where most of the radiation is, and the radiators distributed on the various floors above are supplied by risers, the horizontal branches to the risers being taken from the bottom of the steam main and the base of the steam risers being provided with a bleeder to the return lines, which are carried on the cement floor, so that steam mains and steam risers are drained by the same pipes. The rising lines are run in chases left in the walls, packed with mineral wool around the pipes.

The steam main subdivides into a number of smaller mains, as indicated, and the returns travel back parallel with them, finally collecting into a 6-inch main which is run toward the engine room. Before dropping to the floor of this room and connecting with the feed-water heater, which is arranged for use as a receiving tank for the heating system, it has a water seal of the inverted U type with the vertical pieces of the pipe forming the U about 4 feet high, provided with a by-pass or direct continuation of the main, controlled by valve, so that it can be blown through at any time. The feed-water heater is a Cochrane heater, provided with oil separator. The water is delivered from this to the boilers by feed pumps, of which there are two, of the Barr make and 6 x 4 x 6-inch duplex type, cross-connected, the suction being taken from the return main, which extends across the pumps in a trench and which terminates in the feed-water heater. These pumps and a 4 x 4 x 5-inch single-acting pump for lifting the contents of the blow-off tank to the sewer whenever necessary, are located side by side in the engine room near the feed heater. The blow-off tank, which is 5 feet in diameter by 12 feet long, is located in a brick pit built under the coal vault.

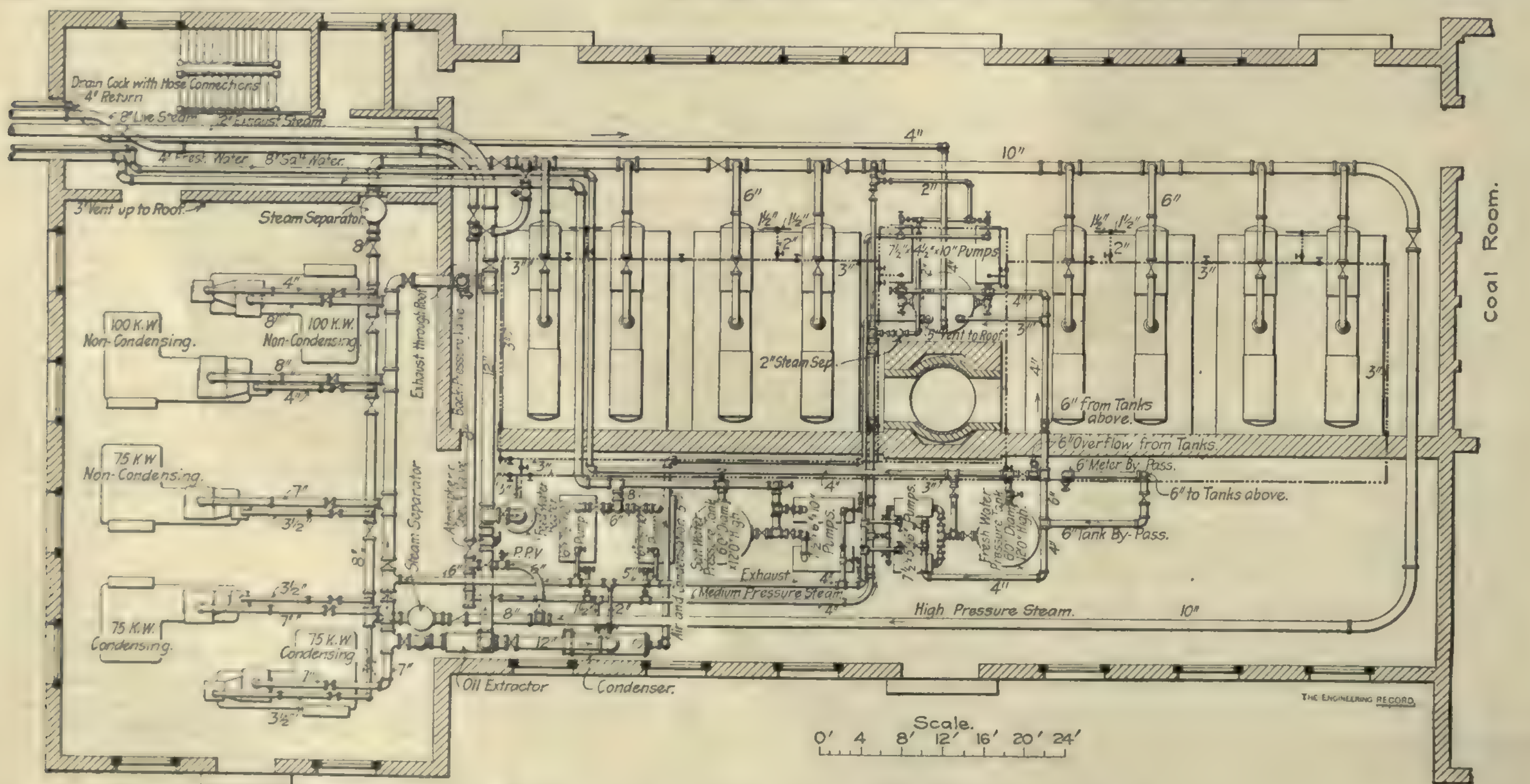
The plenum system starts from the rear court where the fresh air is taken through a hooded inlet. It drops into a brick chamber in which there are two banks of cast-iron indirect radiators, two tiers each, provided with by-pass underneath, for allowing such a portion of the air, as desired, to pass through without warming. Altogether there is about 600 square feet of surface in the four groups. The air passes directly to a fan, which is of the Seymour disk type, 96 inches in diameter, motor driven by belt. It discharges into a duct of 29¼ square feet cross-section, which is carried at the basement ceiling toward the front of the building. It supplies various branch duct mains, as indicated on the basement plan.

Immediately beyond the fan a small branch is taken from the duct on each side and some





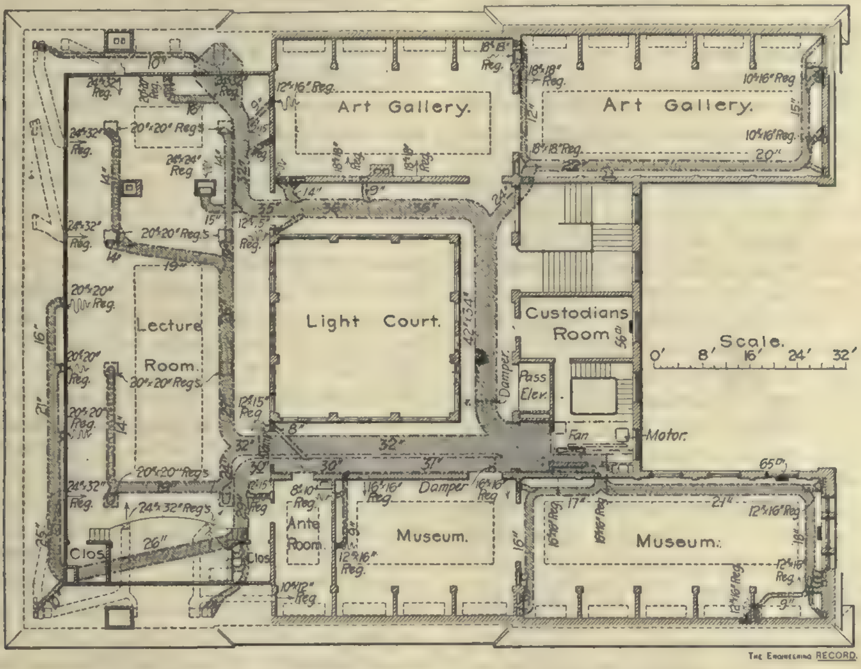
Typical Book-Stack Floor and Book-Stack Radiator Connections.



THE MECHANICAL PLANT OF THE NEWARK FREE PUBLIC LIBRARY.

RANKIN & KELLOGG, ARCHITECTS; FRANCIS BROTHERS & JELLETT, ENGINEERS.

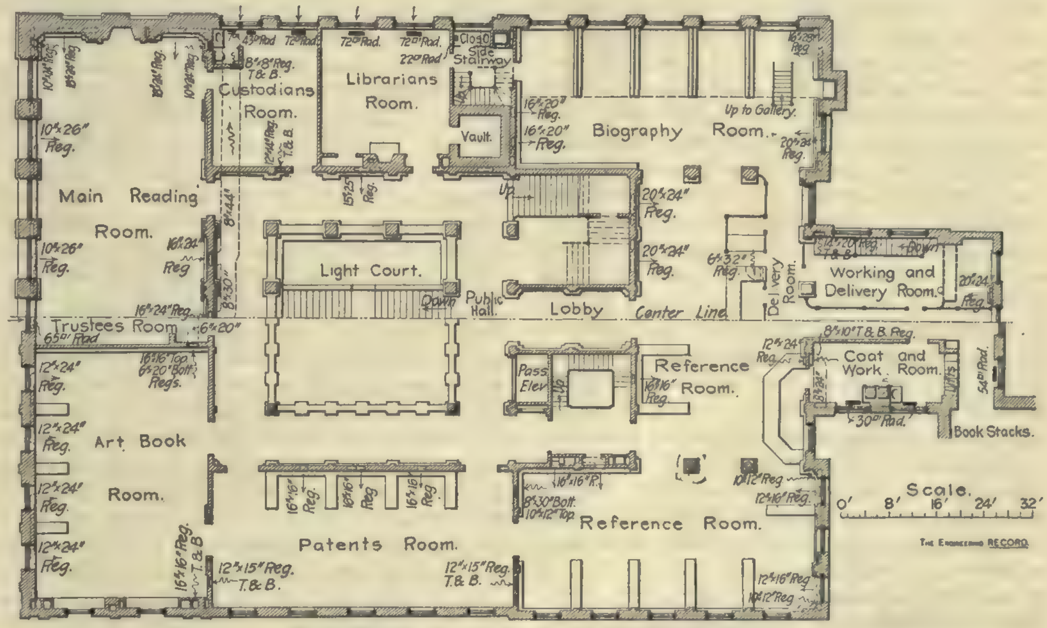
distance beyond two large ones start. These are 1,800 and 2,300 square inches in cross-section and pass in opposite directions around the outside of the building, supplying practically all the indirect radiators. Grouped around the center of the main building, however, are a number of other indirects that are supplied from the continuation of the main duct, this finally subdividing into two small main ducts which supply tempered air to flues for the lecture room on the top floor. Some of the indirect radiators in the center of the basement provide a hot-air supply for the other rooms of the top story. At branches from the main duct, there is, in general, a wedge or diverting damper at the junction of the main and branch to direct the desired proportion into the branch. An interesting feature in connection with the basement duct system is that the two main branch ducts—those supplying the indirect radiators distributed about the outside of the basement—are connected at their far ends, across the front of the basement, so that there is a continuous circuit and the distant indirects may surely receive their proper proportion of air, regardless of wind conditions likely to influence the pressure in the different rooms.



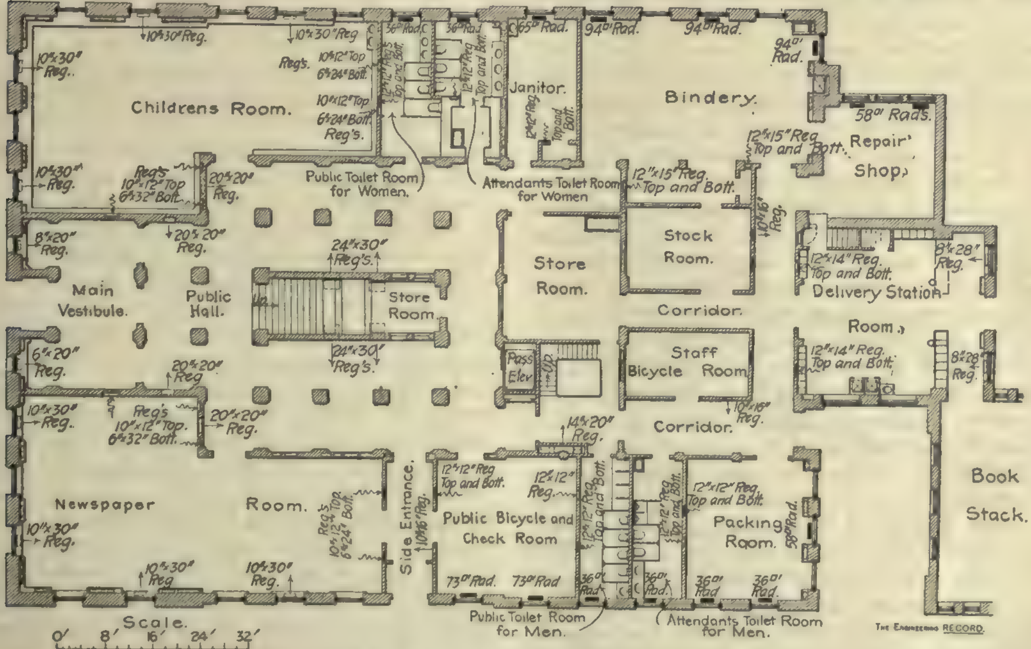
THIRD FLOOR, SHOWING ATTIC VENT DUCTS.

The indirect radiators are suspended from the ceiling at the flue bases they supply and the branch duct to it feeds tempered air which passes through the stack and thence into the warm-air flue. Some of the large and much-used rooms—the children's and newspaper rooms on the ground floor, the reading room and the delivery working space with the biography and fiction departments on the main floor—are designed for thermostatic control, the intention being to vary the temperature of the inflowing air by a mixture of tempered and heated air. In these cases, the tempered air branch duct splits, one part leading, as before, to the indirect casings and the other passing underneath it in an independent path to the flue. A damper at the split is arranged to vary the amount admitted to the two air channels. The thermostats are to be grouped, in the reading room, for example, so that two will control four flues each. The flues are of galvanized iron throughout and rise in chases for the purpose. In general the air is discharged about 8 feet above the floor. In the reading room, part of the air enters through registers in the window sills, which are about 5 feet above the floor. Where there are book cases, the discharge inlet is above them, controlled by cords.

A table giving data on the ventilation and heating of the principal rooms of the building is given herewith. In all these cases but one, the radiation is indirect, the exception being the book-stack building, in which the heating is obtained by direct radiation comprised in 66 radiators aggregating 1,386 square feet, while tempered air is distributed through it for ventilation, entering through 24 registers and passing out in the dust extractor system. The cubical contents are given for all the rooms and the desired number of air changes per hour. The warm-air flues are calculated for 400 feet velocity to the ground-story registers and 500 to all stories above. It will thus be seen, from the third column, allowing 0.7 as the ratio of free flow area in a register to the total area, that the velocity of discharge ranges from 380 feet per minute in the ground floor rooms to 300 feet per minutes in the Art Gallery. The Lecture Room was designed to have 10,000 cubic feet of air per minute, which makes 15 changes per hour. The exhaust air system was designed to take slightly less than the amount of air sent into the building, so that there would be a tendency for the air to flow outward through open doors, due to the slight excess of pressure, and not cause in-drafts; this is indicated in the fourth column, which gives the ratio of the areas of vent to fresh-air flues. The remaining



HALF PLANS OF THE MAIN AND SECOND FLOORS.



PLAN OF THE GROUND FLOOR.

three columns give the exposed wall and glass surface and the amount of radiation installed.

Table of Ventilation and Heating in the Principal Rooms.

Rooms.	Contents, cu. ft.	Air change per hr.	Ratio heat reg. to flue.	Ratio vent flue to ht. flue.	Exposed wall, sq. ft.	Exposed glass, sq. ft.	Heating surface, sq. ft.
Children's room...	22,275	6	1.5	0.65	1,022	288	440
Newspaper room..	22,275	6	1.5	0.65	1,022	288	440
Delivery station..	11,907	4	1.5	0.75	588	168	240
Side entrance......	2,363	4	2.2	....	.....	.....	50
Main reading	59,367	6	1.6	0.48	2,599	845	1,160
Biography	25,704	5	2.3	0.39	1,274	343	520
Delivery	47,943	5	2.	0.44	1,480	389	950
Fiction	25,704	5	2.3	0.45	1,249	389	520
Public catalog....	24,633	4	2.	0.76	796	275	480
Official catalog....	16,524	4	2.	0.78	830	210	320
Reference	36,167	4	2.2	0.77	956	300	700
Patents	15,836	4	2.3	0.79	539	150	300
Art Book	16,781	4	2.	0.74	833	180	320
Lecture	39,218	..	1.9	1.05	2,745	485	400
Museum	25,381	4	2.1	0.79	1,790*	898	280
Art Gallery	28,256	4	2.4	0.76	1,914*	919	390
Book Stacks	79,233	..	...	....	5,004	3,096	1,386
Freight Elev. Hall	14,307	4	...	....	427*	60	140
Public Hall	182,480	4	...	....	1,908*	1,100	1,840

*Includes roof surface, 1,169 sq. ft. in Museum; 1,174 sq. ft. in Art Gallery; 230 sq. ft. in Freight Hall, and 454 sq. ft. in Public Hall.

The exhaust system of the ventilation covers the entire building in the following manner: All rooms on the ground floor and the entire book-stack are connected by flues leading down into the basement and delivering to fans which discharge directly out of doors, the apparatus serving the book stack comprising the dust removing system already mentioned. All rooms above the ground floor of the main building are ventilated by flues leading upward to an attic system of ducts, which run to a fan chamber, where the air is discharged by a fan at that point. The fans are in all three cases Seymour disk fans 42 inches in diameter, driven by Lundell motors. The dimensions of the attic ducts indicate the limited clearance of the space in which they are run. The main branch of the attic system, carrying air from all the ceiling outlets in the Lecture room ceiling, is controlled by a damper as shown, which is operated in the anteroom adjoining the lecture room, by cords with indicators to show the position of the damper. In general all vent registers are without valves, an exception being those in the book stack.

The dust-extracting system includes direct ventilation of the book stack building, the fan motor that sets up the draft for drawing away the dust also inducing an outflow through a separate set of openings spaced along the center of the first book-stack floor. Each floor register is connected by a 12-inch branch to a duct at the basement ceiling of the book stacks, running to the fan chamber at the rear end of the building. The dust extracting part of the system consists of a flue in each corner of the building, 12 x 16 inches in section, with openings at a convenient height above the floor. The four flues drop to horizontal ducts in the basement, which lead, as shown, to the fan chamber, the two main branches being controlled by blast gates to cut them out when desirable. The openings at every floor are fitted with iron doors in sliding frame; and a pair of books to be dusted are clapped together within the opening. To prevent the loss of the book down the flue, a wire screen is fitted in it, inclined toward the front. The temperature of the book stacks is arranged for themostatic control, the regulation to be made on the direct radiators, one thermostat for each side of the building on each floor, 12 thermostats in all.

The electric part of the installation, as stated, includes a lighting and power distribution, the latter for motors for lifts and fans. The switchboard consists of three panels, with a single set of bus bars on the back on which both light and power circuits are tapped. Each generator is connected through a single-throw three-pole switch and is protected by a single-pole circuit breaker. There are two ammeters, corresponding to the two machines and one voltmeter with the usual multiple-point switch. Besides these there is a recording wattmeter. The feeder switches are grouped on either side of the wattmeter and above the dynamo switches and below the indicating instruments, three for power circuits and the rest for lighting.

The mains for the electric lighting of the building rise through a shaft alongside the passenger elevator. The feeders are carried on the ceiling of the basement from the switchboard to the shaft, and one pair of conductor is run to each floor of the main building (two to the main floor) to a main box located at the shaft. From this box sub-mains are run to each of the other panel boards on each floor and in these the distribution circuits are tapped. The main hall and corridor lighting is distributed from the main box on each floor. The loss of potential allowed was 5 volts, as follows: Three volts on the main, one volt on submain and one volt on distributing circuits, except those feeding direct from the main box, which were allowed 2 volts, calculations based on all lamps burning at the same time and 0.6 ampere per 16-candle-power lamp. The feeders are carried up the shaft on porcelain knobs mounted on stout cleats, about 4 feet apart. The wiring system is a 2-wire one, in iron-armored conduit. A special arrangement of lights was had in the ceiling over the light shaft. A sub-feeder is tapped from the main panel box in the third story and formed into a closed loop around the court ceiling running through junction boxes with cut-outs from which groups of the lamps are fed by wires dropped in flexible tubing to them. The panel boards, of which there are 17 in the main building, are of Italian marble, 1 inch thick, set in a box of ½-inch marble linings.

The wiring of the book stacks is exposed with ⅜-inch conduit containing No. 14 duplex wire. Two mains run from the switchboard to the basement of the book stack building into junction boxes, one main and junction box for the aisle lights of the book stacks and the other for the book stacks themselves. The feeder for the aisle lights continues vertically from the junction box, passing through a panel box on each floor in one corner, six boxes in all, the main encased in steel conduit, one wire to a tube. Each panel board contains a main fuse, three branch fuses and three switches, corresponding to three aisle circuits. The feeder for the book cases consist of a pair of No. 00 B & S wires, which distribute through 25 fused circuits, all rising from the basement, against the end of the shelves in the center aisle. This line of conduit in every case is continuous from the junction box in the basement, ending at the sixth story. It passes through a switch on each floor and feeds two lights supported overhead, so that each tube feeds 12 lights through six switches. Each switch, however, controls the two lights on its own story, and, in addition, the two lights of the story immediately below, the floors throughout the book stack building being of heavy glass, and the idea being that if the overhead lamps at any book case do not light the lower books sufficiently well, the lamps immediately below the glass flooring will transmit enough additional light to supply the deficiency. The switches are of the snap pattern, and by turning 90 degrees, the two lamps overhead are turned on; at 180 degrees turn, the pair below the floor are lighted; at the third turn, the latter pair are turned off; and at full turn, all four are turned out. Three vertical wires are sufficient for this system, each No. 14 and made into a triplex wire under one braided cover and carried in the ⅜-inch tubing.

The passenger elevator has a lift of about 52 feet and was installed to carry a maximum load of 2,000 pounds at a speed of 200 feet per minute and an average or 1,200-pound load at a speed of 250 feet per minute. The bottom of the hatchway is built tight to act as an air cushion. After the elevator was in place, the contractor, the National Elevator Machine Company, of Scranton, was required to make the following tests: The elevator was loaded with both maximum and average loads to demonstate lifting capacity and speed under those conditions; the hoisting cables were removed and the elevator dropped to demonstrate the efficiency of the mechanical devices and governor; the operating device was removed and the elevator run at full speed up and down to demonstrate the efficiency of the automatic stop; and finally, with all devices and attachments removed, the car was dropped into the basement to demonstrate the efficiency of the air-cushion safety.

Provision has been made in the building for nine book lifts, and five, made by the Burdett-Rowntree Manufacturing Company, of New York, are now in operation. Three run between the ground floor and the six galleries connecting with the book stacks, one operates through the delivery working space, from the ground floor to the second floor, and one runs from the bindery to the official catalogue room. The cars are of wrought metal, those serving the book-stack galleries to carry 25 pounds at 150 feet per minute and the others 100 pounds at 100 feet per minute. Each machine is controlled by the push-button system, so arranged that the car can be sent from any floor to any other by pressing the button designating that floor, provided the door opposite which the lift is standing is closed.

The architects for the library building were Messrs. Rankin & Kellogg, of Philadelphia. The work described was designed and the drawings and specifications prepared under their supervision by Francis Brothers & Jellett, Incorporated, of the same city. It was submitted for approval to the Board of Trustees of the Library, of which Mr. James M. Seymour, Jr., of Newark, was consulting engineer. The contract for the heating apparatus was awarded originally to the Philadelphia Steam Heating Company, which became insolvent before the work was completed, and the completion was let to another company of the same name. Messrs Gillis & Geoghegan, of New York, installed the fans and tempering coils, and Messrs. Blake & Williams, of New York, installed the electric wiring. Mr. George A. Warren is the operating engineer of the plant.

Difficult Sewer Work was necessary last year in building a surface-water drain for Goldsmith Brook in West Roxbury, Boston. A bed of quicksand was encountered 60 feet below the grade of the conduit, and borings showed no stratum of gravel through which water could be pumped in order to dry out the quicksand. Tubular wells were sunk 20 to 25 feet below grade, surrounded by gravel, through which the water from the quicksand filtered to the well. The method adopted to accomplish this was first to sink a 10-inch pipe by means of a water jet, then to place inside of it a 2½-inch pipe, perforated for about 5 feet at the bottom. This smaller pipe extended down to the bottom of the large pipe. The space between was then filled with coarse sand and the large exterior pipe withdrawn, leaving the perforated pipe surrounded with coarse sand. The water which filtered through was then pumped from the 2½-inch pipe by means of a steam ejector nozzle, placed at the bottom of the well, connected with a still smaller pipe in the interior of the 2½-inch pipe.

The Waste of Water.

In the report of the convention of the American Society of Civil Engineers printed last week, mention was made of the discussion of the waste of water by Messrs. Kuichling and Brackett, which was held at the last session. The subject was discussed by a number of other members, and the full report which may be expected in an early issue of the Society's "Proceedings" will be found of unusual value. The following notes, like those printed last week, merely outline a few points of the discussion.

The purveying of water, according to Mr. Rudolph Hering, was a business matter and should be put on a practical basis. It was not good business in selling water any more than it was in selling merchandise to pay more for economies than the value of the saving they effected. This matter was brought to his attention during the late investigation of the New York water supply under the direction of the Merchants' Association. He found that the average cost of metering service supplies was $2 to $2.50 each per annum, including an allowance for depreciation, renewals, inspection, repairs and reading. Taking $2 as the minimum charge, he found that with water at $10 per million gallons and an assumed saving by metering of 75 gallons per capita daily, it did not pay to meter a house having less than 7 people; with water at $25, less than 3 people; and with water at $50, less than 1½ people. Hence two rules were suggested: first, every consumer should be allowed to take water by meter if he desired, and, second, a city should have the power to place a meter on any service where there was good ground for suspecting leakage.

Mr. Herschel took exception to these figures because there were very few if any water-works supplying good water at $10, and even $25 was a very low figure, so that Mr. Hering's figures really showed, in his opinion, that metering was an economical measure in most cases. Leaving aside that phase of the matter, however, it was self-evident that the cost of a public service of any kind should be equitably assessed on those benefited, and in the case of water-works nothing but a meter system would enable such a division of the charges.

The definition of water used, in his judgment, was water paid for. After the supply was turned over to the consumer, the purveyor had nothing more to say about it, provided he was paid for the water. The large consumers did not need to be taught economy or thrift; the ordinary teachings of business life would dictate such a step, and the city or company was not justified in going farther in the sale of its supply than measuring the water and getting the money for it. One of the great problems of a superintendent was to obtain payment for all water he was furnishing, in other words, to prevent leakage and thus obtain a maximum revenue. Leakage he defined as the losses above or upstream from the service meter. A large part of it could be checked by district meters on the mains, while another large part would be indicated by the service meters. Without such measuring instruments it was impossible to detect the numerous leaks that never show on the surface of the ground. A case of this sort was furnished by a galvanized iron service running to his barn. The meter showed an inordinate consumption through this pipe, although the fixtures were tight, so it was uncovered and found to be little better than a sieve. There was no surface indication of this leakage, and it would have continued indefinitely without the warning given by the meter.

Another object lesson in the use of meters was mentioned by Mr. Desmond FitzGerald. It was in a town of 41,000 people, having somewhat more than 5,000 services and 4,300 meters. Although about one-third the supply was furnished for manufacturing purposes, the consumption was less than 30 gallons per capita.

An often neglected but always important factor in causing waste was stated by Mr. Owen to be the pressure on the mains. When pressure is increased for fire service, the losses due to leakage from defective pipes and fixtures may rise 25 per cent. This fact, reversed, may be utilized by the engineer whose works are threatened with a shortage of water, for he can throttle the mains and thus keep down the pressure and consequent leakage. At one time a small plant under his charge ran short of water, so every night the supply was by-passed from a 12-inch to a 2½-inch pipe. It was two months before any consumer discovered the regularly reduced pressure at night, and by that time the danger was over. In another town where he once advised such a step, the engineer preferred to pump a supplementary supply from a source of questionable quality, with the result that a serious increase in typhoid fever occurred.

The experience of Lexington, Va., with water waste was described in an interesting manner by Prof. D. C. Humphreys. When the works were installed they afforded excellent fire protection by gravity and there was more water than the 3,000 to 4,000 people used. Gradually waste increased, however, and owing to shortage of supply it has been necessary at times to shut off the water at night. There is no question about the trouble being due to leakage and waste, and the speaker was endeavoring in one way and another to educate the people up to a recognition of the value of meters. By introducing them extensively he had no doubt that the existing supply would be found ample for many years. This idea of educating the public to an appreciation of the value of meters was developed in an interesting and amusing manner by the next speaker, Mr. John C. Trautwine. He believed that meters should be introduced in any case, whether or no their cost was greater than the saving they effected, because they made the people careful in using water, deferred the date when new works became necessary, and, where filtration was adopted, made it necessary to purify only enough water for legitimate use. Incidentally he referred to an extraordinary preventative of waste in Moscow. There are no sewers there, and the difficulty in removing waste water of any sort is so great that the potable supply required is only 6 gallons per capita daily. Mr. Brackett said that twenty years of experience in water-works management had thoroughly convinced him that the molding of public opinion was an important part of a city official's duty. It was often a very slow process, and he recalled a remark by Mr. Joseph P. Davis, when the first report on water waste in Boston was issued, that no tangible result was to be expected from it; a good result did follow, however, for the Deacon district system of waste prevention was introduced. Mr. J. H. Harlow stated that a good method of educating the public was to make the meter rates low enough to induce people to ask for meters as a matter of business economy on their part. Mr. Edward Flad stated that the experience of St. Louis was such as to make him a firm believer in the advisability of metering most services.

One of the most important discussions was from Prof. G. S. Williams, formerly the civil engineer of the Detroit water-works. In that city readings of the pump delivery, as given by plunger displacement, of the pressure gauges at the station, and of gauges at different points on the mains, were taken every hour. From these simultaneous readings many instructive diagrams have been plotted, five of which were shown by large charts at the meeting. The speaker's remarks referred constantly to the curves on the charts and cannot, therefore, be reproduced satisfactorily at this time, but in a general way they showed very clearly the effect of temperature and rainfall on the consumption of water. With temperatures between 32 and 50 degrees, these influences have no appreciable effect on the draft, but with the temperature below freezing or above 50 degrees they increase the consumption materially.

In the course of his discussion Professor Williams contradicted flatly the deductions generally made as to the effect of meters in lowering the water consumption in Detroit. The great saving usually attributed to meters in that city was really caused by checking waste in the pumping station. In 1887-88, all parts of the city were placed on a direct-pumping system. The chief engineer of the station was a man who never excused an assistant for allowing an engine to stop, so they made it a practice, when the draft was light, of opening the by-pass gates so as to allow the surplus pumpage to run to waste. The consumption, as shown by the pump records, ran up enormously and the trustees finally decided to introduce meters. At the same time they were installed in any large number, the waste at the pumping station was discovered. Beginning in 1893, records were kept of the time the waste gates were open, and the engines were also remodeled; since 1895 the gates have not been opened at all. Professor Williams' diagrams showed clearly that a very large proportion of the saving heretofore attributed to meters in Detroit was really due to the prevention of waste at the pumping station, and as so much has been printed concerning the Detroit meter system, his discussion on the subject, when it appears in the Society's "Proceedings," will be a valuable contribution to the data on the subject. Mr. C. W. Hubbell, the present civil engineer of the Detroit water-works, stated that meters really had little effect on the use of water in Detroit, for it was sold at such a low rate, 2 1/3 cents per 1,000 gallons, that there was little incentive to prevent small leaks. There was some talk of filtering the supply, in which case the price would be raised and the meters would be more effective. At the present time 23 per cent. of the total supply passed through meters.

One of the most interesting discussions was by Mr. J. N. Chester, chief engineer of the American Water-Works & Guarantee Company, which operates water-works in many cities. He said that it was necessary, in fixing rates, to take into consideration all costs, depreciation, amortization, repairs, interest on investment and the like, as well as operating expenses. If this were done at Detroit, it would probably be found that their rate was too low. On the other hand, it did not pay, from the point of view of the average water company, to meter all supplies. It was a good thing to let people sprinkle lawns and otherwise use water to make their homes attractive, and he gave some interesting example of neighboring towns in support of this view. By metering factories, saloons, hotels and like large consumers, it was possible to keep the draft down to 100 gallons per capita daily, which he considered a reasonable figure. Tables of the consumption of water in different cities were very misleading unless accompanied by full notes on the character of the consumption. At Birmingham, Ala., for instance, one blast furnace alone purchased an amount of water equivalent to 100 gallons per capita daily, and at Shreveport, La., where every house connected with the sewers was required to have a water connection also, the consumption ran up very high on account of the waste in the negro quarters.

The discussion was closed by President Croes, who summarized a number of his studies of water supply which have already appeared at greater length in this journal. These studies showed in a general way that whenever the responsible head of the water department was an engineer or a man willing to follow sound engineering advice, the consumption per capita was cut down, otherwise it increased rapidly.

Heavy Street Railway Track laid in 1900 on Thirty-Fourth Street, New York, for the use of storage battery cars, is described in the report for that year of Mr. Wisner B. Martin, engineer of subsurface construction of the Department of Highways. The 9-inch rails are spiked to 5 x 7-inch long-leaf yellow pine ties 6 feet long spaced 5 feet apart. Combined tie-plates and rail braces are placed on alternate ties and the track brought to line and grade. The earth is then removed below and around the ties on which the tie-plates have been placed, so as to leave a trench of a uniform depth of 8 inches below the rail base and a width of 10 inches under the ties and 15 inches under the rails. The track is carried by the alternate ties after this excavation is finished, but it remains in line. The trenches under the rails and ties are then filled with concrete which forms a firm bearing for them; no wooden forms are used. The concrete for the asphalt pavement is then laid 6 inches thick in the track and outside, and adjacent to the web of the rails. The asphalt pavement is laid without any toothing stones. A special mixture of the asphalt is prepared to be placed under the head and lip of the rail. This mixture will stand much more heat without softening than the ordinary asphalt mixture. This construction is very durable, gives an excellent appearance to the highway, and there has been no trouble nor unusual expense in maintaining the pavement. The roadbed is firm, the cars ride easily and the construction seems to be satisfactory, the report states.

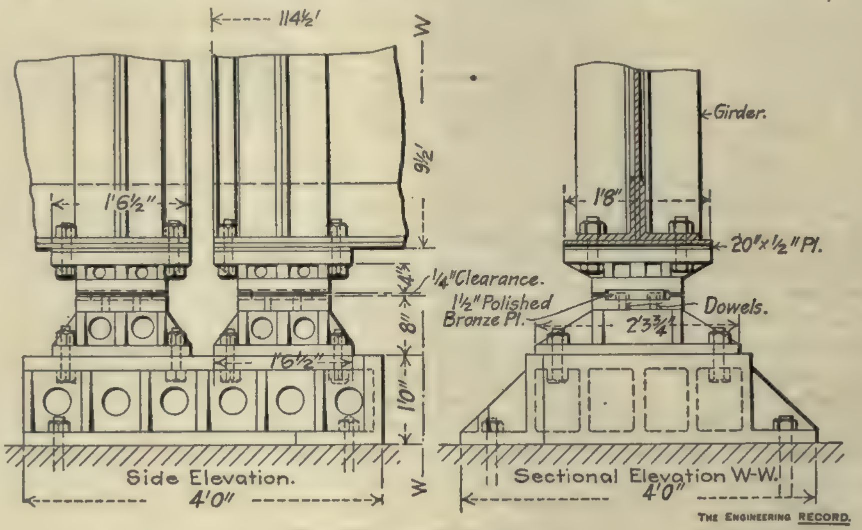
The Reservoir Construction now being carried on by the Croton Aqueduct Commissioners of New York was the subject of an important resolution passed on June 21, which reads as follows: "Whereas, In the prosecution of the work upon the New Croton Dam, on Croton River, at Cornell site, in the Town of Cortlandt, Westchester County, N. Y., and of the Jerome Park Reservoir, near Kingsbridge, in the 24th Ward of the City of New York, certain conditions and circumstances have developed which suggest that a change or modification may be desirable in the plans for the construction of that portion of the dam designed to be constructed of earth with a masonry core-wall, and of the core-wall and embankment of the reservoir of somewhat similar construction; and, whereas, it has been suggested by the Chief Engineer that, before any final determination is arrived at, advice should be sought from engineers of recognized ability and experience not connected with the present plans or the work of construction thereunder; therefore, resolved, that the President of the Aqueduct Commissioners be and hereby is authorized to employ Mr. J. J. R. Croes, Mr. Edwin F. Smith and Mr. Elnathan Sweet to examine the present plans for the construction of said dam, and the work of construction thereof so far as the same has proceeded, and also of the core-wall and embankment of the Jerome Park Reservoir of somewhat similar construction, and to report to the Aqueduct Commissioners what changes or modifications, if any, should be made in the plans for the construction of said dam and reservoir."

The Janesville Bridge.

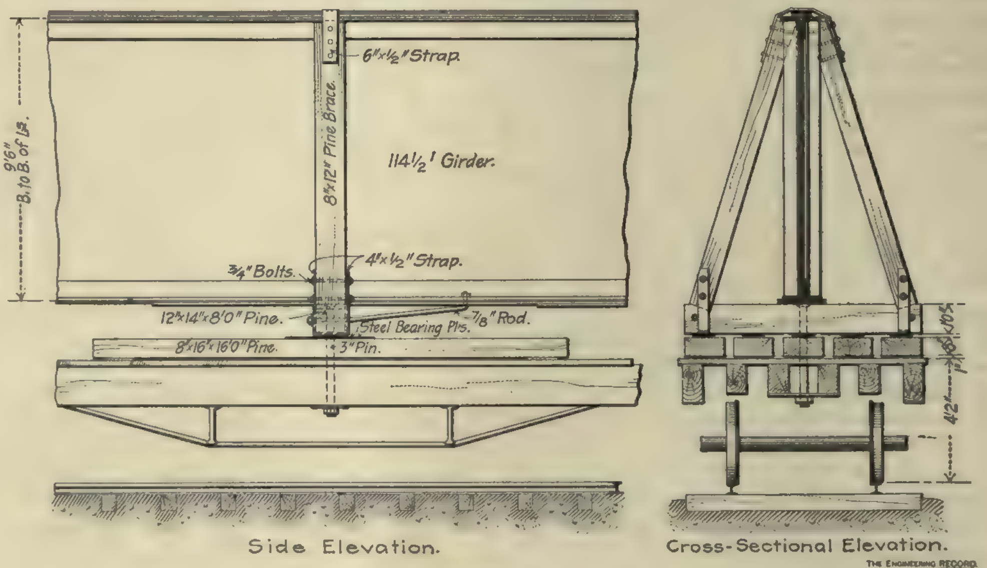
The Janesville & Southeastern branch of the Chicago, Milwaukee & St. Paul Railway crosses a mill race at Janesville, Wis., on a single-track deck bridge of two 114½-foot spans of plate girders 9½ feet deep and 9 feet apart on centers, which weigh 42 tons each. The web of each girder is made in six lengths from ⅝-inch to ½-inch thickness, and is spliced with four vertical rows of rivets at each joint. The 8 x 8 x ¾-inch chord angles are made in three lengths and spliced with cover angles. There are two rows of rivets in each horizontal flange and three rows in each vertical flange. The top chord has one full-length and three part-length 20 x ½-inch cover plates, and in the middle of it there is an 8½ x ⅞-inch bearing plate from end to end, fillered up to the top of the middle reinforcement plate, to give a level, uniform smooth bearing for the track ties.

The bottom chord has two 20 x ⅝-inch and two 20 x 9/16-inch cover plates, only one of the former extending the full length. Each girder is divided into twelve equal panels by 6 x 6-inch vertical web stiffener angles at the splices and intermediate between them, and at the ends there are double vertical angles. The girders of each span are staggered with each other one panel length to correspond with the skew of nearly 45 degrees in the abutments and pier, and they are connected together by sway-brace angle frames normal to the webs at panel points. The top and bottom flanges are braced by transverse struts and X-brace lateral angles.

The expansion ends of the girders are seated on cast-iron supports made in two pieces, one above the other, and separated by a planed phosphor-bronze plate 8 inches square and 1½ inches thick, on which the girder is free to slide longitudinally and can deflect without disturbing the pedestal bearings. The upper casting or shoe is bolted to the lower flange of the girder and the lower casting or bed-plate is seated without bolts on top of a large webbed cast-iron box or pedestal, which distributes the load on the surface of the masonry. The shoe and bed-plate have projecting longitudinal flanges which enclose the bronze bearing plate, and lock the girder against transverse displacement. The bronze plate is tap-bolted to the bed-plate and the pedestal is anchor-bolted to the masonry. The fixed ends of the girders are seated on ordinary cast-iron pedestals.



End Expansion Bearings.



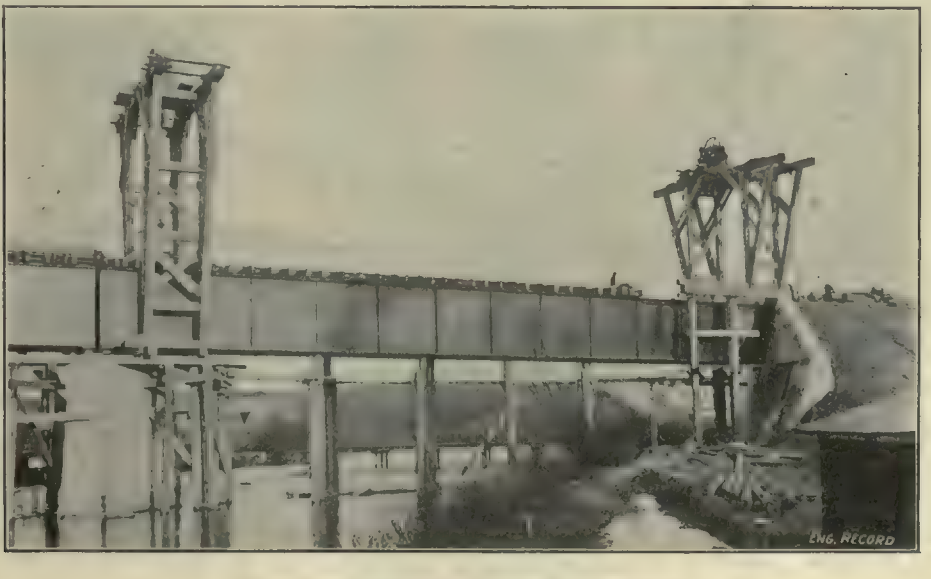
Girder Bearings on End Car.

Each girder was shipped from the bridge shop on two 30-ton standard flat cars 40 feet long with a 34-foot idle spacing car between them. The bearings were over the centers of the cars on transverse 12 x 12-inch bolsters 8 feet long with batter braces slightly notched into their ends and fitted under the top-chord flanges of the girder. The bolster swiveled on a vertical steel pin in the center and had steel-plate sliding bearings on five longitudinal sills which were packed up at the ends an inch above the car floor to allow for deflection and to transfer the load nearer to the car trucks.

At the site the cars were run across the river on a pile trestle and unloaded from a pair of double-bent gallows frames with a clearance above the railroad track 21 feet high and 13 feet wide. Each bent had two plumb posts and two batter posts, a 32-foot cap and an 18-foot sill, and the posts were mortised and bolted at both ends. The bents of each gallows frame were set 6 feet apart and on longitudinal sills and were connected together by cross-braces and X-bracing on the sides of the plumb posts and by cross planks on top. All the timber was 12 x 12-inch except the 8 x 16-inch caps and longitudinal tackle beams across them in the middle. The gallows frames were set on pile bents with their sills at the top of the masonry, about 12 feet below the rail base, and although independently stable on their longitudinal sills, were guyed together from pier to abutment and beyond at each end, with tackles to anchorages.

The six-part hoisting tackle was rove with ⅝-inch steel plow rope, and was suspended from a 1¾-inch U-bolt which was placed between the pair of longitudinal beams and was supported by nut bearings on the reinforced web of a short 12-inch transverse channel across the tops of the beams. A hand windlass from the standard derrick car was set on a platform on two 12 x 12-inch longitudinal beams across the caps of each gallows frame, and operated the hoisting tackle, to unload the girders from the cars and lower them to their seats after the cars were withdrawn.

This arrangement is used for the erection of plate-girder spans and for pony trusses up to 150 feet long, the truss or girder being lowered to a transverse timber and then the windlass moved transversely a few inches and the girder lifted and swung over, and so on until it can be lowered directly to the masonry seats. In some cases the windlasses are not moved, but the girders are unloaded on special trucks on transverse rails, and are easily rolled across to position. The trucks are very simply made with a platform consisting of a 13 x ½-inch plate 24 inches long with two 6 x 4-inch angles 24 inches long riveted to the under side with the 6-inch flanges vertical and 5 inches apart, back to back. These flanges are bored for two 2¼-inch axles, on each of which is keyed a 7-inch double flange wheel.



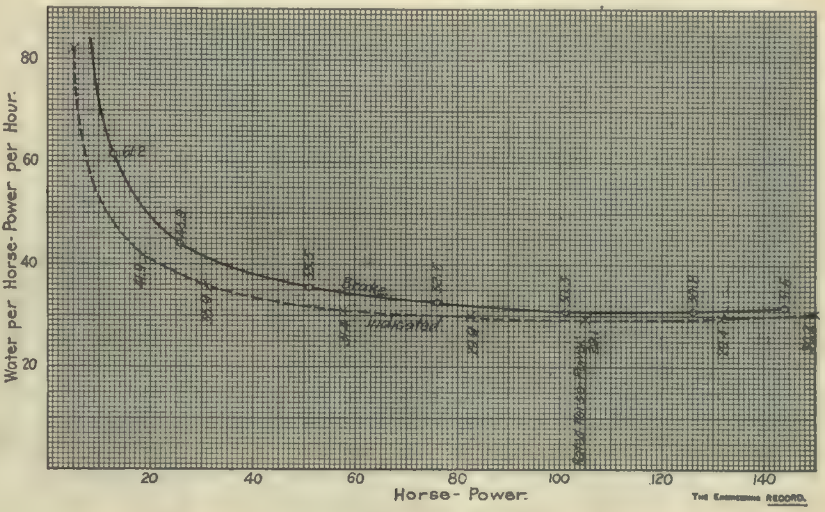
Plant for Erection of Plate Girder Spans.

The Janesville bridge was designed in the department of bridges and buildings of the Chicago, Milwaukee & St. Paul Railway Company, while Mr. Onward Bates was engineer of bridges. Mr. Albert Reichman was the assistant engineer in charge of the work, and the contractor was the American Bridge Company.

Test of Engines Under Different Loads.

Some valuable information showing the effect of the change in load on the steam consumption per indicated and per brake horse-power in an Ames engine is given in the accompanying illustration, which is printed through the courtesy of the Ames Iron Works, Oswego, N. Y. This firm has made a practice for some time of testing their engines by means of the indicator and the Prony brake, where guarantees are made, and the diagram reproduced is typical of a number of others that have been obtained. The engine is of the usual high-speed automatic cut-off type made by the builders, having a cylinder 13 inches in diameter and 12 inches stroke. The steam pressure was 95 pounds and the rotative speed 250 revolutions per minute. At the rated load of the engine, 105 horse-power, the steam consumption was 29.1 pounds per indicated horse-power per hour, while at half load, it was about 31.5 pounds, an increase of less than 10 per cent. per unit of power developed. At 31 horse-power, a little more than quarter-load, the steam per horse-power per hour was, according to the test, 35.9 pounds, or an increase of about 20 per cent. per horse-power over the rate at normal load. Of course the proper basis for comparing the economy is the steam consumption per brake horse-power, for that is the useful work done by the engine. It will be seen that the steam consumption is about 30.3 pounds at full load; 35.5 pounds at half load, and 43.9 pounds per brake horse-power per hour.

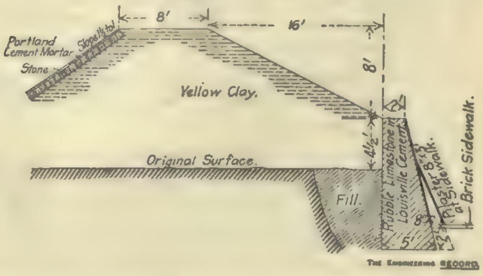
The overload tests show that the economy falls off about as rapidly as the load is increased above the normal, as it does when the load is decreased from this point. The engine, it will be noticed, was tested to about 50 per cent. over its rating. When developing its rated power of 105 horse-power, the mean effective pressure would have to be about 52 pounds with the cylinder dimensions and rotative speed as given.



Duty Curves of Automatic Engine.

The Restriction of Watersheds as sources of municipal supply, to the communities nearest them, has been before the House of Commons twice this year. The first case, according to the "Journal of Gas Lighting," was when the authorities of Wolverhampton sought to improve their supply by drawing on sources at some distance from the borough. The House decided that the construction of the contemplated works would deprive the local landholders of water, to their injury, and the bill was accordingly thrown out. A few weeks ago the Rickmansworth & Uxbridge Valley Water Company sought power to take more water from an area which helps to feed the Thames. This was refused for the same reason. These decisions are in line with recent recommendations of the British Association of Water-Works Engineers and with the action of the Massachusetts State Board of Health in the matter of an increased supply for Springfield, and show that the fallacy of "water free as air" has about run its course in thickly populated districts.

A Retaining Wall holding back one side of a service reservoir at Ottumwa, Iowa, was recently shoved forward bodily on its base from 1 to 2 feet, except near the center, where 6 inches of the batter was taken up by a turning of the wall on its toe to that extent. The acompanying cross-section of the wall and embankment is given on the authority of City Engineer John T. Brady, who states that at the place marked fill, there had been a cave-in after the street grade was lowered, at which time the wall was built. The pilasters on the face of the wall were spaced 16 feet on centers. The sliding of the masonry followed the laying of a switch in the street, for which purpose some of the pavement was taken up. The bricks in the sidewalk were pushed up and the curbstone was broken in places. Beyond and at the top of the wall, the bank between the masonry and reservoir for a distance of about 12 feet back from the coping dropped 4 feet or more.



The Setting of Portland Cement is the subject of an interesting article by Mr. Gavin J. Burns, recently printed in the "Professional Notes" of the Surveyors' Institute. The pith of the article is given in the following quotation: "In order to watch the process of setting, a little cement may be dusted on a slide, an ordinary cover glass placed over it and fastened down, and the whole put into a dish of water. On examining the slide with a power of about 200 from time to time, it will be found that the grains of cement become covered with tufts of acicular crystals, which begin to make their appearance, sometimes in half an hour, sometimes not for two days. The crystals are much too minute for their form to be observed, but they appear to be of uniform width, so may be assumed to be prismatic. The crystals appear to grow only in length, the width remaining constant. The greatest length observed is 0.002 inch. The width is too small to be measured with the powers used, but is probably under 0.0001 inch. The tufts of crystals generally spring from angles or prominences on the grains of cement."

Construction of the Cambridge Bridge Piers.

The old pile bridge between Boston and Cambridge, known as the West Boston Bridge, is now being replaced by a massive steel and masonry structure 2,300 feet long and 105 feet wide, with ten plate-girder arch spans. The piers are comparatively wide and low, with varying dimensions which increase toward the center of the bridge, where their unusual width is intended to give a very effective appearance to the substructure. The water is from 4 to 15 feet deep at low tide, and the piers are built on piles driven from 20 to 40 feet into a hard bottom, which, according to the indications of test holes, consists of mud, sand, clay and gravel, above a stratum of gravel from 30 to 60 feet below low tide. About 15,000 piles in all will be required in the ten piers, 7,400 of which have been driven.

A record of driving 135 40-foot piles in nine hours was made by a special steam pile driver with a 75-foot tower in which are extension leads 70 feet long suspended by a single line from one of the drums of the main hoisting engine. The leads are connected by a heavy transverse plate and a ring at the foot, through which the pile is inserted, the leads being pulled up above water. Then the pile is centered between the sliding leads by means of a pair of dogs pivoted at one end to the leads opposite each other. The ends of the dogs have knife edges which are driven into the sides of the pile and are slightly higher than the pivots when the pile is centered and ready to drive. A 14 x 14-inch white oak follower 30 feet long, a 10,000-pound steam hammer, and the leads are all lowered at once to rest on the pile head and by their combined weight of 22,000 pounds, sink it several feet into the soft mud bottom immediately releasing the dogs which drop vertically in the leads and clear the pile. Then the leads are held by the drum line, and the pile is driven by rapid hammer blows until its upper end is nearly down to cut-off level, from 15 to 32 feet below the surface. The whole operation only takes from one to three minues and often requires but ten blows.

As the hammer rises to the top of the tower it engages the sliding extension leads and lifts them off the drum line, in readiness to have their load concentrated on top of the next pile. The unusual weights of the driver, leads and follower necessitated special construction and details of the tower and rigging; heavy washers of webbing filled with solid rubber are used for cushions, wherever regular or accidental impact on iron may occur, and the drum ropes are steadied by passing over guide sheaves on a horizontal arm built out from the middle of the back legs of the tower. There is a 50-horsepower hoisting engine and boiler, and the eight drums and capstan heads required to operate the pile driver are all run by steam power and are thrown in and out of gear by friction clutches.

The hammer does not strike directly on the iron cap of the oak follower, but a short section of oak timber is interposed. At first a cylindrical block 12 inches in diameter and 12 inches long, bound with heavy top and bottom rings was used, but only lasted a few hours. Now the oak block is entirely enclosed in a 12-inch section of extra-heavy welded steel 12-inch pipe, and it lasts a week or two before the pipe splits.

A cement storehouse is built on temporary piles between the old and new bridges and about 4,000 barrels of cement are kept there. A link-belt chain 220 feet long is operated by a driving wheel geared to an old hoisting engine, and extends through the storage house and to the foot of the concrete tower, the latter being located close to the middle of the new bridge. Small trucks or cradles are attached to the chain at intervals of 30 feet and run in opposite directions on two 15-inch wooden tracks, one about 18 inches above the other. Barrels of cement are rolled from an elevated platform to the cradles on the upper track, and are delivered at intervals of about 40 seconds at the foot of the concrete tower. There, on a signal from above, they are emptied into a hopper from which a bucket elevator delivers into the charging hopper.

Sand and gravel are dredged in the bay and delivered at the bridge site in 500-yard barges from which they are unloaded by a boom derrick and clam shell bucket. This empties over a series of three inclined screens 20 feet long, on top of the concrete tower, about 40 feet above the water. The large stones are rejected, the sand is delivered on one side of the tower, and the gravel, up to 3-inch stones, is delivered to the other side of the tower. Both sand and gravel are raised by bucket elevators which deliver into 20-yard hopper-bottom storage bins on the upper platform of the tower. At first great difficulty was experienced with the sand buckets, which refused to empty when inverted. Finally a number of ½-inch perforations were made in the bottom of each, and these prevent the formation of a vacuum there and make them discharge freely. All of the bucket elevators are made with link belts.

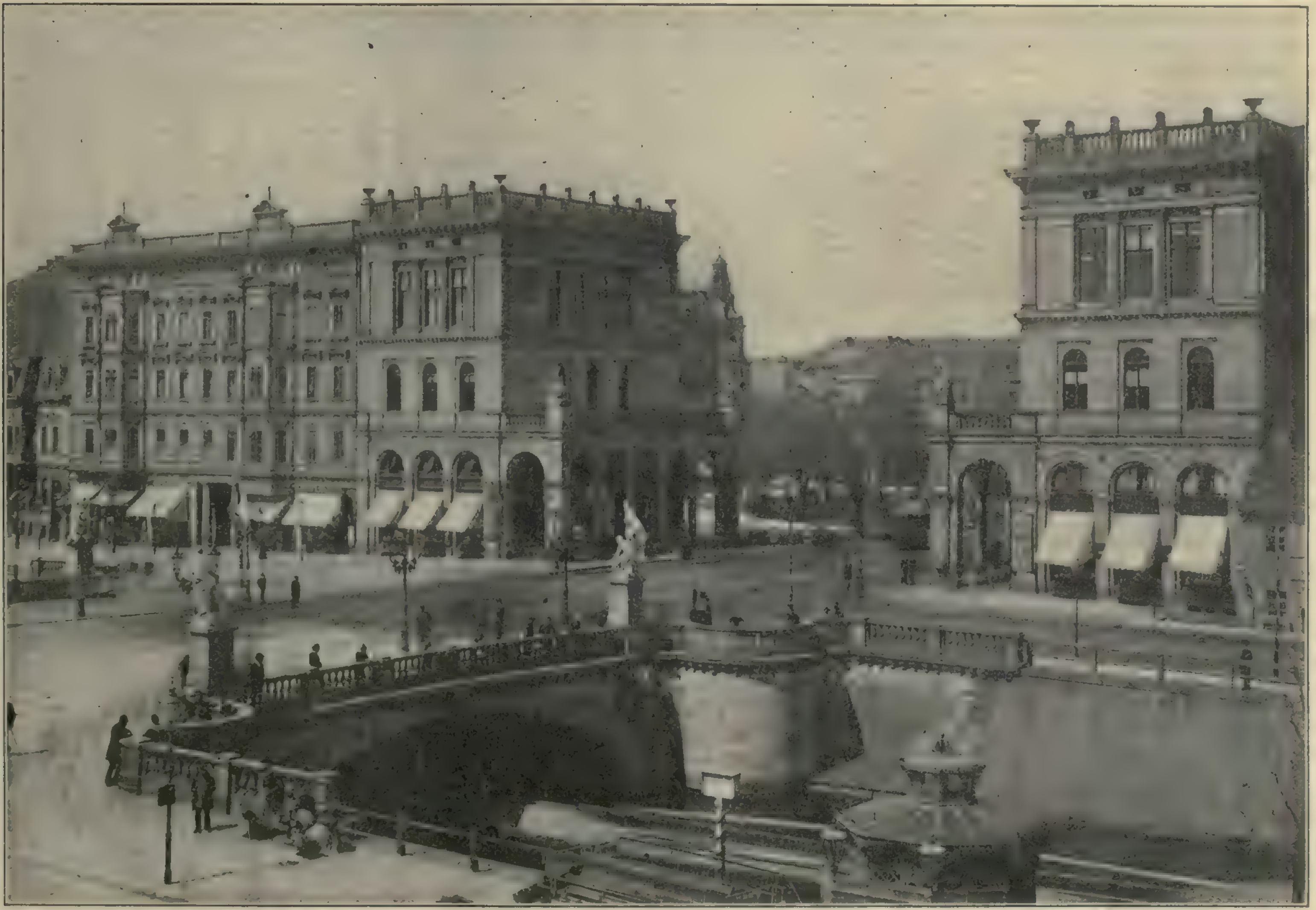
Under the center of these bins, on the second platform, is a large hopper-bottom charging bin with three compartments on each side of a center partition. All of the compartments extend to the vertex of the hopper and are closed there by a single horizontal sliding gate which opens one set when it closes the other. In each side of the bin one compartment is under the gravel hopper and holds just twelve barrels of gravel when filled up to the level of a batten nailed across it inside. Another compartment is under the sand bin and holds six barrels when filled up to a similar mark, and the third compartment is lined with iron and receives the cement from the elevator, and diverts it to one side of the central partition or the other according to the arrangement of a butterfly damper. The sand and gravel storage bins each have at the vertex a horizontal sliding gate and discharge through it into a vertical hinged steel chute which can be swung so as to deliver into either side of the charging bin. All of the sliding horizontal gates are made of cast iron with reinforcing ribs, and are operated by rack and pinion gears commanded by hand wheels.

A 5-foot Carlin's cubical concrete mixer is mounted at the level of the third platform, and when it is empty the door is opened and swung under the hopper, connected to it with a funnel on a swinging bracket, and the contents of the mixing bin are discharged into the mixer and turned ten times or more. Water is measured in a tank on the third platform and injected through the hollow trunnion, and the concrete, about 58 cubic feet for each batch, is discharged into a wooden bucket on a car. This car is drawn by a cable and hoisting engine on a pile trestle track which extends from end to end of the new bridge and connects all the piers. The bucket is unloaded from the car by a 70-foot derrick boom which swings it over the concrete platform on top of the pier where its contents are discharged into the hopper by opening the double flap bottom.

The piers are surrounded by cofferdams of 6-inch splined sheet piles and the foundation piles are cut off alternately at two levels, one about at the surface of the dredged bottom and the other from 14 to 22 feet below low tide. The concrete is deposited under water to a height of about 5 feet below low tide, and then the cofferdam is pumped out by a 15-inch centrifugal pump and the remainder of the concrete is laid dry up to 4½ feet below low tide, above which level the pier is to be built of stone masonry. The concrete laying apparatus is similar to that used for the piers of the Charlestown bridge, described in The Engineering Record of March 5, 1898, and is considered very efficient and satisfactory. A single rail is laid on each long side of the top of the cofferdam and on this track is mounted a Howe-truss bridge which spans the cofferdam and carries an upper and a lower platform, both of which roll together, between the trusses from end to end of the bridge. The upper platform carries the concrete hopper which is closed by a horizontal sliding gate operated from the lower platform.

A riveted steel tube 18 inches in diameter at the top and 22 inches at the bottom, with a funnel top is suspended by differential hoists under the vertex of the hopper. The tube is made in 4-foot outside flange-jointed sections and has a 2-foot top section so that by different combinations the bottom may be made to reach to any depth in the cofferdam while the top is close to the hopper. The bottom of the chute is set at first just above the pile tops in one corner of the cofferdam and filled with concrete, the descending mass acting as a plunger which often expels all the water before it so that none rises to the top inside. When the concrete has spread out as far as possible beyond the end of the chute and ceases to sink at the top, three men operate a rack and pinion gearing to slowly traverse the chute along the bridge and across the width of the cofferdam. The attendant admits concrete from the hopper as fast as it sinks in the chute, and thus a continuous uniform layer is deposited across the pier. Then, care having been taken to have the chute completely filled with concrete, the bridge is pulled about 4½ feet forward by ropes to the hoisting engine of the derrick which unloads the concrete cars, and the operations are repeated, a 2-foot layer of concrete being deposited across the pier in about 25 minutes under favorable circumstances. As many as 130 batches, or about 280 yards, of submerged concrete have thus been mixed and deposited in one pier in ten hours by a total force of thirty-five men, including those in the cement storage house and those unloading the sand boat. Of these men, twelve are directly employed in attending the concrete mixer and eight are employed on the pier. When the cofferdam is pumped out the surface of the concrete is found very level and the concrete is solid and well set. Frequent tests are made by filling a headless barrel with concrete in a hogshead of water and examining it after 24 or 48 hours; the concrete being accepted or rejected on the results of these tests which usually show hard, solid, well-set concrete.

The bridge is being built under the direction of Mr. William Jackson, chief engineer, and Mr. John E. Cheney, assistant engineer. The substructure contract, of about $650,000, has been let to Messrs. Holbrook, Cabot & Daly, of Boston, and the work is in direct charge of Mr. James W. Rollins, Jr., of that firm.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXIII, BERLIN, BRIDGE NEAR THE PLACE BELLE-ALLIANCE.
The arch and its round abutments are pleasing. Here again the statuary were better omitted. The balustrade is evidently planned to be continued along the quays.

Test of Sprague-Pratt Elevators in the Park Row Building, New York.

At the time of the completion of the Park Row Building in New York City the details of its construction and equipment were explained in The Engineering Record, the mechanical plant being described in the issue of July 1, 1899. The building is equipped with ten Sprague-Pratt electric elevators, of the vertical screw type, which were tested a little more than a year ago by Messrs. Charles R. Pratt and B. H. Jones, then of the Otis Elevator Company. The report concerning this test was made to the Otis Elevator Company and through the courtesy of Mr. W. D. Baldwin, its president, The Engineering Record is allowed to print the results of the tests. Steam for the building is supplied by 300 horse-power Babcock & Wilcox boilers. For the purpose of furnishing the elevators and lighting system with electricity a power plant is installed in the sub-basement, which consists of five Dick & Church engines made by the Phoenix Iron Works Company, direct-connected to Westinghouse generators operating at 120 volts. Four of the engines are of the compound non-condensing type; two of 320 horse-power each, one of 160 horse-power and one of 120 horse-power, connected to Westinghouse direct-current generators operated at 120 volts. There is also a 460 kilowatt-hour storage battery for night service charged during the day and evening by a booster in series with one of the generating units. The battery serves to balance the elevator load on the generator. The details of the passenger elevators, which were tested, is described in the following abstract of the report of Messrs. Pratt and Jones:

The elevators are geared 8 to 1 by seven pairs of multiplying sheaves running on high-grade solid roller bearings, the ropes from these sheaves leading up to a traveling sheave that doubles this gear, making the total gear 16 to 1. All of these sheaves, with their connection to the ball-bearing nut, counterweight the car to within 950 pounds of their gross weight. The chain rope counterbalance consists of two chains attached to the traveling sheave frame, and the gravity load on the machine does not vary over 4 per cent. during the entire rise. Five of these cars have 36 square feet area; four have 40 square feet area, and one has 44 square feet area. Two are run as locals to the 12th and 13th floors, 150 feet average; four as locals to the 25th and 26th floors, 297 and 308.75 feet; three as expresses to the 12th floor, and locals from the 12th and 25th and 26th floors, and one is reserved for building porters, freight, etc. The two that run to the 12th and 13th floors during the day are run to the 25th and 26th floors during the night.

General conditions of plant.—No work or adjustments whatever has been made on these elevators since their installation in March, 1899, aside from the regular daily work to keep them in good running order, done by the two mechanics employed by the Park Row Building for that purpose. The starting current on the start up, and the delay in bringing the rheostat arm to stop on the up stop, are excessive and probably increase the kilowatt hours per car mile 10 per cent, over what could be done with proper adjustment. In other respects the plant was in excellent condition, and its condition was not altered in any way before, during or after the test.

Total passengers carried up.—This was obtained by the use of two hand counters, one worked by the elevator starter and the other by the assistant during the greatest rush of traffic. These counters tallied up to 1,000, and the sum of the two was recorded for each even hour and also by each even 1,000 for each day's work. The number of passengers in each car was counted by each operator and called off to the starter or his assistant, just as the operator closed his landing door. The starter and his assistant each took certain cars for their tally.

Synopsis of Elevator Test.

Hours of test each day	8 A. M. to 6 P. M.
Total number of hours of test	60
Total number of passengers carried up	48,860
Total number of car miles travelled	982.93
Total electrical energy consumed, kilowatt hours	4099.5
Average kilowatt hours per car mile	4.17
Average number of car miles per hour	16.38
Average number of passengers carried per hour	814.3
Average number of passengers per trip from first floor	4.92
Average number of passengers per car mile	2.94
Average weight of each passenger, lbs.	150
Average total load on car hoisting ropes, lbs.	1,541
Average number of stops per car mile going up	78
Average number of floors between stops	5
Average actual elevator efficiency, all loads, per cent.	67.75
Average speed with average load, feet per min.	460
Average horse power at average load and speed	23.4

Total number of car-miles traveled.—This was obtained by a tally kept in a book, each page ruled in squares, 10 horizontal lines numbered for each elevator with the top floor to which it traveled noted. As the starter calls the number of each car as it starts, the man having this book in charge puts the tally mark in a square on the line of the car that started, only one tally mark in each square. This tally was easily and accurately kept, and easily figured after the test by a guage numbered and marked to correspond with the tally squares; the distance that each car traveled was reduced to a decimal of a mile and the total mileage figured on that basis. The only possible error would be in getting the mileage too low and thus raise the kilowatt-hour per car-mile rate, and this error exists to the extent of having no record of going back up to a floor when the operator misses the signal on his down trip. Revolution counters would have been better but would have caused too much delay and expense to have put them on for this test.

Total electrical energy consumed.—The total electrical energy consumed by the bank of elevators during the test run was measured by the Thomson recording wattmeter, 3,000 amperes capacity at 115 volts, mounted on the main switchboard and connected in series with the negative bus-bar on the power panel of the switchboard. Hourly readings of this meter were taken daily from 8 A. M. to 6 P. M., and these readings were checked with the total kilowatt-hours recorded for the ten hours. In order to determine the accuracy of the above wattmeter, it was calibrated by being run in series for a period of six days with a new Thomson recording wattmeter, 1,200 amperes capacity at 115 volts. The permanent switchboard wattmeter was found to be 0.71 per cent. slow in recording the kilowatt-hours consumed by the bank of elevators tested.

Average kilowatt-hours per car-mile.—The car-miles having been obtained as before described, amounted to 982.93 for the 60 hours' test, and the total kilowatt-hours amounting to 4,099.50, the kilowatt-hours per car-mile were 4,099.50 ÷ 982.93 = 4.17.

Average number of passengers per trip from first floor.—This was obtained by dividing the total number of passengers carried each day by the total number of round trips made each day, and averaged 4.92 passengers per trip from the first floor, viz.:

Day.	Passengers.	Round trip.	Av. per trip.
Monday	7,888	1,738	4.54
Tuesday	8,196	1,703	4.8
Wednesday	8,253	1,718	4.8
Thursday	8,684	1,674	5.13
Friday	8,218	1,680	4.94
Saturday	7,621	1,453	5.24

This table shows a remarkable uniformity of passenger service and elevator starting.

Average number of passengers per car-mile.—The average number of passengers per car-mile was determined by counting the actual number of passengers carried up between all floors on 337 trips, the number of car-miles traveled in hoisting for the same car trips being 15.96. The total number of passenger miles was found to be equivalent to one passenger carried 41.48 miles. Dividing the total passenger miles by the total car-miles in hoisting gives an average of 2.596 passengers per car-mile.

Floor.	No.	Floor.	No.	Floor.	No.	Floor.	No.	Floor.	No.
1	1,137	6	91	11	1	16	11	21	4
2	922	7	97	12	191	17	2	22	0
3	626	8	66	13	178	18	9	23	2
4	330	9	44	14	123	19	9	24	3
5	174	10	30	15	153	20	8	25	8

This table shows the aggregate number of passengers on the cars for runs of specified floor distances made without intermediate stops; 1,449 passengers were taken on at first floor during these 337 trips, making an average of 4.3 passengers per trip, 2.596 being 60 per cent. of 4.3, 60 per cent. of the average passengers taken on at the first floor during the entire week, which was 4.92, 60 per cent. of which is 2.94, equals the average number of passengers per car-mile during the 60 hours' test.

The results of twenty tests on elevator.—On April 5 the current, voltage, speed and number of passengers carried on ten trips by car No. 3 were measured. On April 7 the same readings on this car were taken, but having for the passenger load 12 building porters, each being weighed to obtain an accurate load test. The following table gives the number of passengers whose weight was not known and the electrical horse-power required to raise them, also the electrical horse-power and the known load of porters obtained in the test of April 7, and in the last columns, the average weight of the passengers carried in the first test, obtained by dividing the known loads in pounds in the second test by the number of passengers carried in the first test, the electrical horse-power being about equal in each case. The instruments used in determining the electrical horse-power were a standard Weston voltmeter and ammeter, portable type. Each instrument was calibrated and certified correct by the Weston Electrical Instrument Company just previous to the above test. The actual car speed was determined by means of a Schaeffer & Budenberg tachometer, belted to the armature shaft of the motor. Each revolution of the armature being equal to 20 inches of car travel, the car speed in feet per minute was equal to the number of revolutions indicated multiplied by 1.667. The following table gives the readings where the horse-power was nearest alike:

No. of pass. April 5.	Electrical H. P. April 5.	Electrical H. P. April 7.	Pass. load in lbs. April 7.	Av. weight per pass. April 7.
1	25.71	24.70	185	185
2	26.56	27.00	327	163
3	30.73	30.80	582	194
4	32.33	33.00	735	184
8	37.88	37.30	1,044	130
10	42.40	41.90	1,359	135
12	47.24	47.30	1,804	150

Average weight per passenger, 163 lbs.

The number of passengers taken in this test, is, of course, too small to be a fair average of a day's work.

Actual elevator efficiency, all loads.—The actual elevator efficiency was determined by lifting a known load on one of the elevators at a measured speed in feet per minute and noting the current consumed and potential at the main switch on the controller of the hoisting machine. The excess weight of empty car over counterweight was weighed and found to 950 pounds.

This test consisted of ten trips at maximum speed with actual gravity loads ranging from 1,135 to 2,939 pounds from the first to top floor of building. On each run, the speed, current and potential were noted at the same instant by two readers, to avoid possibility of error. The electrical horse-power delivered to the motor compared with the gravity work done on each test run shows a total efficiency ranging from 75.5 per cent. with a net load of 1,320 pounds on car hoisting ropes to 61.2 per cent. with a net load of 29.39 pounds.

By actual count of 337 trips, only 12½ per cent. of the cars leaving the first floor carried over 7 passengers, up to which load the elevator tested showed an average efficiency of 70.2 per cent., making the average efficiency of the elevator 70.2 per cent. for the average load lifted 87½ per cent. of the time during the day. The average efficiency for all loads was 67.75 per cent.

On these test runs, the hoisting current during the entire run up did not vary more than 4 per cent. with the same car loads, showing uniform effect on the car at various points in the hoistway of the chain counterbalance, as well as the uniformity of friction loads on the system. The following is a table of the readings taken from this test:

Elevator No. 3, April 7, 3.15 to 3.42 P. M. — Car and Operator = 1,135 Pounds.

Test No.	Amperes, start.	Amperes, run.	Volts.	No. of Pass.	Load in lbs.	Speed, F. P. M.	Elec. H. P.	Grav. H. P.	Per cent. effic.
1	400	150	116	0	1,135	483.0	23.3	16.61	70.1
2	420	160	116	1	1,320	466.7	24.7	18.66	75.5
3	424	176	115	2	1,462	438.3	27.1	19.41	71.6
4	432	192	115	3	1,604	425.0	29.6	20.66	69.8
5	440	200	115	4	1,717	411.6	30.8	21.41	69.5
6	448	214	115	5	1,870	400.0	33.0	22.66	68.6
7	460	242	115	7	2,179	375.0	37.3	24.75	66.4
8	480	272	115	9	2,494	358.3	41.9	26.07	64.6
9	520	296	115	10	2,651	341.6	45.6	27.44	60.2
10	554	310	114	12	2,939	325.0	47.3	28.94	61.2

The average gravity load during the 60 hours' test is computed from the average number of passengers per car-mile or 2.94 at 150 pounds per passenger, equals 441 pounds, plus the operator at 150 pounds, plus the unbalanced car weight of 950 pounds, making a total of 1,541 pounds. The electrical horse-power for this load is estimated from the readings on No. 3 elevator test to be 28.4.

Sewage Disposal at Oswestry, England.

Last month the Midland district branch of the Association of Municipal and County Engineers met at Oswestry, a town of about 10,000 population, which received a royal charter of incorporation about 600 years ago from Richard II. Although it is an interesting place historically, it has been particularly attractive of late to members of the engineering profession on account of the method of disposing of its sewage by the contact-bed system. In 1895, the town was advised by a firm of consulting engineers to put in disposal works costing $75,000, but the expense was prohibitive. The next year Mr. R. O. Wynne Roberts, the borough surveyor, obtained authority to experiment with contact beds, which proved so successful that works for treating the entire sewage flow by this method was designed. The construction was carried out under the direction of the present surveyor, Mr. G. W. Lacey, who described them, together with the other municipal works of the town, at the Association's recent visit. From the paper and discussion as given in "The Surveyor," the following notes have been prepared.

The sewage passes from the outfall sewer through either or both of two small grit chambers into either or both of two settling tanks measuring 70 x 15 x 4½ feet, where a considerable quantity of sludge is collected without the use of chemicals. From these basins the sewage flows to nine primary beds arranged in a square with three beds on a side. It then passes to nine secondary beds, similarly arranged, from which the effluent is discharged into a small stream.

The surface area of each primary bed is 60 x 60 feet, and of each secondary bed 60 x 50 feet.

They are constructed partly in excavation and partly with earth banks, 11 feet wide at the bottom and 2½ feet wide at the top. The embankments for the secondary beds were puddled with clay as a precaution against percolation. On the floors of each basin lines of 3-inch agricultural drain pipes are laid 1 yard apart and connecting with brick channels which end in a small brick chamber, except in the case of the central bed. These chambers are piped to a brick valve chamber in the center of the central bed, 9-inch vitrified pipe being used to connect the beds in this way. The sewage and the effluent from the primary beds are distributed over the filtering material by means of wooden troughs.

The beds are filled with cinders which are screened from a large accumulation of house refuse. The material in the primary beds is from ⅜ to 1½ inches, very little being of the largest size, and in the secondary beds from ⅜ to 1 inch. The beds are 4½ feet deep in every case. At the valve chamber in the central bed of each series, there are automatic valves which distribute the sewage and primary effluent to the various beds in rotation, hold up the sewage in contact in the bed, and discharge the effluents in due course. Since the completion of the bed it has been found necessary to put in aeration pipes from the ends of the collecting channels to the surface, in order to facilitate the drainage of the beds.

The primary beds, since the beginning of their full use, have been reduced in capacity about 30 per cent., but no further decrease has been observed for some time. If anything, since the aerating pipes have been introduced, the capacity has increased and certainly the results have been somewhat better. No appreciable decrease has taken place in the capacity of the secondary beds.

The sludge from the settling tank is pumped out at intervals of eight to ten weeks, mixed by machinery with fine screened ashes, and finds a ready sale among farmers. It is not contended that this is an ideal method of disposal or one desirable to continue indefinitely, but it serves a useful present purpose in getting rid of a large accumulation of undesirable fine ashes.

The quantity of sewage dealt with in the course of a year is about 192,000,000 gallons, the average daily flow in 1900 being 528,000 gallons and the dry-weather flow 486,000 gallons. This includes a considerable quantity of ground or surface water which finds its way at some points into the sewers, as otherwise the dry-weather flow should not be more than 300,000 gallons. Notwithstanding this dilution, the sewage is very strong for it contains a large amount of brewery, tannery and fellmonger's refuse. A number of typical analyses are given in the accompanying table. The occasional analyses made of the effluent from the primary beds show that a large proportion of the purification is effected by the first contact. Samples of the effluent which have been kept for more than a year show no signs whatever of putresence, and analyses made during very severe winter weather showed but a slight diminution in the degree of purification. This diminution is but natural, for when the beds are partially covered by a sheet of frozen snow the admission of air into them must of necessity be retarded; but this lessening of aeration is unlikely to be of sufficient duration at Oswestry to affect the results materially. Records of temperatures taken during severe weather show that not only the sewage but the interior of the beds, both full and empty, were several degrees above freezing point.

The cost of construction of the contact beds and other work in connection with them has been about $10,000, or about $1 per capita. The net cost of maintenance at the present time, including sludge disposal, is about $1,100 annually, or 11 cents per capita. It is expected that this cost will be reduced materially before long, when the automatic valves have been improved so as to become reliable in their operation; up to the present time it has been necessary to have a man on the works during the night.

Analyses of Sewage and Effluent from Double Contact Beds, Oswestry; in Parts per 100,000.

	Albuminoid ammonia.			Oxygen absorbed, 20 minutes.		
1899.	Sewage.	Effluent.	Reduction.	Sewage.	Effluent.	Reduction.
August 28....	1.136	0.130	89.8%	4.0	0.3	92.5%
Sept. 16.......	2.600	0.180	93.0%	5.0	0.4	92.0%
Oct. 11.......	1,860	0.191	89.6%	2.8	0.4	85.7%
Nov. 18........	1.680	0.150	91.0%	3.6	0.5	86.1%
Dec. 4.........	1.320	0.129	90.2%	3.2	0.36	89.0%
Dec. 22........	1.200	0.120	90.0%	3.4	0.36	89.4%
1900.						
Jan. 2.........	1.140	0.120	89.4%	3.0	0.31	89.4%
April 10........	1.920	0.240	87.5%	3.6	0.42	88.3%
April 16.......	1.509	0.186	87.6%	3.8	0.48	87.4%
July 5.........	2.280	0.280	87.7%	5.6	0.7	87.5%
Sept. 7........	2.040	0.240	88.2%	7.4	0.74	90.0%
Oct. 2..........	1.680	0.210	87.5%	5.6	0.68	87.9%
1901.						
Jan. 22........	1.800	0.174	90.3%	2.8	0.4	86.0%
Feb. 15........	1.380	0.126	90.9%	5.0	0.4	92.0%
March 15.....	1.380	0.108	92.2%	3.0	0.7	90.0%
March 27.....	1.080	0.108	90.0%	3.0	0.74	88.7%
April 23.......	2.040	0.156	92.3%	3.2	0.76	89.0%

In the discussion that followed the reading of the paper Mr. A. D. Greatorex (West Bromwich) asked the author as to the capacity of the beds, whether he had a meter fixed, or how he had obtained his data as to capacity. In his own case he found the capacity was reduced by about 30 per cent. He had had meters at work and was still gauging the capacity of the beds. It was the one thing they required very definite information about, and he advised every town to have meters fixed, and to collect the information for the benefit of the association. Judging from the cost of the beds at Oswestry they had been carried out remarkably cheap—very much cheaper than he had been able to carry out his works.

Mr. J. S. Pickering (Runeaton) quite endorsed what Mr. Greatorex said as to the necessity of measuring the effluent from the beds either by meter or some equally accurate means. A mere general statement that the beds did not decrease in capacity was not sufficient. He thought it would be found in every case, without exception, that this gradual silting up was taking place, notwithstanding the opinion of many experts to the contrary. He felt quite sure that the capacity of these beds was not permanent at 30 per cent. or 33 per cent. It might be a very gradual silting up that was taking place, but sooner or later he was quite of opinion that the whole of the material would have to be resifted. He did not know that that was any very serious objection to the use of the bacteria system. In fact, though he recognized that difficulty might arise, he was putting down beds to the extent of 18,000 square yards. But it did affect the question of material very considerably. It used to be thought that coke and ashes were the best materials to be used. That idea was now exploded, and it seemed to be recognized that any hard material would answer the purpose. His own opinion was that it would be difficult to find a better material than granite. He was using granite for the coarse and probably for the fine bed. He thought the advantage of that would be seen when they came to sift the material. In the case of coke it would be a difficult matter, because there would be a good deal of disintegration. That was the only weak point of the bacteria system. As to its efficiency, there could not be the slightest doubt—that was proved up to the hilt. Mr. Lacey incidentally remarked that he had made a series of analyses. He found Mr. Lacey had actually made these analyses himself. The duties of a borough surveyor were very varied, but not often did they find that a borough surveyor would take the trouble of studying the question of the scientific analysis of sewage. Mr. Lacey had taken a great number of analyses, which in each case had saved his authority one guinea, and he had the advantage of comparing results from day to day. He thought if some of them could follow his example it would be a very material advantage.

In the reply to the discussion, Mr. Lacey stated that he had gauged the sewage by meter almost from the commencement of the beds, and they tested the time the whole of the beds took to fill and then calculated the quantity. They had not a meter from the primary to the secondary beds, but they could judge the capacity in the secondary beds from the time they took to fill from the primary beds. He was inclined to be at one with Mr. Pickering as to the material forming the beds. Cinders certainly showed a tendency to disintegrate.

Water-Works of Gibraltar.

Among the papers which were on the program of the recent convention of the American Water-Works Association was one by Prof. W. P. Mason, of Troy, N. Y., on the water-works of Gibraltar. He was unable to present this paper, but has kindly furnished The Engineering Record with the following notes concerning it. So carefully are the military secrets of the fortress guarded that even the individual officers of the post are not fully informed as to the nature of the defenses outside the section where their duties lie. To such an extent is this carried that the engineer officer designing the works for the new water supply stated that he could not go up the west face of the rock until his pass had been signed in England.

The bold-faced rock of Gibraltar so familiar in pictures faces the land and not the sea; the east side is also very precipitous, while the west slope, although decidedly steep, permits of enough fairly level ground to be found at its base to furnish room for the "city," with its surrounding walls and 20,000 people. The garrison numbers 6,000. The real defenses of the place are invisible to the stranger, who cannot locate a single piece of modern artillery unless he chances to be present during a gun drill, when he quickly becomes aware that the cannon are very many and very large.

Gibraltar is not limited to a single source of water supply. For flushing, street sprinkling and the like, a brackish water is used, which is obtained from wells sunk in the flats north of the rock and near the neutral grounds. The supply so secured is about 25 per cent. sea water in winter and about three times that amount in summer, owing to the variation in seasonal rainfall. It is pumped into a tank from which it is distributed by gravity, and is sold at about 5 cents per 120 U. S. gallons.

On the west slope there is a distilling plant for furnishing a potable supply from sea water. The apparatus is well protected and ready for an emergency, but is not ordinarily in use.

The principal supply is from the rainfall on about 16 acres near the top of the west face of the rock, which has been carefully cemented at a cost of about 30 cents per square yard. The water falling on this area, about 33 1/3 inches annually, passes through a rough strainer of polarite and sand, and is thence pumped into underground storage reservoirs, four in number at present. Each is 201 feet long, 51 feet high, 22 feet wide at the top and 18 feet wide at the bottom. The sides are stepped off by 4-inch ledges every 7 feet, measured vertically. The sides, bottoms and ends are concreted and plastered with four coats of equal parts of cement and fine limestone. Security against an enemy's shell fire is not the only advantage of this form of storage, for the absolute darkness which prevails inhibits the growth of aquatic vegetation and the temperature of the water is maintained constantly at 50 degrees. The exact location of these reservoirs a civilian is not permitted to know.

Designs have been completed and work is now in hand for a much larger storage system to consist of a tunnel driven through the entire rock from side to side, excepting, of course, the unexcavated ends. Exact information concerning the work cannot be secured, but in a general way it is known that the tunnel will be about 400 feet above sea level, 2,000 feet long, and 1,311 square feet in sectional area. It is expected to cost $750,000. The catchment area must necessarily be increased largely to provide enough water to fill this new reservoir.

Many of the citizens of Gibraltar store in private cisterns such rain water as they are able to catch on their roofs; there are nearly 700 of these cisterns. In default of such a supply they purchase water from the government at the rate of 2 cents per 12 U. S. gallons for rain water and 4 cents for distilled sea water.

Difficult Foundation Work on a New York Apartment House.

The 90 x 90-foot Park Realty Building, at 63d Street and Madison Avenue, New York, is a twelve-story, steel-cage apartment hotel which is being built on made ground where considerable difficulty is experienced with the foundations. These consist of 58 concrete piers which are being carried down to solid rock from 30 to 40 feet below the bottom of the cellar of the old building which formerly occupied the site. Wherever practicable the piers are built in pits made in open excavation with sheet pile sheathing. They are generally circular, with the piles driven around segmental timber rangers which are removed when the concrete is rammed in the pits up to the level of the cellar floor. On one side of the lot the fill is largely composed of earth and clay, through which the pits are being sunk with a moderate amount of pumping, but in some places the fill is almost entirely of rock, much of it in large sizes, so that it is almost impossible to drive sheet piles through it.

When it is found too difficult to sink open pits, cylindrical wooden-stave pneumatic caissons are substituted. These are all made in 25-foot lengths and have sections of cofferdams added to the upper ends when necessary. Most of them are 6 feet 8 inches in diameter but a few are larger, up to 10 feet. All of them have steel cutting edges, removable domes for the working chamber, are built with heavy planed and splined staves bolted to inner horizontal angle rings, and correspond to those illustrated in The Engineering Record's descriptions of the Atlantic Mutual Building, the Fabbri residence, and other buildings. Alongside the party wall of an adjacent building all the piers are built in caissons which are sunk with bevelled cutting edges, lowest near the lot line, to prevent the escape of compressed air there. Braced timber guide frames are built to enclose the upper ends of the caissons when first started, and the staves are smeared outside with grease to facilitate sinking.

The two adjacent buildings have their brick party walls supported on steel needle beams during the construction of the new substructure. One wall is being underpinned and has been lifted bodily a fraction of an inch on groups of three or four 15-inch steel I-beams set close together in the groups and about 6 feet apart on centers between groups. These beams are about 30 feet long and are supported by jack screws on timber cribbing under each end. The ends of the beams project only a short distance into the cellar of the adjacent building so that the opposite ends extend a long distance beyond the wall in the new building and leave room between their supports for unobstructed work on the underpinning. Between the groups of beams the 4 or 5-foot lengths of brick wall are supported by rows of jack screws set on short timbers under the footings and removed as necessary to allow the new work to be built. One of the old walls does not need to be underpinned, but is similiarly supported on groups of transverse I-beams which have jackscrews only under the long ends, and are carefully watched and adjusted if necessary to compensate for any settlement in the soil around the foundation pits. Permanent marks have been made on the wall, and instrument sights are made on them daily to detect any movement in the wall. The beams are screwed up to keep the wall exactly plumb and to carry as nearly as possible about a half of its weight and relieve the ground under the footings of some pressure until the new substructure is completed.

Messrs. Buchman & Fox are the architects of the building, Messrs. Purdy & Henderson are the consulting engineers, the George A. Fuller Company is the general contractor, and Mr. J. F. O'Rourke is sub-contractor for sinking the pneumatic caissons.

Sewer Reconstruction in New York.

The outfall sewer at Pier 34, East River, New York, is carried under the deck of the pier in two wooden stave pipes, 4½ feet in inside diameter and about 400 feet long, built by Mr. James Pilkington. Pairs of 5 x 16-inch horizontal transverse timbers were first bolted across opposite sides of the pier piles in the transverse rows intersected by the line of the sewer. They were set with a level and afterward were notched out on the upper edge to a depth of about 4 inches to fit the outside of the invert. The notching was done by a template carefully set with transit and level, and then the staves forming the invert were laid in the notches with the ends of adjacent pieces from 1 to 3 feet apart and successively racked back so as to prevent the concentration of joints in any one place and distribute them throughout the whole length of the sewer. After the invert staves were laid circular inside templates were set on them, and the remainder of the cylinder was built up over them as lagging is laid on arch centers. There are 63 strakes in the cross-section of the sewer, and they are 4 inches thick and 3 3/16 inches wide outside, planed to radial lines on the edges. They are made of creosoted pine, in lengths of about 16 feet, with square-sawed, butt-jointed ends, and are banded with flange-bolted steel hoops, about 3 feet apart, as illustrated in The Engineering Record of May 6, 1893. Wherever it is possible a transverse wall or bulkhead of planks bolted to the pile bent is fitted around the sewer, and the strakes are blind-nailed to it and to each other by diagonal nails through their edges.

At one place the sewer makes a horizontal angle and the adjacent sections are cut obliquely to their axes so as to make a mitered butt joint, which is enclosed by an extra wide hoop like a sleeve. At the land end, the wooden cylinders are built 3 feet into the concrete wall of a terminal chamber of the connecting brick sewer, care being taken to bed them all around with extra fine, rich mortar. As no provision had been made for the sewer in the design of the pier it was necessary to cut out some of the piles which were in its alignment; when this was done a short wooden sill was set across the tops of the cross beams supporting the sewer, and on it, close to the side of the sewer, was set a vertical 12 x 12-inch column tightly and accurately fitted under the deck of the pier to replace the piles.

Where the Rapid Transit subway is being constructed on Fourth Avenue, the large brick sewer originally occupying the middle of the street has been replaced by two lines of smaller sewers, one on each side of the street, close to the outer wall of the subway. These sewers are made with 14-inch, 16-inch and 18-inch pipes, and when the flow becomes too large for the latter, are built of brick and continued to the nearest transverse sewer. These sewers are located under the curb, in a very narrow space between the sidewalk vaults and the subway, and as there are many lines of water and gas pipes, conduits, etc., directly above them, are inaccessible by ordinary vertical manholes. Therefore, at street corners manholes are built a few feet beyond them and connected with them by a transverse bottom passage with concrete base and brick walls and vault intersecting the sewer brickwork.

At Eighty-first Street and Broadway there is a very large amount of storm water to be carried in the sewer, and to save headroom it is carried under the subway floor in two 48-inch cast-iron pipes solidly bedded in concrete and built into receiving chambers with steel beams and concrete roofs each side of the subway. A trench was dug and a temporary 2-foot steel pipe with flange-bolted connections was suspended in it to carry the dry-weather sewage flow, and the old sewer was removed. Then the excavation was completed and the new work built in very short sections, great care being taken to have the work always in such condition that it would suffer little damage when a sudden rain filled the trench and submerged the work, as sometimes happened.

Much more difficulty was anticipated and was experienced with the longitudinal sewers than with any of the others involved in the subway construction. The methods employed have not been unusual, but great care and incessant watchfulness have been requisite, and every precaution has been taken to provide for the temporary service and to avoid leaks and stoppages in replacing sewers, lowering or moving them and making new connections. The obstructions encountered have been very numerous and presented constant difficulties which demanded skill and patience to overcome. In some places the bottom and side walls have been made of monolithic concrete, and the arch of two-ring brickwork, a design which is considered very satisfactory, but not materially cheaper than the all-brick construction.

At 116th Street and Lenox Avenue a 5½-foot circular brick sewer is being constructed in a trench about under the center of the sidewalk. The house line is only about 10 feet away on one side, and on the other side, between it and the subway excavation, there is an earth bank about 10 feet wide and 20 feet high, with grass and trees on top which are to be preserved. The ground-water line is above the top of the sewer and as the soil is loose and sandy it was difficult to carry on the work without causing settlement or undermining. The sides were very carefully sheeted and braced and the sheeting was carried below sub-grade and braced across the bottom of the trench by permanent transverse struts wholly below the bottom of the concrete footing. This plan allowed the sewer to be built without removing the bottom braces and as it is in constantly saturated soil the timber will not decay and no fear is entertained of future settlement. All this work is in charge of Mr. Calvin W. Hendrick, division engineer of the Rapid Transit Railway Commission.

Plumbing in the Prudential Buildings, Newark, N. J.

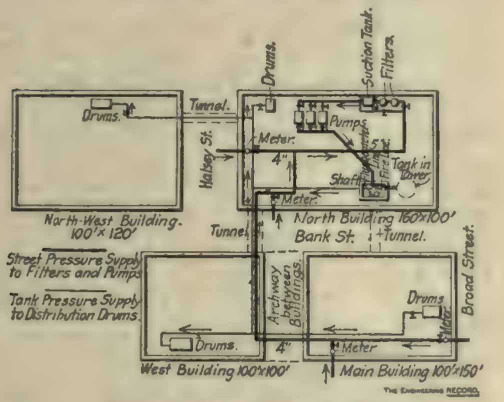
The main offices of the Prudential Insurance Company are located in a group of four large new twelve-story buildings occupying adjacent corners on Central street, in Newark, N. J. These buildings are all of steel and masonry construction, and except part of one building, which has been built and in service for a few years, have been constructed within the last few months. Besides containing a printing plant and other provisions for the special business of a large organization, they are designed and equipped similarly to modern office or commercial buildings, and have sanitary and mechanical installations adapted to such requirements. The power plant, the principal plumbing apparatus, and the electric, heating and ventilating plants are installed in the basement of the north building, and operated from there to a large extent for the service of the other buildings. The north building is separated from the other three buildings only by narrow streets, and is connected with each of them by a separate tunnel, through which ducts and pipes are carried.

Four 4-inch supply pipes from the mains in different streets enter the building independently, are connected to Trident meters and deliver through a 5-inch main to a Continental filter of a capacity of 500 gallons a minute. It is intended to filter all the water used, including the supplies for the steam boilers and for flushing purposes, but a by-pass is provided by which the water can be supplied either to the storage tank or directly to the pump suction if the filters are cut out. The filter delivers through two 3-inch ball cocks into a rectangular galvanized steel storage tank of 750 gallons capacity which is located in the cellar. Near it are three Worthington pumps cross-connected together for house supply and fire service, and taking their suction from the storage tank or directly from the meters. These pumps deliver through a 4-inch riser to the 18,000-gallon storage tank in the fifteenth story of the tower, about 200 feet above the level of the pumps. Each pump is provided with a Ford regulating valve under tank pressure, arranged to admit steam and start the pump as soon as the water level falls in the tank, and to stop them automatically as soon as it rises to the required height. Steam is intended to be always ready to operate the pumps, but one pump will suffice for the regular duty and the other will be kept in reserve and alternately used so as to be ready for any emergency, but will probably be shut off when not required, thus leaving only one pump constantly under steam pressure.

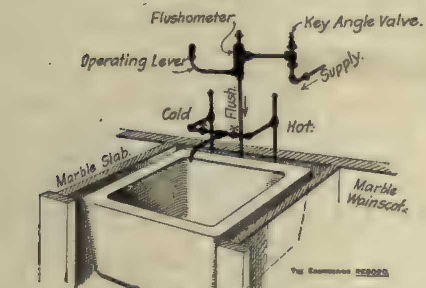
The storage tank is a 10-foot steel cylinder 31 feet high, and is braced with inside horizontal rods in pairs at right angles to each other. These rods are ¾ inch in diameter and are hooked into angle clips riveted to the shell about 5 feet apart vertically. The tank is set in cement about 1 inch thick on the bottom of a steel safe with sides 12 inches high. The safe is supported on 10-inch transverse I-beams resting across two longitudinal riveted girders which are built into the walls of the tower. The 4-inch pump riser is carried over the upper edge of the tank and extends down inside to within 1½ inches of the bottom, thus forming a hush pipe. It is not closed by any ball cock or other valve, but has a valved 2-inch vacuum pipe rising from its highest part and returning over the tank to prevent suction from the tank if it is required to empty the pump riser.

There are three main supply pipes taken from the side of the tank near the bottom, carried horizontally just above the top of the safe, and then valved and taken to the cellar in the shaft with the pump riser. There is an 8-inch pipe for the general supply to the steam boilers, the hot water heaters and for the cold water distribution lines in the four buildings. There is a 6-inch pipe for the flushing systems, and this and the 8-inch pipe have 2-inch valved pipes just below their upper valves, which are connected to a vertical pipe emptying over the tank so as to prevent vacuum if it is desired to empty the large pipes. The 6-inch fire line has a separate 2-inch vacuum pipe below its main gate valve and check-valve, and this pipe has a horizontal offset in which there is set a check-valve closing against pressure toward the tank, thus facilitating the emptying of the fire line and preventing the escape of fire pressure. A 1½-inch pipe rises 10 feet above the tank and returns into it to vent all the hot water heaters in the different buildings. The tank overflows to the main roof through a 5-inch pipe which is tapped to receive the valved 2-inch emptying pipe which passes through the safe pan, and to receive the 2-inch waste pipe from the safe itself. The tank occupies most of the interior of the tower, but is encircled by a spiral stairway giving access to the observation balcony just above the top of the tank.

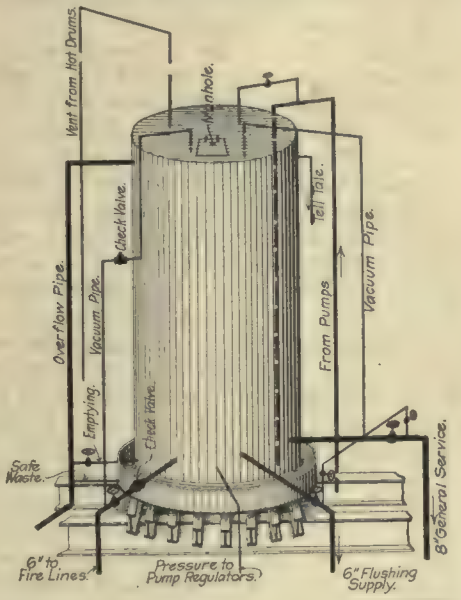
The three supply lines from the bottom of the tank are run a short distance horizontally,



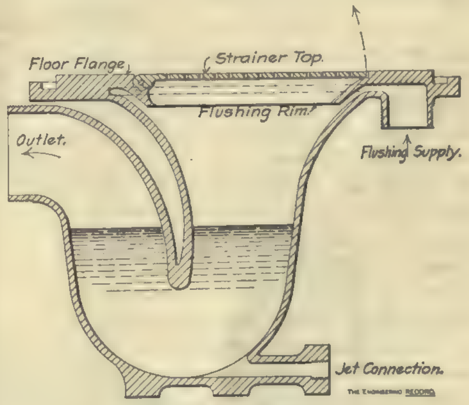
ARRANGEMENT OF BUILDINGS.



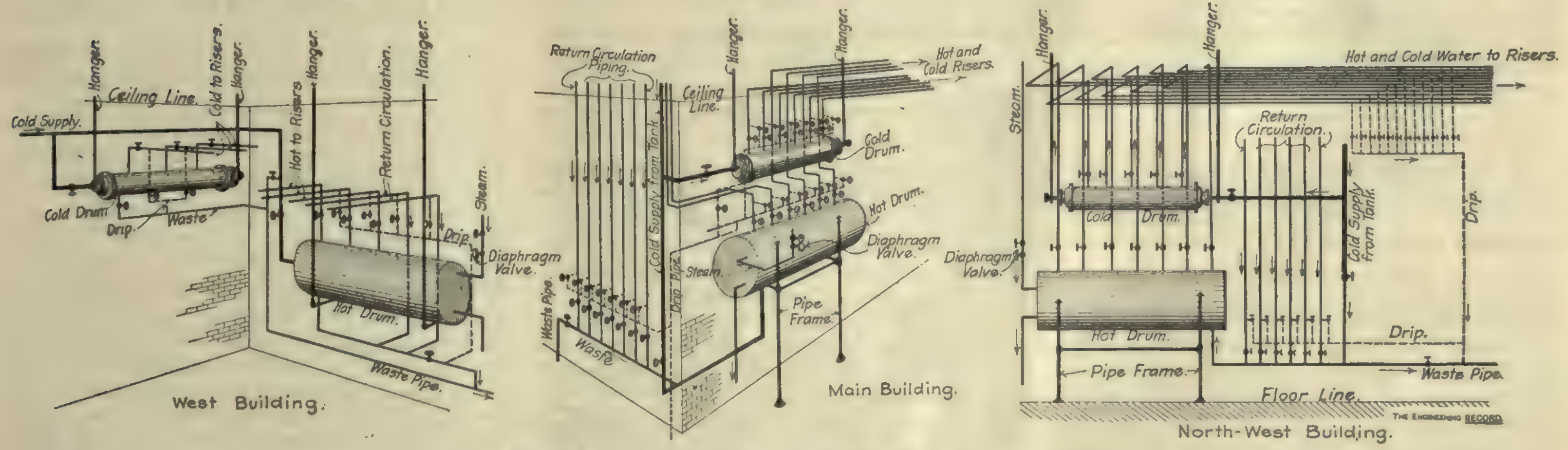
SLOP-SINK FITTINGS.



TANK IN TOWER.



FLOOR STRAINER.



HOT AND COLD DRUMS AND CONNECTIONS IN THREE BUILDINGS.

PLUMBING DETAILS IN THE MAIN OFFICES OF THE PRUDENTIAL INSURANCE COMPANY, NEWARK.

GEORGE B. POST, ARCHITECT; JOHN TUCKER, CONTRACTOR.

and are then taken vertically through a shaft to the cellar and valved to horizontal distribution mains which are carried through all four buildings on the cellar ceilings. The fire and flushing mains have valved connections to vertical risers supplying respectively two sets of 2½-inch hose lines, and one toilet room line, in each building. The 8-inch general supply pipe is branched to a cold water distribution drum and to a hot water heating and distribution drum in each building, and from these drums all the distribution lines and supplies for fixtures are run. The large risers in the main shaft are supported at every story by collars tightly bolted to them and having long projecting flanges resting across the tops of the floorbeams. In the tunnel between the buildings there are four large and three smaller pipes carried along the vertical wall on ordinary hangers such as are used for suspending pipes from the ceiling. These are set about 5 feet apart horizontally, and are leaded 8 inches into the wall. The pipes are in two parallel vertical planes, the smaller pipes being in the plane farthest from the wall and supported on longer and heavier hangers.

All the plumbing lines, headers and tanks in the cellars were under the disadvantage of being located in very cramped positions and had to be run to clear steam, ventilation and electric work which was first installed, thus involving much irregular and offset work. The arrangement of the distribution drums differs in each building; in the main building the cold water drum was a riveted steel cylinder about 12 inches in diameter and 4 feet long suspended horizontally close to the ceiling and directly above the 24 x 60-inch hot water drum. Both drums are supplied from a 3-inch tank-pressure pipe which connects to the end of the cold drum and to the under side of the hot water heater. There are six hot water and six cold water outlets from the drums, and all of the hot water pipes have return circulation pipes connected to a horizontal header on an adjacent wall at right angles to the drums.

The arrangement of the hot and cold drums in the northwest building is similar, but there the cold water drum is a 4½-foot section of extra heavy 10-inch steel pipe about ⅞-inch thick and the outlets are simply tapped into its sides without reinforcement or flanges. The ends of the drum are closed by thick convex castings like reducers, with holes in the ends. In one of them is screwed the 4-inch branch from the tank pressure pipe, and in the other end is screwed a short nipple which is capped and which serves, as does the other 4-inch pipe, for a neck by which the drum is suspended. The hot water heater directly below it is a 30-inch riveted steel cylinder 5 feet long, which is supported on a pipe frame and has seven 2-inch outlets to riser lines offset to pass under the cold drum and run parallel with the cold water pipes on the cellar ceilings. In both these buildings the hot water return circulation pipes are connected to the cold water supply pipe just before it enters the heaters.

In the west building the hot and cold water distribution drums are arranged at right angles to each other in the same horizontal plane and suspended close to the ceiling. The cold water drum is a 10-inch steel pipe 5 feet long with screwed caps on the ends, and the hot water drum is a 30 x 60-inch riveted cylinder with the cold water inlet in the middle of one end and the return circulation pipes connected to the emptying pipe. In all cases both drums are covered with sectional magnesia and canvas sewed on and painted, and all supply pipes are valved and dripped near the drum, except in the west building, where one hot and one cold supply pipe run only a short distance to supply an adjacent sink, and are pitched so as to empty completely through their faucets..

All the hot water drums are heated by a Tucker brass steam pipe, about 5 inches in diameter, in the center of the drum which acts as a surface condenser. The steam supply is regulated by a thermostat which operates a diaphragm valve automatically turning the steam on and off to maintain the temperature at a fixed point. The hot and cold water drums previously installed for the distribution system in the old part of the main building consist of a pair of larger cylinders with parallel rows of risers which will be entirely cut out and removed after the completion of the new system. In many cases it was impracticable to run all the distribution lines to the drums and so the pipes were run of a larger size from the drums, and horizontal branches were taken from them at various points for the rising lines. These branches were always commanded by valves arranged in passage ways in a circuit conveniently accessible to the engineer.

Both hot and cold water risers all have 2-foot expansion loops under the floor of every second story, and are supported midway between each loop. Except where nickel plated in the toilet rooms and offices, all exposed cold water pipes are covered with composition felt, magnesia, and canvas sewed on and painted two coats. The hot water pipes are protected in the same way, except that the felt is omitted. All pipes are valved to be completely emptied, and wherever there is any bend or irregularity which makes air binding possible an extra valve is set to relieve it. All water pipes were tested after being completely fitted up, by a pump pressure of 275 pounds, under which no important leaks or imperfections were developed.

The third floor of the main building is entirely occupied by the Fidelity Trust Company, which has fitted up a large toilet room for the clerks, another for women, and a private toilet room and bath room in the basement. On the first floor there is, on each side of the corridor, a very small circular toilet room for the special use of officers of the company, fitted with a water-closet and wash-basin. In the basement there is a toilet room and bath for the engineer, and the same for his assistants, and on each of the upper floors there is a small toilet room, and on every third floor there is a large one. In the other buildings there is generally a toilet room on every floor. All water-closets, urinals, and slop-sinks are fitted with flushometers made by the Kenney Manufacturing Company. These are all supplied from special riser lines under full tank pressure, but the branch of each flushometer is controlled by an angle valve operated by a key-wrench and adjusted by the engineer only. These valves are very carefully throttled to give exactly the right effect under the pressure at that point.

All waste, vent and soil pipes are of extra heavy galvanized screwed steel; where they run horizontally under the toilet room floors they are solidly bedded in the concrete, and all the pipes above the floors there are run between the fireproof partitions and the marble wainscot of the toilet room. The sewer pipes under the cellar floor are of extra heavy cast iron, bedded solid in concrete. The total number of fixtures include about 280 water-closets, 300 wash-basins, 60 slop-sinks, 8 iron sinks, 200 urinals and 4 bath tubs. The contract price for the plumbing work will exceed $200,000, and it has already been in progress over a year with a maximum force of about 60 men.

At the commencement of the work the plumbing previously installed in the old part of the main building was subjected to the required pressure test of 250 pounds per square inch and the pipes being found unable to withstand it, have all been removed, new lines put in and the fixtures connected up to them without any interruption to the constant service. Some of the old pipes had been in service for seven or eight years, and were found to be very thickly coated with rust inside, and to be eaten nearly through in occasional small spots.

When the new work was commenced a 4 x 6-inch Worthington pump was set up in the main building and its suction connected to a 100-gallon galvanized iron boiler fitted with a ball cock under street pressure so as to act as an intermediate supply tank. The pump discharged into a 2-inch header with five valved branches to rising lines in the different buildings. These lines were successively extended to the upper floors as the buildings were erected, and were capped and provided with valved outlets for the masons' use. The pump was kept constantly under steam and was controlled by a regulating valve set to maintain a constant pressure of 85 pounds in the header.

All pipe cutting and threading has been done in the building by a Merrill machine driven by a Meitz-Weiss 2-horse-power gas engine. This arrangement has expedited the work and decreased the cost.

All soil and waste pipes discharge by gravity to the street sewers, but the subsoil drainage is collected in a brick cess-pool and periodically lifted to the sewer by an automatic steam pump. All the floor drains have Tucker's patent floor strainer traps of heavy cast brass with a perforated hinged cover and a flushing rim. The upper rim of the trap is grooved to engage the cement or asphalt floor firmly, and there is an inclined inlet at the base, directed towards the outlet, so that the jet from a ½-inch flush pipe screwed in there will scour out any sediment in the trap. This inlet and the flushing rim are connected to a pressure pipe controlled by a valve conveniently located on the wall near by, so that the trap can be at any time readily filled and cleaned out.

Mr. George B. Post is the architect of the building, Mr. John Tucker is the contractor for the plumbing and Mr. Charles Ward, the foreman in charge of the work.

Messrs. Steele & Condict, Jersey City, have installed the apparatus for an ice-water drinking plant, including a refrigerating machine, a circulating tank pump, a 100-gallon Continental filter to supply about fifty drinking fountains, one in the corridor in every story of each building, which, with the piping, were fitted up by the plumbing contractor. Each riser is valved top and bottom, and the water is circulated at a constant temperature of 36 degrees. The ice-water pipes are lined with tin and are covered with 2 inches of cork, put together with cemented square butt joints, painted two coats of a special paint, then covered with canvas sewed on and again painted with the same paint.

The First Arch of brick masonry of which there is any definite record was built about 4,200 B. C., and was a barrel vault in the tomb of an Egyptian king. There is a picture of it in the paper on the sources of Egyptian architecture, recently presented to the Institute of British Architects by Prof. Flinders Petrie. This discovery, according to Prof. Aitchison, indicates that possibly the original cloaca maxima at Rome may have been vaulted, although it is generally held that the first roof was of stone slabs and that the arch was originated about the time of Alexander the Great. Another interesting view shown by Prof. Petrie was a photograph of a granite pavement laid about 4,700 B. C., and another showed some coursed limestone rubble masonry of about 4,350 B. C., with the faces of the stones still bearing the marks of the flint adze with which they were dressed.

The Emperor Francis Joseph Bath at Reichenberg.

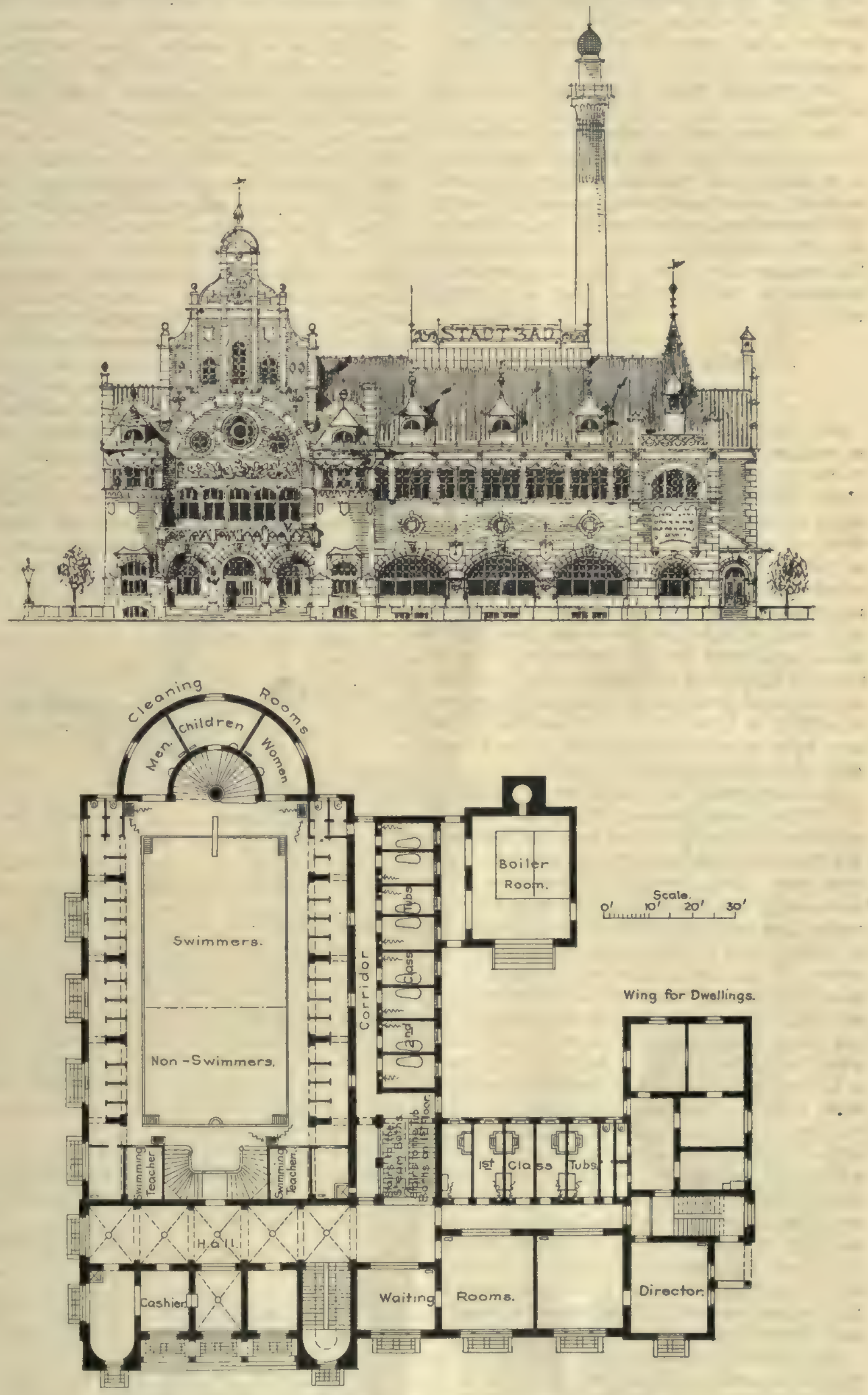
The year 1898 was celebrated in Austria by the starting of many important public works, intended to commemorate the fiftieth anniversary of the Emperor's reign. Among these undertakings was a public bath at Reichenberg, the money for which was given by a local bank. This Bohemian city has a population of about 40,000 people, nearly half of them workmen, to whom such a bath is a great boon. The plans were prepared, as the result of a limited competition, by P. P. Brang, and from his account of the building in the Zeitschrift of the Austrian Engineers and Architects' Society, the following notes have been prepared:

The building is located on a street corner at the foot of a hill, on a site which furnished an opportunity for a more ornate exterior than the crowded streets of many cities will warrant. The project contemplated, first, a swimming tank, with about 60 dressing rooms and a large room for 100 schoolboys; second, about 40 tub baths, divided into three classes, in the usual European manner; third, Turkish and Russian baths; fourth, shower baths; fifth, dwelling rooms for the superintendent and chief engineer, apart from the baths proper; sixth, a steam laundry and drying rooms; seventh, a boiler and engine house. Care was taken to arrange the tub baths in rooms looking out on the court, and the dwelling rooms for the superintendent and engineer were located in a separate wing with an independent entrance. In the basement are the storerooms, laundry, drying rooms and other departments of like nature.

Luxury was not attempted in either inside or outside decoration, but attention was paid to securing exceptionally strong construction. Wood is confined almost exclusively to windows, doors and dressing rooms. The ceilings are all arches turned between rolled beams, the floors are everywhere covered with tile, and the walls in all the bathrooms are covered with tile, either wholly or on the lower 6 feet. Columns and steps are partly granite and partly sandstone. The large roof, with a monitor over the swimming tank, is carried by five sets of trusses, from which the Monier ceiling is suspended. A bluish-green sandstone has been used for the stone trim, and all flat masonry faces are covered with yellow tile. All ceilings are faced with glazed tile of two colors.

The ventilation and heating system was installed by Messrs. B. & E. Koerting, of Vienna. In the independent boiler house there are three boilers, one of them kept in reserve, fed by injectors. The steam is piped by a single main to two cast-iron distributing headers, one for the high-pressure system and the other for the system under about 14 pounds, which is produced by a pressure-reducing valve on the pipe leading to the header. All rooms, except those of the dwelling apartments, are heated by steam. Steam at 14 pounds is employed for the Russian and Roman baths, the wash-boilers, drying rooms and the tempering coils for the air entering the swimming hall. All other rooms are heated by steam at 2 to 3 pounds. Fresh air is admitted through openings in the window sills, except in the swimming hall. The air is drawn from the rooms through exhaust ducts with openings near the floor and near the ceiling. These ducts are carried to large outlets in the roof. The swimming hall is supplied with fresh air warmed in a tempering chamber in the basement and forced through the heating coils into the room by an electric fan. The warm air is admitted below the stairs leading to the gallery around the room, while the foul air is removed through ducts fitted with two electric exhaust fans and opening above the roof.

The tubs of the third-class bathrooms are made of galvanized iron, and the hot water is admitted through safety mixing valves; each tub is also fitted with a shower for tempered water. Sunken baths lined with Dutch tile are used for the first-class rooms, and are fitted with safety mixing valves for both tubs and showers. The second-class fixtures are of the same sort. The swimming pool has two warming appliances and a drain with valve and overflow screen. The cleaning baths are each fitted with a tempered head spray, a jet douche for cold water and a rubber hand douche for tempered water. All pipes for tempered water have safety mixing valves. The douche rooms have three head sprays, a needle bath, a breast spray, a seat spray and two jet douches. There are also cold and tepid pools with a heater for the water. The steam baths have a head and breast douche for tempered water, likewise controlled by safety mixing valves, and there are also bibbs for cold water and copper pipes for admitting the steam. The hot-air baths are similarly provided with cold-water bibbs.



GROUND PLAN AND FRONT ELEVATION, REICHENBERG BATHS.

The water supply is pumped by steam from a large well near the boiler house into a tank in the roof, and a pulsometer is kept in reserve in case of acident to the pump. The water is piped to headers on the basement ceiling, and from them through risers to the various rooms. The warm water is provided by a heater with steam-jet apparatus, which raises the temperature to about 140 degrees Fahrenheit. The swimming bath and the pools or full baths are fed by a special cold-water main from a 160,000-gallon masonry reservoir nearly 2,000 feet from the buildings. In this pipe there is a steam-jet apparatus to warm the water during its flow. The swimming bath has a constant supply.

The drainage of the establishment is led to a pipe on the ceiling of the cellar, which discharges into a cesspool from which the sewer runs.

The large swimming bath and the tepid pool have warming apparatus connected by separate pipes with the high-pressure steam header, and there is also a heater, similarly connected, to produce a circulation of the water in the swimming bath.

The drinking water is supplied by 18 wall fixtures.

The laundry plant is designed to handle half a ton of towels and other supplies daily. There is a double-drum washing machine, a rinsing machine, a centrifugal drier, a steam boiler with filter apparatus, a chest mangle and a laundry car. The soaking tubs are of cement masonry. The condensation from the drying apparatus is returned to the boiler-feed tank by a steam trap.

LETTERS TO THE EDITOR.

Purchasing Agents.

Sir: The extremely bright and witty, as well as sensible and timely paper presented by Mr. Porter at the recent meeting of the American Water-Works Association was thoroughly enjoyed by the writer. Purchasing agents are indeed apt to become trials to the souls of selling agents, and apparently often enough for the reasons advanced in the paper "Mattoids in Engineering." But, by way of discussion, attention may be called to the other side of the shield, to account for the presence in places of power of these same purchasing agents. Enough of them have earned their "jobs" by sheer force of ability to make such an explanation necessary when objurgations are thus to be heaped upon their wretched heads.

There are two kinds of purchasing agents, in the writer's experience. One is the man of business training, who tries to be an engineer; the other is the engineer who tries to be a business man also. Should there not be a single class, composed of business men who, for that reason, are engineers? The cause of the trouble is fundamental in our system of training engineers. While there is, indeed, a good deal of loose talk about "economy" and "efficiency" in the text-books on mechanics and engineering, the simple truth is that the bare science of engineering, stripped of every financial restriction, is all that is systematically taught in our technical schools. Some say that this is all that can be studied or taught in the professional course. But cannot a change be made in the attitude of engineering instructors toward the financial phase of the subject? Do they at present keep constantly before the minds of the students of engineering the modifying effect of cost upon the final result? And do they endeavor constantly to instill into the student how fatal to real economy it is to take a partial, limited, narrow, petty view of a special problem?

It is common enough to hear derogatory remarks made about the financial stupidity of engineers by heads of corporations. "You engineers are forever spending the principal to save the interest," they will say. "You can't make him see it," the engineer will say of his superior, referring to some improvement of plant the engineer wants but very likely cannot defend when it comes down to hard cash.

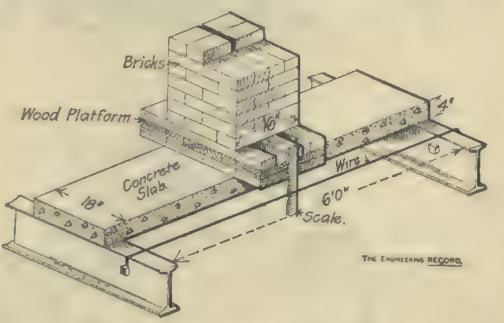
There is little doubt that in the future all purchasing agents will be technically trained in engineering; but they certainly must always remain men of fine financial sagacity as well.

Worcester, June 23. George I. Rockwood.

The Definition of Civil Engineering

Sir: Referring to Mr. Brinckerhoff's criticism of Tredgold's famous definition of Civil Engineering in your issue of May 4, it occurs to me that we may fairly question whether Tredgold's definition was ever strictly accurate, for even in early time the civil engineer was not the sole director of "the great sources of power in nature for the use and convenience of man." If there were then no chemists, there were at least physicians who, in a small way, employed the chemical forces of nature. Again I venture to question whether the phrase "for the use and convenience of man" indicates in any wise the engineering character of the work. If a work were for the inconvenience of man, or for the convenience of some and the inconvenience of others, like the Chicago drainage canal, would it therefore be any the less civil engineering?

For a strict and rigid definition of civil engineering as at present practiced I beg to submit that it is "the art of skilfully building stationary economic structures." And, in anticipation of the adverse criticism that this homely phrase will naturally arouse in comparison with the graceful and comprehensive definition so long prized by engineers, I wish to claim that "structures" would properly describe even tunnels and dredged channels; "economic structures" would include everything but military structures; "stationary" would exclude such things as machinery, ships and otner moving structures, valves, and the turntables of drawbridges, which, though sometimes built by civil engineers, are more properly the work of others; and it would include houses and sky-scrapers, but in these the engineer must leave the fine art to the architect; "skilfully building" involves proper design and economical construction. The inception of the engineering structure as a solution of an economic problem may be by an engineer, or by a statesman, an editor, an industrial magnate or by any one with sufficient knowledge, but it is characteristic of the engineer that he only can "skilfully build."



Testing Concrete Slabs.

I fear that this definition is yet in very crude form, but I respectfully offer it as a suggestion, hoping that some of your readers may pursue the idea further and perfect it.

John W. Burke.

New York, June 12, 1901.

Strength of Slabs of Cinder Concrete, Quantities of Material and Weight of Concrete.

Sir: In connection with some tests of reinforced concrete floor slabs, the writer recently tested three slabs of cinder concrete, the record of which may be of interest to engineers and architects.

The slabs tested were each made in a box 6 feet 9 inches long, 18 inches wide and 4 inches deep. The concrete was composed of Portland cement, coarse sharp sand and screened cinders, passed over a No. 4 sieve, mixed in the proportion of one part cement, two parts of sand and five of cinders, a different cement being used for each slab. By trial it was found that with these proportions, it required exactly 0.665 cubic foot of cement, 1.33 cubic feet of sand, and 3.325 cubic feet of cinders to make a slab of the desired dimensions. These quantities were put in a mortar box and thoroughly mixed, both dry and wet, then put in the mould box and tamped until the surface was brought to a level with the sides of the box. Just enough water was used in the concrete to work easily and to cover the cinders with mortar. When the slabs were 24 hours old, the sides of the box were removed, the slab still resting on the bottom.

When the slabs were 4 weeks old they were tested as shown in the accompanying sketch. The load consisted of a platform of plank, 16 inches wide and weighing 49 pounds, on which were placed, two at a time, paving bricks weighing 6 pounds. The platform was bedded on about ¼ inch of fine sand and the slabs were bedded in neat cement on top of the steel beams.

The area of the slab between the flanges of the beam was 72 x 18 inches or 9 square feet. The bearing of the platform on the slab was 16 x 18 inches or 2 square feet.

The loads at which the different slabs broke were as follows:

Slab No.	Cement.	Breaking load.	Equiv. distrib. load per sq. ft.
1	Colo. Portland..........	465 lbs.	92 lbs.
2	Colo. Portland (old)...	250 "	49 "
3	German Portland......	156 "	31 "
4	Red Diamond (Utah)..	306 "	60 "

The cement used in slab No. 1 was run off about 30 days before the slab was made. The cement used in slab No. 2 was made last fall and was of an inferior quality compared with that now manufactured by the company.

The deflection of the slabs was measured by means of a scale graduated to fiftieths of an inch attached to one end of the plank platform and coming in contact with a fine wire stretched across the top of the steel beams. Slabs 1, 3 and 4 showed a deflection of 0.04 inch just before they broke, while slab No. 2 showed none at all. As soon as the slabs were broken they were placed on a Fairbanks scale and weighed. The equivalent load per square foot is the load which would theoretically produce the same moment as that which broke the slab.

The following data concerning weight and quantities of material are valuable, as they were determined with great accuracy:

Concrete in one slab........................	3⅜	cu. ft.
Materials in one slab; cement............	.665	" "
Sand	1.33	" "
Cinders	3.325	" "
Total	5.320	" "

Weight of cement by actual measurement in box containing ⅝ cubic foot, 88 pounds per cubic foot; weight of cinders, 40 pounds, per cubic foot. Average weight of concrete slabs, 316 pounds, or 93.6 pounds per cubic foot.

On the above basis a cubic yard of concrete would require 5.32 cubic feet, or 468 pounds of cement, 10.64 cubic feet sand and 26.6 cubic feet of cinders.

It is well to note that the weight of the concrete per cubic foot is considerably more than that usually given in the circulars of concrete fireproofing. None of the cinder concrete weighed by the writer has shown less than 90 pounds per cubic foot and none more than 96 pounds. F. E. Kidder.

The Effect of the Chicago Drainage Canal on the public health in the Desplaines and Illinois valleys, not to mention St. Louis and Cahokia, may be the subject of spirited legal combat, but it is certain that the canal has worked wonders for Chicago. Shortly after the Lockport gates were opened, a boy caught a real, live fish in the South Branch, and now whitefish have reappeared in Lake Michigan near the city, after years of absence. Chicago is to be congratulated.

A Practical Test of the Danger from Electric Wires.

For about three years, two Swiss electric railways, the Stansstad-Engelberg and Zermatt-Gornergratt lines, have been working with a three-phase alternating current at 750 volts. It is conveyed through two overhead trolley wires, the rails acting as the third wire. The authorities at first refused to permit more than 500 volts, so Prof. H. W. Weber, of Zurich, carried out on his own person two series of experiments to determine the voltage at which life is endangered. The experiments are described in detail in the "Ingenioren" of Copenhagen, in an article which the Institution of Civil Engineers recently reviewed as follows:

The first series was devised to meet the accident of a person laying hold of the two overhead wires at the same time with both hands bare; or the alternative of both conductors falling upon bare parts of his body. With wet hands, starting at 10 volts potential difference, a very slight trembling was felt in the muscles of the fingers; the measured strength of the current passing through the body from hand to hand was equal to 0.001 ampere. Increasing by 10 volts at a time, 40 volts paralyzed fingers, hands, and arms instantaneously, producing almost unbearable pain, and in hardly any instance could the experimenter loose his hold of the wires again; after five seconds the pain became unendurable. At 50 volts there was likewise instantaneous paralysis of all the muscles in the same limbs, the trial became unbearable in two seconds at the outside, and the wires could not be let go without the greatest effort. With wet hands therefore no higher tension was tried. With dry hands, a slight tremor was occasioned of the muscles in the fingers and hands at 50 volts, and the current strength was less than 0.0001 ampere. At 80 volts, fingers, hands, and arms were almost stiff, with severe pain in all parts, and only with great struggling could the wires be let go; the strength of the current was from 0.009 to 0.011 ampere. At 90 volts the hands were completely paralyzed at the very instant of grasping the wires, which could not be let go again; the pain in hands and arms was so great as to make the experimenter shriek involuntarily, and the trial became unendurable in less than two seconds. On going back again to 80 volts, the difference was so great that the effect of this tension now seemed extraordinarily small in comparison with that of 90 volts. No higher tension was therefore tried. From this first series of experiments Prof. Weber concluded that it is too dangerous to touch simultaneously both poles of an alternating-current circuit in which the potential difference exceeds 100 volts; it is impossible then to let go, and instant help must be forthcoming on the spot. Hence the prevalent notion that even 500 volts tension is not dangerous does not hold good; death is recorded where it did not exceed 240 volts.

The second series of trials represented a person standing either upon the ground or upon the car, and touching one of the overhead wires. Here the feet are tolerably well insulated by the soles of the boots, and the nature of the ground affects the result. Standing on moist gravel, the experimenter could feel scarcely anything up to 800 volts potential difference, whether touching the wire lightly or grasping it tight; but at 2,000 volts the wire produced a violent burning of the skin when lightly touched, and a stronger tremor in the fingers when grasped tight. Standing on clay covered with moist coal-dust, he could feel scarcely anything below 200 volts; but at 1,000 volts the skin was burnt as if by fire on lightly touching the wire, and on grasping it tight the effects upon fingers, hand, arms, and feet were unbearable in less than two seconds, and the wire was with difficulty let go. On grasping it tight at 1,300 volts, fingers, hand, and arm were completely paralyzed, and it could not be let go. Hence the tension should not exceed 1,000 volts.

While therefore the potential difference begins to grow dangerous as it rises above 200 volts, Prof. Weber concluded that there is no need to be afraid of using the higher tensions, between 500 and 1,000 volts, which are so much more advantageous; for there is extremely little likelihood of passengers or others ever happening to touch both wires at once. The only persons exposed to this risk are the men employed on the wiring, who as a rule are trained to understand the danger and to guard against it. The consequence of the foregoing experiments was the sanction of 750 volts for the working of the two railways mentioned at the outset.

An Overland Journey of a Lightship.

The Columbia River light vessel, also known as No. 50, broke from her moorings during a severe storm, and having only sail power was driven ashore, on November 29, 1899, on a little patch of sand beach near McKenzie's Head just north of the mouth of the Columbia River. It was great good fortune that she landed on this little beach, for at either side of it the shore is bold and rocky. The question of getting the ship off again was immediately taken up and two ways considered, either that of pulling her off to seaward or of transporting her overland. On account of a much lower bid, a contract was let for the first method on December 8, 1899. The contractor having failed to accomplish anything and his contract having long expired, on June 18, 1900, this contract was annulled and new proposals issued. Again the lower bids were for the seaward method and a second contract was let on July 16, 1900. This contract was annulled on January 4, 1901, for similar reasons.

A third letting was then had and a contract was given to Allen & Roberts of Portland, Ore., on February 14, 1901, to move the ship overland from the Ocean Beach to Bakers Bay, a distance of 2,000 feet. When the ship first went on the beach and until after the letting of the second contract she had rested head on toward the shore, but by the time the contract with Allen & Roberts was made, she had turned so that she was nearly broadside on and was embedded in the sand to a depth of six or seven feet. The first operations were directed to turning her bow in the direction in which she was to be moved. For this purpose a cribwork of logs about 20 feet in height was built, on which was placed a large wooden roller 2½ feet in diameter. Chain cables were passed over the cribwork and roller and fastened to the bow and power applied by means of horse-power capstans. In this manner a lifting pull was obtained and the ship was straightened around to the desired direction and moved some 125 feet. In accomplishing it, the vessel was turned on her side so that the deck was almost at an angle of 45 degrees. She was raised to a vertical position by means of screws resting on logs. It was then decided to place chains under her at the bow and stern to help lift her out of the sands. This was done at the bow by stretching the chain along one side of the ship, carrying it across the bow and attaching the end to a 70-ton capstan, the other end having been made fast also. Where the chain passed across the bow a trench was excavated to get it well down before applying the power; while this strain was being applied, the sand underneath the keel was loosened as much as possible by means of a steel bar 30 feet in length, sharpened at the end like a chisel. The same method was followed at the stern, and the cables were thus drawn under the ship to the desired amounts. Other methods, involving the loss of a month's time, had been tried without success. The ends of these chains were fastened to large logs supported by a cribbing of timber raised on a plank foundation constructed of 4 x 12-inch stuff, 2½ feet in depth. Previous to using the plank foundation, one built of logs resting on the sand was tried, but a storm came up and washed the logs out, allowing the ship to settle back in her bed, after she had been raised ready for the cradle.

In the earlier part of the work much trouble was experienced from high tides, rain and storms and the shifting nature of the sands.

By means of large screws on the plank foundations and using the cables also, the ship was raised between 12 and 13 feet and the cradles and trackway placed under her, constructed as follows: Two timbers, 9 feet apart, each 25 feet in length by 12 x 24 inches, were placed under the keel near the bow, transversely to the length of the ship and two more near the stern. Then on top of these timbers, other timbers were laid, extending out from and abutting against the keel and others higher up from the side of the vessel, all timbers extending out the same direction as the long timbers. Longitudinal timbers were used to connect the various sets of transverse timbers, thus forming a cribwork cradle.

Two oak shoes, 4 feet apart, were placed under each end of the through timbers. These shoes, when the vessel was lowered ready for moving, rested on oak rollers, running on a plank track, laid on the ground, previously leveled transversely and graded were necessary to an even slope. Heavy cables were passed around the stern and forward alongside, and others to her anchor bitts, through the hawse pipes. These cables were attached to blocks and these in turn to capstans operated by horse power.

With the arrangement outlined the ship was taken up the beach over the uneven ground of the peninsula, across a swamp and finally down a grade to the beach in Bakers Bay, where her further progress was stopped in order that repairs could be made upon her while she was still out of the water. After starting the rate of progress averaged about 175 feet per day. The altitude of the highest point crossed has been variously estimated at from 30 to 40 feet, but no accurate measurement has been made.

After the repairs are completed the contractors propose to launch her upon rollers in the same manner, instead of building the usual ways. They adopt this method because the water in Bakers Bay is shallow for a long distance out from shore and they fear that if the ship were launched from ways, even at high tide, she would plunge her bow into the mud and stick fast, whereas, by following the method just described they believe that she can be taken out to a sufficient depth of water to float without either difficulty or danger.

The above description is derived mainly from the contractors themselves, to whom credit for it is due and for their good work on the vessel. The ship is in the Thirteenth Light-house District, of which Capt. W. C. Langfitt, Corps of Engineers, U. S. A., is the engineer officer.

Trade Publications.

The pocket edition of the local 1901 trade catalogue of the Gurney Heater Mfg. Co., Boston, is a small morocco-bound book of about 60 pages, containing in addition to descriptions and lists of dimensions of the large variety of boilers and heaters for steam and water, radiators and heating fittings made by the company, some tables and suggestions concerning heating plants, which will be found of value by the practicing architect.

An interesting description of a new style of water-closet has just been issued in an attractively printed pamphlet by the Pierce, Butler & Pierce Mfg. Co. Syracuse, N. Y. The closet has a large vent, which is caried back and upward to the top of the bowl to an upright elbow connection with the vent pipe in the wall. The purpose of this construction is to make it impossible for water to enter the vent pipe even if the closet becomes clogged and the water overflows the rim.

Among the displays at the Pan-American Exposition is a building of fire-proof construction shown by Henry Maurer & Son, New York. To explain its important features the firm has prepared a little book which contains some useful information on terra-cotta floors, roof tiles and partitions, including the "Herculean" floor of terra-cotta blocks with T-bar reinforcing members.

The Sprague Electric Co., New York, has issued a new edition of its bulletin of Lundell motors, which are now made in sizes from 1-20 to 1,000 horse-power. The catalogue is fully illustrated and there are the usual tables of dimensions of the different types of motors. One of the illustrations shows a large exhaust blower of a ventilating plant driven by a direct-connected motor of this make.

Personal and Obituary Notes.

Mr. T. D. Allen has been appointed city engineer of Pasadena, Cal.

Mr. Francis W. Heisler, purchasing agent of the American Bridge Co., has tendered his resignation.

Mr. John Field, Deputy State Engineer of Colorado, had a leg broken and was otherwise injured by the collapse of a building near Denver recently.

Prof. C. W. Marx Professor of Mechanical Engineering in the University of Missouri, has resigned to accept the professorship of engineering in the University of Cincinnati.

Henry R. Bradbury, who died from heat prostration at his New York home on July 3, was well known to engineers from his connection with asphalt paving industry and, more recently, with the Virginia Portland Cement Co.

Lebbeus Baldwin Ward, a member of the American Society of Civil Engineers since 1869, was found dead in his room at the Hotel Washington, Jersey City, on July 3. He was born in Vermont about 66 years ago, and was educated for his father's profession of engineering He was successful at a comparatively early age, became chief engineer of the Morris and Essex Canal when it was an important factor in the transportation world, and was interested in private water and gas companies. For many years he wielded a strong political influence in New Jersey, where his wide knowledge, business ability and keen sense of fairness to all parties to a controversy made his opinions valued by his friends and respected by his opponents. Law was his favorite study, particularly the law of water and water-courses, and although he never applied for admission to the bar, it was well known to his friends that briefs in some of the most important water suits before the New Jersey courts were drawn by him. His advice on law points was often sought by engineers of his acquaintance, and of late years The Engineering Record has printed a number of articles on water rights and river pollution, either written or outlined by him. His intimate knowledge of men and public affairs, his extensive reading and quiet humor rendered his acquaintance a privilege which all prized highly who enjoyed it.

Mr. Elwood Mead, M. Am. Soc. C. E., who was severely injured in an accident lately, has been requested to undertake for the U. S. Industrial Commission the preparation of a full report on irrigation and irrigation laws, with special regard to their effect on labor. It is stated that he will shortly be transferred to Washington from Cheyenne, where the Irrigation Bureau's office will be turned over to his assistant, Mr. Clarence T. Johnston.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv, xxii and xxiii.

WATER.

Atlantic City, N. J.—Bids are wanted July 22 for furnishing a quantity of cast iron pipe, as advertised in The Engineering Record.

Laurel, Md.—Bids are wanted July 11 for furnishing and laying a quantity of pipe, etc., constructing a dam, dyke and pump well; also for a boiler and pumps, as advertised in The Engineering Record.

Williamsburg, Mass.—Town Clk. Henry W. Hill writes that no action has as yet been taken by the town, but water-works will probably be built this year; authority was granted at the last session of the Legislature.

Union, N. Y.—The Endicott Water-Works Co. has been incorporated with a capital of $50,000. Directors: G. F. Johnson and A. H. Bixby, of Binghamton, and C. Fred Johnson, of Union.

Fayette, Miss.—Plans are being prepared for a water-works plant to cost $10,000.

Columbus, Ind.—Bids are wanted July 18 for erecting a power house and pumping station. James Cochrane, City Clk.

Lancaster, Pa.—The Superintendent of the Water Department will receive propositions until July 25 for the old Berkenbine pumps, as advertised in The Engineering Record.

Anacortes, Wash.—Press reports state that local citizens have raised funds to purchase and improve the water-works system.

Radcliffe, Ia.—The contract for water-works was awarded to the Des Moines Bridge & Iron Works for $6,147. This includes a deep well pumping plant, a brick pump house, a wooden tank of 40,000 gals. capacity on a steel tower 70 ft. high, and about 2,100 ft. of mains, with hydrants, etc.

Sturgeon Bay, Wis.—W. H. Wheeler, of Beloit, Wis., is stated to have been granted a franchise for an electric lighting and water-works plant.

Tacoma, Wash.—Press reports state that the Commissioner of Public Works has been authorized to purchase 30 tons of 4-in. cast-iron water pipe, four 4 x 4 crosses and six 4 x 4 tees.

Tullahoma, Tenn.—At a meeting of the Electric Light and Water Works Commissioners, Granberry Jackson, of Nashville, was selected to do the surveying, prepare specifications, and superintend the work of putting in water-works and electric light plants for the city.

La Crosse, Wis.—The estimated cost of proposed water-works extensions is $18,782.

Guthrie, Okla. Ter.—The following bonds were sold June 28: For sewers, $65,000; for water-works extension, $30,000; for city hall, $30,000; and for a new high school building, $30,000.

Corunna, Mich.—The question of constructing a system of water-works estimated to cost about $18,000 is under consideration.

Seaside, Ore.—The Seaside Water Co. has been incorporated for the purpose of constructing and operating a system of water-works at Seaside, with headquarters at Astoria. Capital stock, $20,000. Incorporators: Leander Lebeck, W. J. Barry and C. H. Cooper.

Covington, O.—The construction of municipal water-works and electric light plants is under consideration.

Rantoul, Ill.—Press reports state that a steel tower 100 ft. high and a 50,000-gal. tank will be constructed at the water-works.

Redwood Falls, Minn.—Bids are wanted Aug. 6 for $6,000 bonds for erecting a water tower. C. G. Johnson, City Recorder.

Philadelphia, Pa.—Local press reports state that Director Haddock on June 26 awarded contracts for the completion of the new Belmont filtration plant, to consist of a reservoir, filter and basin, to Ryan & Kelly, their bid for the reservoir being $670,000, filter $999,000, and basin $260,000.

The contract for constructing a water conduit from Torresdale to the pumping station at Lardner's Point has been awarded to D. J. McNichol for $1,281,000, and to be completed within 9 months.

Binghamton, N. Y.—Bids are wanted July 19 for furnishing and erecting a hand power traveling crane and hoist at the City Water-Works Building. John Anderson, Secy. Bd. Water Commrs.

East Grand Forks, Minn.—Bids are wanted July 20 for $15,000 water-works bonds. Henry Harm, City Recorder.

Coquille, Ore.—Bids are wanted by the City Recorder until July 31 for $14,000 water-works bonds.

Clinton, Ind.—It is stated that bids will be received July 16 for water-works.

Wisner, Neb.—Bids are wanted July 15 for an extension to the water-works system, consisting of about 2,000 ft. of mains. C. S. Deily, Village Clk.

Hannibal, Mo.—City Clk. C. F. Shepherd writes that it was voted June 25 to grant a 25-year franchise to the Hannibal Water Co.

Tucson, Ariz. Ter.—City Recorder N. E. Hawke writes that L. Zeckendorf & Co., of Tucson, has received the contract for furnishing cast iron pipe, plugs, tees, etc., for $6,642.

Humboldt, Tenn.—W. H. Mason, Chmn. Finance Com., writes that on June 25 it was voted to issue $30,000 bonds to pay outstanding indebtedness and improve the water-works and electric light plant.

Bricelyn, Minn.—Village Recorder K. O. Sandum writes that it was voted June 24 to construct water-works at a cost of $4,000.

Baker City, Ore.—F. S. Lack, Gen. Mgr. of the Powder River Land & Irrigation Co., writes that it is proposed to construct an irrigation system, for which surveys are about completed. Estimated cost, $150,000. Engr. in charge, C. M. Foster, of Chicago, Ill.

Elk Point, S. D.—City Clk. H. L. Moore writes that the contract for putting in a compressed air system of water-works has been awarded to J. L. White, of Peru, Ill., for $7,500.

Dexter, Me.—C. M. Sawyer, Chmn. of the Water-Works Committee writes that Frank L. Fuller, of Boston, Mass., has submitted plans and estimates for a system of water-works, to be voted upon by the town at an early date.

Bonaparte, Ia.—Bids are wanted July 19 for a system of water works. H. H. Meek, Mayor; Chas. F. Sturtevant, Consulting Engr., 1208 Fisher Bldg., Chicago, Ill.

Mapleton, Ia.—Bids are wanted July 10 for extending the water works, consisting of laying 2,160 ft. of 6-in. pipe, hydrants and connections. C. E. Chrisman, Mayor.

Wickliffe, Ky.—Bids are wanted July 10 for a water supply having a capacity of 60,000 gal. per 24 hours, including a tank, having 40,000 gal. capacity, 14,000 ft. of 4 to 6-in. mains; a one-story brick pump station 50 x 50 ft.; 2 wells, etc. Plans and specifications to be furnished by bidder.

New Whatcom, Wash.—The City Engineer has prepared plans and specifications for a steel water pipe line. The 20-in. pipe to cost $20,505, or 18-in. pipe $18,000.

Holgate, O.—The Council has sold $15,000 water-works and electric light bonds.

Georgetown, Ky.—The Georgetown Water, Gas & Electric Co. has been organized with a capital of $200,000. J. P. Jackson, of Georgetown, Pres.; D. J. Hauss, of Cincinnati, O., Gen. Mgr., and R. W. Nelson, of Newport, member of the Board of Directors.

Elgin, Ill.—Specifications have been prepared and the contract is about to be let for sinking an artesian well to a depth of about 1,350 ft.

Norfolk, Va.—The Water & Finance Committees for the City Council recommend that a system of water meters be adopted, as recommended in the report of City Engr. W. T. Brooke. Estimated cost, 7,600 ⅝-in. meters installed, $102,600; 400 ¾-in. meters installed, $7,000; total, $109,600.

Whitney, Ore.—Press reports state that a water-works system is to be installed; the supply to be brought from the mountains 1¾ miles distant.

Wills Point, Tex.—Local press reports state that at a recent citizens' meeting the sum of $3,125 was raised toward a bonus to parties putting in a system of water-works.

Gloster, Miss.—The City Clerk writes that it was voted on June 26 to issue $23,000 bonds for water-works and an electric light plant.

Los Angeles, Cal.—The Tijera Creek Water Co., with principal place of business in Los Angeles, has been incorporated with a capital stock of $7,810. The directors are A. J. W. Keating, Bonita Meadows; Jose Machado and others of Los Angeles.

Sandy Hill, N. Y.—The Spring Brook Water Co. has appointed a committee (John J. Cunningham, Chairman) with authority to engage an engineer to devise plans for an increased water supply.

Durant, Ind. Ter.—D. Head, Pres. of the Commercial Club, writes that the question of constructing water-works at a probable cost of $15.-000 is under consideration, but nothing definite has yet been done.

Craig, Neb.—Village Clk. H. W. Whitaker writes that water-works are to be constructed at a cost of about $3,600.

Montezuma, Ga.—City Clk. J. T. Stilwell writes that it was voted July 2 to issue $15,000 bonds for water-works and a sewerage system.

Eatontown, N. J.—The Middletown Water Co. has been incorporated with a capital of $2,000,000. Incorporators: Wellington LaMonte, James A. Morrow, Chas. Krause and others.

Newark, N. J.—Local press reports state that contracts will soon be let for the construction of the 750,000,000-gal. storage reservoir to be built at Cedar Grove. Estimated cost, about $1,500,000.

Sanford, N. C.—Bids are wanted July 23 for additions to present water-works, as advertised in The Engineering Record.

Arlington Heights, Ill.—Plans and specifications have been prepared by Chas. H. Patten for proposed water-works system, estimated to cost $19,600.

Riverside, Cal.—The Corona Water Co., recently incorporated, has issued $60,000 bonds for the purpose of buying water-bearing lands, constructing pipe lines, etc. Incorporators: William E. Pedley and Francis E. Hudson, Riverside; R. E. Mellette, Los Angeles, and others.

Marion, Ind.—Articles of association have been filed by the Jonesboro Water-Works Co., with a capital stock of $10,000. Incorporators: S. H. Millikan, Harry C. Ulen, Jr., and Berton B. Bales.

Berea, O.—Frances F. Mills, Clk. of the Water-Works and Electric Light Plant, writes that water-works contracts have been awarded as follows: To the U. S. Cast Iron Pipe & Fdy. Co., Cleveland, O., special castings at $50; 4-in. pipe at $24.50, and 6-in. pipe at $23.50. To T. C. Brooks & Sons, Jackson, Mich., pipe laying at 13 cts. for 4-in. and 14½ cts. for 6-in. To R. D. Wood & Co., the contract for hydrants. To Snyder, Hughes Co., of Cleveland, O., pumping engine connected for $1,938. To Buckeye Eng. Co., of Cleveland, engine, 206 revolutions, for $1,125.

Minneapolis, Minn.—G. W. Sublette, City Engr., writes that the following bids were opened June 28 for one 10,000,000-gal. or one or two 15,000,000-gal. vertical, triple expansion, high-duty pumping engine for the new pumping station: *a*, one or two 10,000,000-gal. steam, respectively; *b*, one or two 15,000,000-gal. steam, respectively; *c*, one or two 10,000,000-gal. steam and electric, respectively: Kelly Mfg. Co., Cleveland, O., *a*, $105,000, $105,000; *b*, $120,000, $120,000. E. P. Allis Co., Milwaukee, Wis., *a*, $57,000 and $63,000; $53,000 and $59,000; *b*, $93,000 and $102,000; $88,000 and $98,000; *c*, $63,000, $59,000. Camden Iron Wks., Philadelphia, Pa., *a*, $100,000, $94,000; *b*, $135,000, $130,000; *c*, $115,000, $112,000. Snow Steam Pump Wks., Buffalo, N. Y., *b*, $70,550, 065,375. Holly Mfg. Co., Lockport, N. Y., *a*, $70,540, $68,440; *b*, $89,755, $87,955; *c*, 73,450, $70,350.

SEWERAGE AND SEWAGE DISPOSAL.

Hamilton, O.—Bids are wanted July 16 for $3,700 sanitary sewer and $3,800 storm sewer bonds. M. O. Burns, Clk. Bd. Control.

Spirit Lake, Ia.—This town will receive bids July 11 for 4,600 ft. of 8 and 10-in. sewers, a septic tank of about 40,000 gal. capacity and 2 sand filter beds, each 100 x 50 ft.

St. Louis, Mo.—Bids are wanted July 9 for sewers in the several streets. Walter Edwards, Secy.

Montezuma, Ga.—See "Water."

Oklahoma, Okla. Ter.—The contract for constructing lateral sewers has been awarded to Black & Lazard, of Kansas City, Mo., for about $50,000.

Adrian, Mich.—The proposition to issue $50,-000 bonds for sewers and paving is stated to have carried at the recent election.

Indiana, Pa.—G. Everett Hill, of New York, in a recent report on proposed sewerage system recommends that the separate system be adopted.

Columbus, O.—The Sub-Committee of the State Board of Health recommends the approval of sewerage plans with some minor changes.

Galion, O.—Plans and specifications are wanted Aug. 3 for a sewage disposal plant, as advertised in The Engineering Record.

Oshkosh, Wis.—Bids are wanted July 29 for constructing Main St. relief sewer; also sewers in portions of Murdock and 19th Sts. Frank Monahan, Chmn. Bd. Pub. Wks.

Merrill, Wis.—Bids are wanted July 12 for 3,-490 ft. of 8 to 20-in. sewer, 10 manholes and 18 catch basins. B. J. Lambert, City Clk.

Schenectady, N. Y.—City Engr. J. L. FitzGerald writes that the contract for constructing Briggs Plot sewer (bids opened July 2) has been awarded to John Allen for $24,773.

Findlay, O.—McGeary & Isbell, of Akron, are stated to have received a $30,000 contract for sewer construction.

West Duluth, Minn.—Plans and estimates have been prepared by the City Engineer for the construction of a sewer in the alley between 54th and 55th Aves.; 3,200 ft. of sewer will cost $10,-655, or 1,385 ft. will cost $5,337.

Cleveland, O.—Chas. P. Salen, Dir. Dept. of Pub. Wks., writes that contracts for sewer construction, bids for which were opened June 25, have been awarded as follows: Outlet portion of main intercepting sewer, 3,000 ft., to Beers & Dolittle, of Cleveland, for $85,026; one portion of Doan Brook Valley sewer to Beers & Dolittle for $22,198.

Crawfordsville, Ind.—C. M. Kirkpatrick of Greenfield, has received the sewer contract at his bid of $48,370.

New Brunswick, N. J.—City Engineer Asher Atkinson writes that the contract for sewer construction for which bids were opened July 1 has been awarded to Van Deusen & Oliver, as follows: 1,320 ft. 8-in. pipe at $2.11; 2 manholes at $35; 2 flushtanks at $65; Y branches at $1.50; total, $2,985.

Roswell, N. M.—City Engr. W. M. Reed writes that it is proposed to construct a system of sanitary sewerage at an estimated cost of $35,000. John W. Poe, Chmn. City Council.

Pomona, Cal.—City Clk. Arza Crabb writes that a system of lateral sewers will probably be constructed, but resolution of intention has not yet been passed. W. H. Sanders, City Engr.

Jackson, Mich.—Warden W. Chamberlain, of the Mich. State Prison, writes that the Prison Board of Control and the city Board of Public Works, propose to build intercepting sewers estimated to cost $40,000. R. M. Newman, of Jackson, Engr. in Charge.

Plattsburg, N. Y.—City Clk. C. F. Halligan writes that bids will be opened Aug. 1 for $55,000 bonds to be spent for sewers and street improvements. Horace Andrews, Engr. in charge.

Guthrie, Okla. Ter.—See "Water."

Woodbury, N. J.—The sewerage plans adopted by the City Council have been approved by the State Sewerage Commission.

Durham, N. C.—Plans are now being prepared by J. L. Ludlow, of Winston, N. C., for a sewer system and street improvements to cost $200,000.

Simsbury, Conn.—Bids are wanted July 12 for constructing sewers and appurtenances and sewage filter beds. Address Geo. C. Eno, Simsbury.

East Cleveland, O.—Bids are wanted July 27 for constructing a septic tank and an additional unit, with appurtenances to the sewage disposal plant. H. B. Chapman, Village Clk.

Central Falls, R. I.—City Engr. Wm. F. Keene writes that one mile of 8 to 15-in. pipe sewer is to be built by the city, at a cost of $8,000.

Newberry, S. C.—City Clk. W. S. Langford writes that a petition is being prepared for a system of sewerage, to cost not more than $25,-000, but nothing definite has as yet been done.

Milwaukee, Wis.—City Engr. C. J. Poetsch writes that the following bids, which were opened June 22 for the West Side intercepting sewers, have been rejected as too high: Jas. O'Donnell, Milwaukee, $9 per lin. ft.; H. Hohensee, Milwaukee, $8.97 per lin. ft.; Geo. J. Markey, Milwaukee, $8.90 per lin. ft.; Jno. J. Crilley, Milwaukee, $8.65 per lin. ft.; F. H. Nakielski, Milwaukee, $8.57 per lin. ft.; Geo. E. Zimmerman, Milwaukee, $8.17 per lin. ft.

Philadelphia, Pa.—According to local press reports sewer contracts have been awarded as follows: Cohocksink relief sewer, to David Peoples, $30,000 available; Orthodox St., to Michael O'Rourke, $20,000 available; Pratt St., to Robert Higgins, $20,000 available; Rosehill St., J. H. Wallace & Co., $35,000 available; Thomas Run relief sewers on Frazer and Conestoga Sts., Daniel Dooley, $65,000 available; Shunk St. sewer extension, E. H. Vare, $30,000 available; York St. sewer extension, R. P. Bennis, $60,000 available.

Fargo, N. D.—Bids are wanted by R. A. Shattuck, Secy. of the North Dakota Agricultural College, until July 16 for $42,000 bonds to be used for sewerage and other improvements at the college.

Irwin, Pa.—See "Paving and Roadmaking."

Swissvale, Pa.—Bids are wanted July 15 for the construction of certain portions of the system of sanitary sewers, as advertised in The Engineering Record.

Springfield, Mo.—City Engr. H. G. Horton writes that the construction of three district sewers (8-in. pipe) is contemplated.

Paris, Ill.—W. C. Lemen, City Engr., writes that the contract for constructing 5,837 ft. of pipe sewer, with 10 manholes and 5 flush tanks, has been awarded to Simons & Mikesell, of Quincy, Ill. at 25 cts., 22 cts. and 17 cts., respectively for 12, 10 and 8-in. pipe sewer complete, 10 cts. for 6-in. drain tile; trenching and back filling at 18 cts. 0 to 6 ft., 26 cts. 6 to 8 ft., 29 cts. 8 to 10 ft., 40 cts. 10 to 12 ft., 49 cts. 12 to 14 ft., total, $3,992.

Columbia, S. C.—This city is about to have made a topographical map and plans for sewerage.

West Newton, Mass.—Isaac F. Kingsbury, City Clk., writes that the work of constructing a sewer through a part of the town of Needham will be done by the city under the direction of Street Commissioner Chas. W. Ross, said work calls for tunnelling along Charles River through Metropolitan Park Reservation, rock excavation will be necessary.

New York, N. Y.—The following bids were opened June 26 by Jas. Kane, Commr. of Sewers, for sewer construction in Jennings, Boone, Longfellow, Bryant and East 172 Sts., Boro. of Bronx: Wm. J. Moore, $34,860; Jas. Dalton, $32,-597; P. F. Brennan, $32,347; J. S. Rogers, $32,897; Leeson & Brown, 215 W. 125th St., $29,904; Chas. W. Collins, $31,045. The detail bid of Leeson & Brown was as follows: 62 lin. ft. of brick sewer, egg-shaped, 26 x 36 in., at $22.10; 710 lin. ft. of brick sewer, 2 ft. 6 in. diameter, at $13.35; 600 lin. ft. of 18-in. vitr. pipe-sewer, at $13.35; 766 lin. ft. of 15-in. vitr. pipe sewer at $4; 1,956 lin. ft. of 12-in. vitr. pipe sewer at $2.50; 1,040 spurs, at 50cts; 41 manholes, at $50; 3 receiving basins, at $150; 7,000 cu. yds. of rock excavation, 10 cu. yds. of concrete, 10 cu. yds. of rubble masonry, 10 cu. yds. of broken stone, 10,000 ft. (B. M.) of timber and 100 lin. ft. of 6-in. to 18-in. vitr. drain pipe, at 1 ct.

Portland, Me.—Geo. N. Fernald, Commr. of Pub. Wks., writes that the following bids were opened July 1 for sewer construction, the work to include 2,600 ft. of 44 to 48-in. brick sewer, and 1,550 ft. 8 to 30-in. pipe sewer, the trench to average 12 ft. in depth and be excavated in gravel and clay:

		Masonry.		Pipe laying.		
Bidders all of Portland.	6,320 cu. yds. earth exc'v.	700 cu. yds. brick.	850 cu. yds. concrete.	850 ft. 8-in. to 15-in.	700 ft. 18-in. to 30-in.	Total.
Rich'd D. Shannahan*	$1.12½	$4.25	$4.00	$.15	$.30	$13,823
D. F. Griffin & Bro....	1.20	5.25	5.00	.40	.30	16,059
John J. Mahoney......	1.35	4.75	4.40	.35	.60	16,315

*Contract awarded.

Boston, Mass.—The following bids were opened June 27th by the Metropolitan Water and Sewerage Board for the construction of Section 60, North Metropolitan Sewerage System, Metrose:

Items and Quantities.	Beckwith & Quackenbush, Boston.	Nat. Con't'g. Co., New York.	Moss Bros. & Pearse, Newport News, Va.	F. W. McCusker & Co., Waltham, Mass.	Met. Con't'g Co., Boston.
Earth excav. and refill.					
36-in. sewer, 1,417 lin. ft.	$7.70	$4.80	$6.00	$4.00	$4.90
30-in. sewer, 2,923 lin. ft.	6.95	4.05	5.00	4.00	3.50
Brick masonry.					
American, 500 cu. yds..	13.75	13.00	11.25	12.50	12.95
Portland, 500 cu. yds...	14.30	14.75	12.00	13.50	14.00
Concrete masonry.					
American, 450 cu. yds..	6.50	6.00	4.25	5.50	4.75
Portland, 300 cu. yds...	7.15	7.50	5.25	6.50	5.65
Spruce lumber in trench, 3 M. ft. B. M............	33.00	35.00	35.00	30.00	35.00
Spruce piles, 1,000 lin. ft.	.28	.23	.50	.25	.15
Rock excav. in trench, 1,200 cu. yds..............	4.40	4.50	3.00	4.00	4.00
Total	56,025	43,200	42,435	39,925	*39,536

* Contract awarded June 28, 1901.

BRIDGES.

Battleford, N. W. Ter.—Bids are wanted July 19 for constructing the iron superstructure of a bridge across Battle River at Battleford. Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

Adel, Ia.—The Commissioners of Green and Dallas Counties are considering the construction of a bridge across Raccoon River.

McRae, Ga.—Wm. McLean, Clk. of the County Commissioners, writes that bids will be received Aug. 5 for the construction of a bridge near McRae. Probable cost, about $5,000.

Parkville, Mo.—Press reports state that the Chicago, Rock Island & Pacific Ry. Co. contemplates constructing a $500,000 bridge across Missouri River at Parkville. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Montreal, Que.—Local press reports state that the total length of the proposed bridge between Montreal and Longueil, estimated to cost $6,000,000, will be 8,800 ft; the main span to be 1,260 ft., height above water 150 ft., width 83 ft. It is proposed to have a double-track railway of 26 ft., a double-track electric railway of 22 ft., a double highway of 23 ft.; and 2 sidewalks of 12 ft. The bridge will require about 74,000,000 lbs. of steel and 90,000 cu. yds. of masonry.

Rochester, Minn.—Press reports state that bids will be received by the Common Council until July 10 for constructing a bridge 96 ft. long at East College St.

Springfield, Mass.—City Engr. Chas. M. Slocum writes that a special committee is now considering the matter of site, grade and approaches for the proposed bridge to be built across Connecticut River by the County Commissioners.

Monticello, Ill.—Contracts will be let July 10 at the Court House for a 100-ft. highway bridge on stone masonry and a 70-ft. highway bridge on stone masonry. For plans and specifications address Ira O. Baker, of Champaign, Ill.

Hackensack, N. J.—The Bergen County Board of Freeholders has voted an additional appropriation of $10,000 for bridge purposes.

Jacksonville, Fla.—The County Commissioners have granted permission to the Ortega Town and Improvement Co. to construct a toll draw bridge over McGirts Creek.

Oakland, Cal.—Local press reports state that Cotton Bros. have secured the contract for constructing a steel bridge across Arroyo Mocho, between Pleasanton and Livermore, at $5,690.

Melrose, Minn.—Bids are wanted July 13 for constructing a 107-ft. steel bridge across Sauk River, Melrose. P. J. Gruber, Co. Aud., St. Cloud.

Syracuse, N. Y.—The contract for constructing a steel girder bridge at Belden Ave. has been awarded to the Syracuse Bridge Co. J. M. Shultz, Gen. Mgr. & Pres., 314 S. Clinton St., Syracuse, for $12,494.

Boston, Mass.—The Metropolitan Park Com., Wm. T. Pierce, Chf. Eng., has contracted with O'Hern & Berrigan, Yonkers, for a Melan bridge with one 50-ft. and two 14-ft. spans 64 ft. wide, and a 20-ft. Melan culvert 130 ft. wide. Price, $44,300; consulting engineers, Concrete-Steel Engineering Co., New York.

St. Boniface, Man.—Engineer J. H. Hargrave estimates the cost of constructing a high-level steel and iron bridge, with timber approaches, to replace present structure across Red River, between St. Boniface and Winnipeg, at $123,000.

Flint, Mich.—It is stated that plans have been completed by the Grand Trunk Western Ry. Co. for a steel girder bridge across the tracks of the Pere Marquette R. R. at Flint. The bridge is to have a main span 75 ft. long and 22 ft. high, stone abutments and approaches of pile.

Billings, Mont.—The construction of a viaduct across the railroad yards at 29th St. is being considered.

Tacoma, Wash.—The County Commissioners are considering the construction of a steel bridge, having a 100-ft. span, and approaches 300 ft. long at each end, across Puyallup river at the reservation. Probable cost, $10,000.

Mt. Carroll, Ill.—The County Highway Commissioners have decided that the construction of an iron bridge at Jacobstown is necessary.

Topeka, Kan.—The County Commissioners have decided to construct 2 bridges, one at Silverlake, the other at Menoken, to be 1,055 ft. and 1,030 ft. long, respectively.

Binghamton, N. Y.—City Clk. I. C. Hull writes that it was voted June 28 to construct a $50,000 wagon bridge at Exchange St.

Allentown, Pa.—The construction of a bridge at Allen St. connecting the 6th and 10th wards is contemplated.

Lowell, O.—Bids are wanted July 10 for constructing an iron draw bridge across the canal at Lowell. Plans to be submitted with bids. C. A. Chamberlain, Co. Aud.

Grand Rapids, Mich.—A correspondent writes that the Pere Marquette R. R. Co. contemplates constructing a 600-ft. steel draw bridge across Grand River at this place. G. H. Kimball, Ch. Engr., Detroit.

Boston, Mass.—Bids are wanted July 8 for building abutments in extension of the existing abutment for Bennington St. bridge over the Boston, Revere Beach & Lynn R. R., Boston. B. T. Wheeler, Supt. of Streets.

Pontiac, Mich.—A resolution has been adopted by the Common Council authorizing the city to borrow the needed funds for constructing the bridge over Clinton river on Water St.

Roseburg, Ore.—A $4,500 county bridge across East Umpqua River at Wimberly place is reported to have collapsed.

Milwaukee, Wis.—Bids are wanted July 10 for $100,000 bridge bonds. Edw. P. Hackett, Commr. of Pub. Debt.

Hinsdale, Mont.—The American Bridge Co. has secured the contract for constructing 2 bridges across Milk River, one at Hinsdale, the other at Saco. Total cost reported to be $14,000.

Somers, Conn.—At a town meeting held June 21 it was voted to construct a steel bridge over Scantic River.

Boelus, Neb.—The Citizens are considering the construction of a $4,000 iron double-track bridge across Loup Fork of the Platte River.

Philadelphia, Pa.—Local press reports state that the following contracts have been awarded: To Ryan & Kelly, for the abolition of grade crossings on the Chestnut Hill branch of Reading Ry., between High St. and Washington Lane, including the construction of bridges under the railroad at High and Chew Sts. and Washington Lane, for $70,000; time 8 months. To Henderson & Co., the contract for constructing Oak Lane bridge, $19,000 available. To P. McManus, for constructing bridge at Luzerne St., $88,924 available.

The lowest bid received for constructing bridge at Dauphin St. was submitted, according to reports, by Henderson & Co., at $59,777; time 9 months.

PAVING AND ROADMAKING.

Janesville, Wis.—The city stone crushing plant is reported to have been destroyed by fire.

Gloversville, N. Y.—Bids are wanted July 8 for 4,320 sq. yds. macadam pavement. C. Fiske, Jr., City Engr.

Hackensack, N. J.—Bids are wanted July 15 for constructing about a mile of Telford and macadam pavement on Paterson and New York Plank Road. Chas. R. Solly, Chmn. "Plank Road Com.," Bd. Chosen Freeholders; Wise & Watson, Engrs., Shafer Bldg., Rutherford.

Meadville, Pa.—It is proposed to pave portions of Walnut and Market Sts. with brick at a cost of about $10,000.

Chelsea, Mass.—City Engr. Alfred L. Maggi writes that the Commonwealth of Massachusetts through its Highway Commission, will build Eastern Ave. in the city at a cost of $18,000.

Mt. Vernon, N. Y.—Plans and specifications have been ordered for several macadam streets with brick gutters; also for paving several streets with second-hand Belgian block.

Portsmouth, Va.—Frank Pidgeon, New York City, has been given an additional contract for 5,000 sq. yds. of concrete sidewalk pavements by the Local Board of Improvements of Fifth Ward at $1.48½ per sq. yd.

Ware, Mass.—It has been decided to pave the south side of Main St. with vitrified brick.

Seattle, Wash.—The ordinance providing for the asphalt paving of Highland Drive has been passed by the Council. The cost of the work is something over $50,000, of which the city must pay about $8,500.

Vailsburg, N. J.—Boro. Engr. Eugene A. McMurray has been instructed to prepare specifications for street improvements, for which contracts are soon to be let.

Helena, Mont.—City Engineer Helmick has prepared estimates for the paving of Main St. with vitrified brick and granite.

Algiers, La.—The following bids are stated to have been received for paving several streets with asphalt: Barber Asphalt Paving Co., $1.90 and $2 per sq. yd.; H. C. Spinks, $1.66; Louisiana Improvement Co., $1.67; Southern Asphalt Paving Co., $1.75.

West Bay City, Mich.—The contract for paving a portion of South Henry St. has been awarded to the Ayers Asphalt Paving Co., at $1.89 per yard.

Branford, Conn.—Bids are wanted July 9 for constructing and laying 10,000 sq. ft. of vitrified stone sidewalk in Branford. Louis A. Fisk, Warden.

Montpelier, Ind.—The contract for improving Jefferson St. has been awarded to T. C. Neal, of Montpelier, for $13,342.

Springfield, O.—Bids are wanted July 29 for 2,125 sq. yds. brick pavement and 815 ft. limestone curbing on Columbia St. R. N. Lantz, City Clk.

Bellefontaine, O.—Bids are wanted July 27 for grading and graveling over 8 miles of Silver Lake pike, in Lake, Harrison and Pleasant townships. Estimated cost, $12,468. J. C. Brown, Co. Commr.

Watkins, N. Y.—The proposition to issue $20,000 bonds for paving a portion of Franklin St., carried at the recent election.

Plattsburg, N. Y.—See "Sewerage and Sewage Disposal."

St. Paul, Minn.—The Board of Public Works has decided to boulevard and curb a portion of Grotto St., at a cost of $6,743.

The City Engineer estimates the cost of boulevarding and curbing a portion of St. Albans St. as follows: Sandstone, 97 cts.; granite, $1.09; total, $6,588 and $7,361, respectively.

Durham, N. C.—See "Sewerage and Sewage Disposal.

Toledo, O.—Street Commissioner Voute reports that numerous asphalt streets are in need of repair.

Topeka, Kan.—Local press reports state that Ritchey & Ramsey have received contracts for paving several streets, their bids being from $1.23 per sq. yd. to $1.28½ per sq. yd.; Wall & Hanley received contracts for paving several other streets at $1.22, $1.23 and $1.24 per sq. yd.

Moline, Ill.—The Council passed four paving ordinances. Estimated cost of work, $13,987.

Cincinnati, O.—The Board of Public Service has approved resolutions ordering the improvement of Oregon St., from Monastery St. to the Third St. bridge, of the distance 1,023 ft. will be improved with brick and the remainder with boulders. Estimated cost, $13,290.

Joliet, Ill.—The cost of paving Cass St. is estimated at $4,526 for the city's share and $1,400 for the railway's share.

Flint, Mich.—The Committee on Streets recommends to the Common Council that contracts for paving with Nelsonville brick be awarded as follows: A portion of Saginaw St. to E. W. Reid & Co., at $14,064; another portion of Saginaw St. to T. Lynch at $12,566, and a portion of W. Kearsley St. to J. Lynch at $8,800.

Alexandria, La.—Press reports state that the contract for 4,000 lin. ft. of paving on Lee St., 30 ft. wide, with a 16-in. vitrified brick gutter, with concrete foundation, on either side, has been awarded to Talbot Bros., of Shreveport, at $2.25 per lin. ft.

Mt. Vernon, Ind.—Bids are wanted July 8 for asphalt pavement on Main and Second Sts. Frank Smith, City Clk.

St. Louis, Mo.—Bids are wanted July 9 for paving several streets. Walter Edwards, Secy.

Sioux Falls, S. D.—Bids are wanted July 10 for cement, plank and tar concrete sidewalks ordered by the City Council from July 10, 1901, to July 10, 1902. E. G. Ledyard, City Aud.

Glens Falls, N. Y.—Jas. Anderson, Glens Falls, is stated to have received the contract for paving Glen St. with granite block at $3.18 per yd. and several other streets with Catskill brick at $1.92½.

Wilson, N. C.—A vote is stated to have been taken in favor of issuing bonds for paving.

Albany, N. Y.—The lowest bid received July 1 for resurfacing a portion of Madison Ave. with asphalt was from Warner-Quinlan of Syracuse at $1.23½ per sq. yd.

New York, N. Y.—Bids are wanted July 16 for repaving with asphalt on numerous streets, Boro. of Manhattan; also a portion of 151st St., Boro. of Bronx. James P. Keating, Commr. of Highways.

Irwin, Pa.—Bids are wanted July 12 for grading, curbing, paving and sewering certain streets and alleys, aggregating 4 miles of sewering and 40,000 sq. yds. paving. S. D. Lauffer, Boro. Secy.

St. Paul, Minn.—Local press reports state that bids are wanted by the Board of Public Works until July 18 for asphalt pavement on Marshall and Western Aves. and Central Park Pl. C. H. Bronson, Clk.

Aurora, Ill.—Bids are wanted July 15 for 33,708 sq. yds. asphalt paving and 16,441 lin. ft. combined curb and gutter. Geo. W. Alshuler, Mayor.

Fowler, Ind.—Bids are wanted for constructing brick street pavement, as advertised in The Engineering Record.

Adrian, Mich.—See "Sewerage and Sewage Disposal."

Denver, Colo.—Bids are wanted July 12 for paving in Colfax Ave. Paving Dist. No. 3. Approximate quantities, 13,112 sq. yds. sheet asphalt, 24,921 cu. yds. grading, 7,329 lin. ft. curbing. Appropriation, $55,907. R. W. Speer, Pres. Bd. Pub. Wks.

Cincinnati, O.—The Board of Public Service has passed the resolution for the repaving with asphalt, of a portion of Laurel St., estimated to cost $29,642.

Windber, Pa.—Bids are wanted for brick pavement on certain streets. For plans and specifications address the Borough Clerk. John W. Campbell, Boro. Engr.

Oakland, Cal.—The Board of Supervisors has voted to appropriate $10,000 as the County's share toward the cost of constructing proposed tunnel road between Alameda and Contra Costa Counties.

Niagara Falls, N. Y.—Local press reports state that contracts will soon be let for asphalt paving on portions of 7th St., estimated to cost $7,073, and Cedar Ave., estimated to cost $10,599.

The Board of Aldermen has decided to pave a portion of Main St. with brick.

City Engineer Very estimates the cost of paving a portion of 2d St. at $6,748.

Newark, N. J.—Local press reports state that the following bids were opened July 27 for paving with oblong granite blocks on portions of 5 streets. *a*, Atlantic St., 2,000 sq. yds.; *b*, Summit Place, 650 sq. yds.; *c*, Kossuth St., 8,700 sq. yds.; *d*, Third St., 5,100 sq. yds.; *e*, Jacob St., 2,900 sq. yds.: Thomas A. O'Connor, *a*, $1.89; *b*, $2.75; *c*, $1.87; *d*, $2.12; *e*, $2.08: David Harper, *a*, $1.68; *b*, $2.55; *c*, $1.78; *d*, $2; *e*, $1.94: J. R. Shanley, *a*, $1.80; *c*, $1.80; *e*, $1.84; James Serne; *a*, $1.81; *e*, $1.82.

Canton, O.—Philip H. Weber, City Engineer, writes that the following bids were opened June 22 for paving with wire-cut block, using Berea or sandstone curb: *a*, Third street with Berea and sandstone curb respectively, work to include 3,500 ft. of straight curb, 180 ft. of circle curb and 6,000 sq. yds of block paving; *b*, West Fourth street with Berea and sandstone curb respectively, work to include 1,750 ft. of straight curb, 100 ft. circle curb, and 6,800 sq. yds. of paving: General Construction Co., Bellaire, O., *a*, $8,152, $7,985; *b*, $4,364, $4,279; Melbourne & Dine, Canton, O., *a*, $7,853 with Berea curb; *b*, $4,228 with Berea curb; F. K. Turnbull & Son, Canton, O., *a*, $7,649, $7,446; Harry Corl, Canton, O., *a*, $8,374, $8,011; *b*, $4,476, $4,292; Wise & McCafferty, Canton, O., *a*, $8,446, $8,173; *b*, $4,537, $4,414; Geo. B. Herring & Son, Mansfield, O., *a*, $8,022, $7,673; *b*, $4,310, $4,133; W. S. Hadley, Canton, O., *a*, $8,306, $8,143; *b*, $3,653, $3,583;; Jos. George, Canton, O., *a*, $8,382, $7,921; *b*, $4,254, $4,019. See accompanying tables for bids received for paving portions of Fifth and Second streets.

Bids for paving on Fifth St., Canton O.:

Items and Quantities.	Geo. B. Herring & Son.	Melbourne & Dine.	Harry Corl.	Wise & McCafferty.	W. S. Hadley.	Gen'l Const. Co.
Sandstone curb:						
2,200 ft. straight.......	$770	......	$770	$858	$858	$902
120 ft. circle...........	54	......	60	54	69.60	60
130 ft. abutment......	45.50	......	45.50	46.80	46.80	39
Curb redressed and reset:						
100 ft. old circle.......	8.00	7	20	15	20	10
1,100 ft. old.............	77.00	104.50	165	110	176	110
Blk. pav., 6,800 sq. yds.	7,072	6,766	6,664	7,412	7,480	7,412
Catch basins, 2..........	50	30	22	36	30	50
Drain tile, 50 ft. 12-in..	18.50	17.50	13.50	.....	.....	80
Manhole tops reset, 7..	7	14.00	10.50	.....	14	10.50
Berea curb:						
2,200 ft. straight.......	968	1,045	968	990	946	990
120 ft. circle	72	70.20	90	72	78	78
130 ft. abutment......	54.60	56.55	49.40	58.50	52	39
Total with Berea curb	8,327	8,110	7,802	8,693	8,796	8,730
Total with sandstone curb	8,102	......	7,570	8,532	8,694	8,624

Yonkers, N. Y.—John Pagan, Jr., City Clerk, writes that the following bids were received for the maintenance and repair of asphalt pavements on numerous streets, in all 123,268 sq. yds.: *a*, per sq. yd. for asphalt surface and binder; *b* per sq. yd. of skimming repairs to surface with burner; *c*, per sq. yd. for asphalt surface, binder and concrete; *d*, total bid on entire contract per annum for 5 years: Barber Asphalt Paving Co., *a*, $1.65; *b*, $1.25; *c*, $2.89; *d*, $29,157. Alcatraz Paving Co., *a*, $1.69; *b*, $1.31; *c*, $2.99; *d*, $29,767. Mack Paving Co., New York, *a*, $1.74; *b*, $1.29; *c*, $3.17; *d*, $30,392.

Chicago, Ill.—The Board of Local Improvements has passed ordinances for $385,000 worth of street paving on portions of numerous streets, among which are the following: with asphalt, North Kedzie Ave., $49,500; North Morgan St., $20,500; West Ohio St., $11,758; West Ontario St., $11,500; slag-limestone granite, West Lake St., $42,500; sandstone curb, asphalt pavement, West Ohio St., $41,000. Six streets in the vicinity of the Belt Ry. Co's line and So. Forty-Eighth Ave. were ordered paved with macadam, with a top dressing of gravel, and a similar surface was ordered for 12 streets in the neighborhood of Belmont Ave., to cost $130,000.

Brooklyn, N. Y.—The following bids were opened July 2 by Jas. P. Keating, Commr. of Highways, N. Y. City, for paving with asphalt on concrete foundation: Bidders; A, Brooklyn Alcatraz Asphalt Co.; B, Cranford Co., 215 Montague St.; C, Eastern Bermudez Asphalt Paving Co., Morgan Ave. & Stagg St.; D, Warner-Quinlan Asphalt Co. of Syracuse, N. Y.; E, Uvalde Asphalt Co., of New York City:

Devoe and Olive Streets.

Bidders.	13,095 sq. yds. asph. pave.	130 sq. yds. stone pave. relaid.	2,253 cu. yds. concrete.	Curb. 6,839 ft. new.	Curb. 800 ft. old.
A.......	$2.47	$.45	$6.30	$1.10	$.50
C.......	2.35	.60	6.00	1.00	.52
D.......	2.60	.50	6.90	1.20	.65

Sixth Ave. and 24th St.

Bidders.	19,750 sq. yds. asph. pave.	260 sq. yds. stone pave. relaid.	3,233 cu. yds. concrete.	Curb. 5,346 ft. new.	Curb. 3,100 ft. old.
A.......	$2.35	$.45	$5.95	$.98	$.45
B.......	2.42	.65	6.10	1.00	.50
C.......	2.43	.45	6.20	1.00	.52

Wyckoff St.

Bidders.	11,197 sq. yds. asph. pave.	120 sq. yds. stone pave. relaid.	1,929 cu. yds. concrete.	Curb. 5,802 ft. new.	Curb. 800 ft. old.
A.......	$2.47	$.45	$6.30	$1.10	$.45
B.......	2.36	.45	6.00	1.00	.50
C.......	2.42	.60	6.25	1.00	.52
E.......	1.92	.40	5.80	.92	.38

Bids for Paving on Second St., Canton, O.:

Items and Quantities.	Jos. George.	Geo. B. Herring & Son.	W. S. Hadley.	Wise & McCafferty.	Harry Corl.	Melbourne & Dine.	Gen. Const. Co.	T. K. Turnbull & Son.
Sandstone curb:								
3,400 ft. straight..........................	$1,190.00	$1,190.00	$1,326.00	$1,292.00	$1,190.00	....	$1,394.00	$1,360.00
180 ft. circle..............................	82.80	81.00	104.40	90.00	90.00	....	90.00	90.00
100 ft. abutment..........................	87.00	35.00	36.00	35.00	35.00	....	30.00	50.00
Curb redressed and reset:								
100 ft. circle..............................	15.00	8.00	20.00	15.00	20.00	$7.00	10.00	8.00
1,700 ft. old...............................	306.00	119.00	272.00	170.00	255.00	161.50	170.00	306.00
Paving, 6,000 sq. yds.....................	6,000.00	6,060.00	6,480.00	6,300.00	5,880.00	5,370.00	6,300.00	5,700.00
Catchbasins, 2	24.00	50.00	30.00	....	22.00	30.00	50.00	100.00
Drain:								
200 ft. 18-in...............................	140.00	112.00	140.00	80.00	82.00	120.00	140.00	120.00
40 ft. 12-in................................	19.60	14.80	24.00	12.00	10.80	14.00	24.00	16.00
Manhole, 1	12.00	25.00	16.00	18.00	12.00	10.00	30.00	20.00
Manhole irons reset, 8..................	4.00	8.00	16.00	....	12.00	16.00	12.00	....
Berea curb:								
Straight, 3,400 ft..........................	1,598.00	1,496.00	1,462.00	1,530.00	1,496.00	1,615.00	1,530.00	1,530.00
Circle, 180 ft..............................	111.60	108.00	117.00	108.00	135.00	105.30	117.00	108.00
Abutment, 100 ft..........................	49.00	42.00	40.00	45.00	38.00	43.50	30.00	60.00
Total with Berea curb..................	8,279.00	8,043.00	8,617.00	8,278.00	7,963.00	7,492.00	8,413.00	7,968.00
Total with sandstone curb............	7,830.00	7,703.00	8,464.00	8,012.00	7,609.00	....	8,250.00	7,770.00

Paris, Ill.—City Engr. W. C. Lemen writes tha the following bids for 11,090 sq. yds brick pavement were opened June 26:

Bidders.	Excav., 4,360 cu. yds.	Limes'e curb, 2,750 ft.	Comb'd curb and gutter, 2,170 ft.	Curb reset, 650 ft.	†Br. pavement on concrete found. A	B	C	Cement filler.	Storm inlets, 21.	Stone drains. 12" 320'	10" 780'	9" 360'	Total.
John F. Bretz & Son, Springfield, Ill....	$.30	$.52	$.60	$.10	$1.38	$1.38	$1.38	$.10	$10	$.25	$.23	$.20	$21,286
Thompson & Case, Peoria, Ill...........	.30	.45	.55	.15	1.34	....	....	.12	15	.40	.40	.40	20,927
Morissey & Porter, Paris, Ill............	.25	.51	.62	.11	1.30	1.33	1.36	.10	15	.20	.20	.20	*20,042
M. A. Talbot, Logansport, Ind..........	.27	.52	.63	.11	1.40	1.57	1.54	.13	11	.22	.21	.19	21,647
Wolf, Maupin & Curdie, Alton, Ill. ...	.25	.45	.75	.10	1.40	1.45	1.42	.10	10	.35	.30	.25	21,201
D. W. Norton & Co., Terre Haute, Ind.	.29	.53	.64	.10	1.33	1.48	1.41	.15	12	.29	.27	.26	21,238
J. E. Vorhees & Co., Terre Haute, Ind.	.35	.52	.63	.12	1.40	....	....	.12	14	.20	.15	.10	21,769

*Contract awarded. †A, 3:3:1 concrete, using gravel; B, 9 gravel:1 cement; C, 4:3:1 concrete.

POWER PLANTS, GAS AND ELECTRICITY.

Cleveland, O.—C. C. Bateson is stated to have received the contract for installing an electric light plant in the court house and jail, for $9,960.

Independence, Mo.—Mayor S. H. Woodson writes that the contract for constructing an electric light plant has been awarded to E. M. Reed, of Kansas City, Mo., for $25,924.

Covington, Ga.—Electric light bonds amounting to $15,000 are stated to have been sold.

Carbondale, Pa.—The Lackawanna Valley Electric Light & Power Co. is stated to have received the contract for lighting the streets by electricity for 3 years at $68 per lamp per year.

Humboldt, Tenn.—See "Water."

San Francisco, Cal.—J. E. Green, Pres. of the Standard Electric Distributing Co., has petitioned the Board of Public Works for permission to erect poles outside of the fire limits to carry electric light wires to supply electricity in San Francisco.

Paterson, N. J.—John Beauvelt, Chmn. of the Bd. of Chosen Freeholders, writes that a 10-year contract for lighting the public boulevards and roads, place or places under control of the Board, has been awarded to the Paterson-Passaic Gas & Electric Co. at $140 per light per year.

Batavia, N. Y.—Bids are wanted July 15 for electric wiring of the main building, laundry, hospital and barn at the New York State School for the Blind, Batavia. F. Park Lewis, Pres. Bd. Trus.

Kendallville, Ind.—City Clk. H. C. Bower writes that the construction of an electric light plant to cost about $6,000 is under consideration.

Covington, O.—See "Water."

Brookfield, Mo.—It is stated that J. A. Peasley and John M. Keefer, of Macon, propose constructing a $30,000 gas plant.

Toledo, Ill.—Bids are wanted July 10 for an electric light and power plant. W. W. Duncan, Secy. Village Trus.

Peabody, Mass.—Town Clk. Elmer M. Poor writes that the work on the proposed extension of the electric light system ti Lynnfield will be done by the Peabody Electric Light Department. A. E. Jackman, Mgr.

Sheboygan, Wis.—The Sheboygan Gas Light Co. has been incorporated, with a capital of $150,000. Incorporators: John K. Russell and Wm. F. Clausen.

Manistee, Mich.—The citizens are stated to have voted to issue bonds for an electric light plant.

Sturgeon Bay, Wis.—See "Water."

Holgate, O.—See "Water."

Tampa, Fla.—It is stated that bids are wanted Aug. 9 for lighting the streets for a term of 5 years with 100 to 200 arc lights. W. H. Frecker, Chmn. Lighting Com.

Winton Place, O.—Bids are wanted July 23 for lighting the streets with gas, gasoline or electricity. Louis G. Dittoe, Clk. Bd. Council.

Gloster, Miss.—See "Water."

Butler, Mo.—Mayor W. F. Duvall writes that the contract for constructing an electric light plant has been awarded to J. S. Tritle, of St. Louis, Mo., for $15,180 complete, except building, which was awarded to C. E. Robinson, of Butler, for $2,160.

New York, N. Y.—Bids are wanted July 15 for furnishing gas or other illuminating material for and lighting, extinguishing, cleaning, repairing and maintaining the public lamps (and supplying gas, etc., for new lamps when required); also furnishing burners and appliances for improved system of lighting on the streets, public buildings, avenues, piers, parks and public places in the Borough of Richmond from July 15 to Dec. 31, 1901. Henry S. Kearny, Commr. of Pub. Bldgs., Lighting and Supplies.

ELECTRIC RAILWAYS.

Toledo, O.—John O. Zabel, of Petersburg, Mich., is reported interested in the construction of an electric railway from Toledo to Ypsilanti by way of Petersburg, Dundee and Milan; also a line from Dundee to Jackson.

Columbus, O.—The Columbus & Granville Electric Ry Co. has been incorporated with a capital of $10,000 to construct an electric railway from Columbus to Granville. Incorporators: W. A. Garst, Jas. Caren and others.

Farmington, Mich.—The Council is stated to have granted a franchise to the Detroit, Howell & Lansing Electric Ry. Co.

Ft. Worth, Tex.—The Electrial Installation Co. of Chicago, Ill., is stated to have received the contract for building and equipping the electric interurban railway line connecting Ft. Worth and Dallas.

Findlay, O.—A press report states that the Toledo, Bowling Green & Southern Traction Co. is to construct a power plant here, to cost about $200,000.

Newton, N. H.—The Selectmen are stated to have granted a franchise to the Haverhill, Newton & Plaistow St. Ry. Co.

Marion, O.—The Marion County Commissioners are stated to have granted a franchise to the Columbus, Delaware & Northern Traction Co.

San Francisco, Cal.—The Market St. Ry. Co. is reported to be considering the erection of a new power house at North Beach. E. P. Vining, Mgr., San Francisco.

Port Clinton, O.—The Lake Erie, Bowling Green & Napoleon Ry. Co. has been incorporated with a capital of $300,000 to construct an electric railway from Port Clinton to Defiance and also supply electricity for heat, light and power. Incorporators: Luther Black, Richard A. Beatty and others.

Springfield, Ill.—The Springfield & St. Louis Ry. Co. has been incorporated, with a capital of $25,000, to construct an electric railway from this city to St. Louis. Incorporators: J. W. Caulbert, Louisville, Ky.; F. W. Tracy, Springfield, and others.

Rochester, Pa.—A charter is stated to have been granted to the North Rochester St. Ry Co. with a capital of $30,000 to construct an electric railway about 5 miles long from Rochester to Freedom. John H. Park, Pres.; Beaver S. Morgan, Secy. Freedom.

Southbridge, Mass.—It is stated that the Southbridge & Worcester St. Ry. Co. will erect a sub-station and power house on Worcester and Mechanic Sts.

La Crosse, Wis.—S. Y. Hyde, A. Hirscheimer and others, of La Crosse, are reported interested in the construction of an electric railway from La Crosse to Neillsville, a distance of about 75 miles.

Angola, Ind.—The Northern Indiana & Ohio Traction Co. has been incorporated, with a capital of $50,000, to construct an electric railway from Angola east to the State line. The road will be 10 miles long. Newton W. Gilbert, of Angola, is one of the directors.

Rayne, La.—It is stated that a company is being formed to construct an electric railway between Crowley and Rayne, a distance of 6 miles. Incorporators: Dr. R. C. Webb, Rayne; Hampton Story, Crowley, and others.

Olney, Ill.—The Olney, Lancaster & Mount Carmel Electric R. R. Co. has been incorporated with a capital of $50,000 to construct a line from Olney to Mount Carmel, via Lancaster. Incorporators: Robt. Parkinson, Mt. Carmel; J. C. Couch, Friendsville; Aden Knoph, Olney, and others.

Tullahoma, Tenn.—See "Water."

Esplen, Pa.—The Council is stated to have granted the Ohio River Connecting Co. permission to consruct an electric railway through the borough.

Ferguson, Mo.—It is stated that the St. Louis & Suburban Ry. Co. is to extend its line to Ferguson. T. M. Jenkins, Gen. Mgr., St. Louis.

Fairport, N. Y.—The Village Trustees are stated to have granted a franchise to the Belt Line Electric R. R. Co.

Mankato, Minn.—The Mankato Electric Ry. & Power Co. on June 28, 1901, was granted an extention of time for 2 months, from July 1, to begin active operations on construction of electric railway system and have three miles in operation by Jan. 1, 1902. The original franchise was granted in April of 1899, but only preliminary surveys have been made as yet.

Lafayette, Ind.—J. M. Manker and Fredk. Hefenberger, of Indianapolis, are stated to have petitioned the County Commissioners for a right of way in Tippecanoe county.

Seymour, Conn.—The Connecticut Ry. & Lighting Co. is stated to have voted to extend the Derby-Ansonia line to Seymour, and the Oakville branch of the Waterbury system to Watertown. J. E. Sewell, Mgr., Waterbury.

Des Moines, Ia.—The Interurban Ry. Co. contemplates extending its line to Adel, Panora, Guthrie Center, Audubon and Harlan.

RAILROADS

Deweyville, Tex.—A charter has been granted to the Sabine & Northern R. R. Co., with a capital of $100,000, to construct a railroad from a point on the Texas & New Orleans R. R. at or near Sabine River, in Orange County, north to Deweyville, Laurel, Newton and Baker. Incorporators: Geo. W. Smyth, Beaumont; J. B. Smyth, Deweyville; W. J. Sanders, Laurel, and others.

Millers Creek, Ky.—It is stated that the Louisville & Atlantic R. R. Co. will extend its line from Millers Creek to Beattyville. C. M. Browning, Gen. Mgr., Versailles, Ky.

Santa Monica, Cal.—The Santa Monica, Ocean Park & Redondo R. R. Co. has been incorporated with a capital of $200,000 to construct a railway about 15 miles long from Santa Monica to Redondo. To be operated by steam or electricity. Directors: Abbot Kinney, W. L. Graves and others, all of Los Angeles.

Mankato, Minn.—The Council is stated to have granted the Chicago, Milwaukee & St. Paul Ry. a right of way through the city for the Farmington extension. D. J. Whittemore, Ch. Engr., Chicago, Ill.

York, Pa.—Wm. I. Koller, Secy. and Treas. of the Rockdale Powder Co., writes that the company proposes to build a 3-mile gauge road.

Atlanta, Ga.—A charter has been granted to the Atlanta & Birmingham Air Line R. R. Co., with a capital of $500,000, to construct a railroad from Atlanta to Birmingham. Principal office at Atlanta. Incorporators: L. B. Nelson, E. P. Ansley and others.

Enid, Okla. Ter.—The Oklahoma, Colorado & Chickasaw R. R. Co. has been incorporated to construct a railroad from Pueblo and run in a southeasterly direction to Ind. Ter. Principal office to be at Enid. Directors: H. E. Evans, Enid; W. O. Purmont, Gainesville, Tex., and others.

Shawnee, Okla. Ter.—The Atchison, Topeka & Santa Fe Co. is stated to have decided to extend the Eastern Oklahoma Ry. southeast from Ripley to Shawnee. W. B. Storey, Jr., Ch. Engr., Topeka, Kan.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Portsmouth, Va.—The Baptist Church is about to erect a $34,000 stone edifice on Court street, and the Methodist Church an $18,500 stone edifice on Smith street.

Olympia, Wash.—The Thurston County Commissioners are stated to have accepted the plans of Saunders & Lawton, of Seattle, for the new court house, to cost about $22,000, to replace the building sold to the State.

Geneva, Ill.—The Kane County Commissioners are stated to have appropriated $18,000 for a new infirmary.

Quincy, Ill.—The trustees of the Illinois Soldiers and Sailors' Home are stated to have approved plans for a hospital, to be erected here, at a cost of about $24,000.

Philadelphia, Pa.—C. W. Bolton, 1007 Witherspoon Building, is stated to have prepared plans for a 1-story edifice, to be erected on Fifty-second and Thompson streets, for the Lutheran Church of the Resurrection. Rev. C. L. Dozer, pastor.

Philadelphia, Pa.—The Council has passed an ordinance providing for the erection of two fire houses, one on South street, the other on Parrish street.

Philadelphia, Pa.—Bids are wanted July 9 for erecting a bathhouse in the Thirty-first Ward. Abraham L. English. Dir. Dept. Public Safety, Bureau of City Property.

Philadelphia, Pa.—J. F. Stuckert & Son, 1421 Chestnut street, are stated to be preparing plans for two 4-story buildings, one 40x120 ft., to be erected at 1308 Walnut street; the other, 20x100 ft., to be erected at 200 S. Thirteenth street. They will be used at eye clinics. Owner, J. L. Borsch.

Narbeth, Pa.—Herman Miller, Witherspoon Building, Philadelphia, is stated to have prepared plans for a 2-story brick, stone and fireproof hospital, to be erected here, to cost about $250,000. Dr. Madison Taylor, 1504 Pine street, is reported to have charge of details.

St. Paul, Minn.—It is stated that the Armory Association of St. Paul will erect an armory on its present site on Sixty-fourth street., at a probable cost of $50,000.

Decatur, Ill.—The Library Board has selected the plans of Mauran, Russell & Garden, of St. Louis, Mo., for a $60,000 Carnegie Library.

New York, N. Y.—Bids are wanted July 11 for erecting a lion house at the New York Zoological Garden in Bronx Park. Geo. C. Clausen, Commissioner of Parks.

New York, N. Y.—Bids are wanted July 15 for completing buildings under construction and connecting corridors and office pavilion, and adding porches at the Upper Quarantine Station, Hoffman's Island, New York City. Chas. F. Bruder, Secretary Board of Quarantine Commissioners.

Asheville, N. C.—It is stated that Burncombe County will erect a courthouse, to cost about $50,000.

Foley, Minn.—The Benton County Commissioners are stated to have accepted the plans of H. S. Haas, of St. Cloud, for a $15,000 court house to be erected here.

Pittsburg, Pa.—It is stated that a new Christian Science Church is to be erected on Clyde St. and 5th Ave., to cost about $60,000. Present edifice at 4000 5th Ave.

Dubuque, Ia.—Wm. G. Williamson, 159 La Salle St., Chicago, Ill., is stated to have prepared plans for the Carnegie-Stout Public Library, to cost about $90,000.

Detroit, Mich.—Andrew Carnegie is stated to have offered to contribute $750,000 toward a new public library.

Bay City, Mich.—Pratt & Koeppe, 514 Crapo Bldg., are stated to have prepared plans for a new edifice for St. Joseph's Church, to be erected at 3d and Farragut Sts., to cost about $35,000.

Jackson, Tenn.—Parrish Bros., of Jackson, are stated to have received the contract for erecting the Carnegie Library, for $25,288.

Newark, N. Y.—Bids are wanted July 15 for erecting, ventilating, heating, plumbing, electric wiring and fixtures and pipe covering of Cottage "F," at the N. Y. State Custodial Asylum, Newark. Chas. McLouth, Pres. Bd. Mgrs.

Oakpark, Ill.—Wm. G. Williamson, 159 La Salle St., Chicago, is stated to have prepared plans for a $30,000 edifice for the First Presbyterian Church to be erected at Oakpark.

Guthrie, Okla. Ter.—See "Water."

Beaverfalls, Minn.—The citizens of Renville County are stated to have voted to erect a $50,000 court house.

Cartersville, Ga.—It is stated that plans have been completed and bids will be received early in July for the erection of a $30,000 court house for Bartow County.

Annapolis, Md.—The State Building Commission is stated to have awarded the contract for erecting the Court of Appeals Building at Annapolis to H. Smith & Son, 118 Regester St., Baltimore, for $206,775.

Brooklyn, N. Y.—A permit has been issued for a 4-story brick extension to the Brooklyn Hall of Records on Fulton St. and Court Sq.; cost, $400,000. Architect, R. L. Daus, 26 Court St.

Detroit, Mich.—Bids will be received by the Board of Guardians of the State Industrial Home for Girls until July 16 for erecting a brick building; also separate bids for heating and plumbing same. Fredk. C. Bowerfine, Treas.

Brooklyn, N. Y.—St. Agnes's R. C. Church, Hoyt and Sackett Sts., was burned July 2.

Janesville, Wis.—Bids are wanted July 20 for erecting a city hall, to cost $42,000. A. E. Badger, City Clk.

Greenfield, Ind.—Bids are wanted July 10 for erecting a church for the M. E. Society. C. A. Krutsch & Co., Archts., 25 W. Washington St., Indianapolis.

BUSINESS BUILDINGS.

Brooklyn, N. Y.—The Brooklyn Masonic Temple Association has been incorporated, with a capital of $150,000, to erect and maintain in the Borough of Brooklyn a building to be known as the Masonic Temple. Directors, Nathan S. Jones, H. C. Sawtelle, Brooklyn; E. A. Klein, of New York, and others.

Philadelphia, Pa.—Local press reports state that the Pennsylvania R. R. Co. will erect a 10-story building on Filbert street, to be used for railroad offices. J. B. Hutchinson, General Manager, Philadelphia.

Atlanta, Ga.—The Atlanta Athletic Club is reported to have purchased a site for the erection of an $18,000 club house.

Torrington, Conn.—It is stated that a company is being formed to erect a brick building, 80 x 100 ft., on the McNiel property on Main street; estimated cost, $65,000. John Alvord and C. G. Hoyle are among the stockholders.

Nebraska City, Neb.—The Overland Real Estate & Investment Co. contemplates building a 2-story warehouse, 50x140 ft., with railroad siding, for Brodley, De Groff & Co., wholesale grocers. A. T. Richardson, secretary. Thos. R. Kimball, of Omaha, Neb., architect.

Dallas, Tex.—F. B. Jones, Vice-Pres. & Gen. Mgr. of the Southern Rock Island Plow Co., writes that the company will probably erect a new building to replace the storage warehouse recently burned.

Buffalo, N. Y.—The freight house of the Lehigh Valley R. R. Co., at Tifft Farm, was destroyed by fire June 27. Walter C. Berg, Chief Engineer, 26 Cortlandt street, New York City.

San Antonio, Tex.—Plans and specifications are now being prepared for a union depot, to be built by the Sunset Railway Co. W. G. Van Vleck, manager, Houston, Tex.

South Bend, Ind.—It is proposed to erect a 6-story addition to Oliver Hotel. Jas. Oliver, proprietor. Ennis Austin, Archt., South Bend.

St. Louis, Mo.—The Smith & Davis Mfg. Co. of St. Louis is to erect a 6-story warehouse 50 x 155 ft.

Homestead, Pa.—The old Homestead electric power house is to be remodeled and fitted up for a livery stable according to plans prepared by D. G. Pratt, 320 8th Ave. Cost, $16,500.

Huntington, W. Va.—The Adelphia Hotel, owned by J. T. Nichels, of Columbus, O., is reported to have been destroyed by fire on July 2.

New York, N. Y.—Bruce Price, 1133 Broadway, is stated to have filed plans for a 20-story fireproof office building for the Century Building Co., of 66 B'way.

Morris K. Jesup, Pres. of the Chamber of Commerce, is to erect a 12-story apartment hotel at 252 and 254 W. 82 St. Architects, Howell & Stokes, 45 Cedar St.

Allenhurst, N. J.—Allenhurst Inn was burned July 1st. W. Johnson Quinn, proprietor. It is reported that it will be rebuilt at once.

Richmond, Ind.—It is stated that the Pennsylvania R. R. Co. will erect a depot here, to cost about $60,000. W. H. Brown, Ch. Engr., Philadelphia.

Chicago, Ill.—Holabird & Roche, Monadnock Bldg., are stated to have completed the plans for the new Hibernian Bank building, to be erected at 18-24 Pacific Ave.; cost $200,000.

Sault Ste. Marie, Mich.—Charlton, Gilbert & Demar, of Marquette, are stated to have prepared plans for a $30,000 business block for Mrs. E. Gowan, of Sault Ste. Marie.

Sheboygan, Wis.—Jacob Schlict is reported interested in the erection of an opera house on New York Ave.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

468 Greenwich St, br & stone warehouse; c, $39,000; o, Henry Kroger; a, Franklin Baylies.

Broadway & New St, br & stone office bldg; c, $900,000; o, Century Bldg Co; a, Bruce Price.

49th St & 5th Ave, br & stone hotel; c, $40,000; o, Sam'l Emory; a, Chas C Thain.

ALTERATIONS.

Bway & 11th St, extension raised; c, $20,000; o, James McCreery Realty Corporation Co; a, Welch, Smith & Provot.

215 W 57th St, repair damage by fire; c, $20,000; o, American Fine Arts Soc; a, H J Hardenberg.

DWELLINGS.

Worcester, Mass.—Frank S. Robbins, 13 Blackstone street, is reported interested in the erection of an apartment house on Wellington, South Irving and Essex streets, to cost about $175,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

6 to 10 Barrow St, br & stone tenem't; c, $35,000; o, Katie Behrens; a, Geo F Pelham.

52d St & 5th Ave, br & stone dwellg; c, $20,000; o, George Roe Lockwood; a, Hiss & Weekes; b, A J Robinson Co.

83d St & 5th Ave, 3 stone front dwellgs; c, $225,000 all; o, James A Frame; a, Janes & Leo.

ALTERATIONS.

62 E 66th St, 2 and 4-story extension; c, $40,000; o, Chas L Bernheimer; a, Small & Schumann.

27 E 64th St, 4-story extension; c, $40,000; o, Georgia Balfour Hurrah; a, Mantle Fielding; b, Andrew J Robinson Co.

SCHOOLS.

Lewiston, Me.—Henry Desjardins, of Lewiston, is stated to have received the contract for erecting the high school, for $47,991.

Quebec, Que.—The contract for constructing the new wing to the Laval Normal School is stated to have been awarded to Joseph Gesselin for about $80,000.

Kirksville, Mo.—J. A. McCarter, of Chillicothe, is stated to have received the contract for erecting a State normal school here for $27,400.

Ponsonby, Ont.—Bids are wanted July 9 for erecting a school. W. Frye Colwill, architect.

Philadelphia, Pa.—Bids are wanted July 8 for erecting a school on Benner and Dittman streets, and a 2-wing addition to Baldwin School; also for sinking an artesian well at Franklin School, and paving at Sartain and Watson Comly Schools. A. F. Hammond, Secy. Com. on Property, Board of Public Education.

Brooklyn, N. Y.—Bids are wanted July 8 (readvertisement) for erecting School No. 140; also for improving the sanitary condition and alterations to Schools Nos. 32 and 57. Richard H. Adams, Chairman Com. on Buildings, Board of Education.

Brooklyn, N. Y.—Bids are wanted July 8 (readvertisement) for erecting addition to and alterations in School No. 164, Borough of Bronx; also for several small improvements to sanitary work, alterations and repairs, and installing electric light plant, fixtures, etc., in various schools, Boroughs of Manhattan and Bronx.

Brooklyn, N. Y.—The following bids were opened July 1 by the Committee on Buildings, Bd. Educ., for sanitary work at new public school 136, Boro. of Brooklyn: Wm. Brodie, $15,995; Jere. J. Deady, $11,387; J. Manneschmidt, Jr., $12,006.54; Jas. Fay, 205 E. 51st St., N. Y. City, $11,124 (awarded); Jas. Harley & Co., $11,363.

Raleigh, N. C.—M. A. Moser & Co., of Raleigh, are stated to have received the contract for the erection of a textile school at $20,000 for the State Agricultural and Mechanical College.

Indianapolis, Ind.—Bids are wanted July 18 for steam heating, plumbing and sewerage in the school at Sheldon and 17th Sts. Jno. E. Cleland, Bus. Dir.

Hartford, Conn.—Bids are wanted July 10 for $94,000 West Middle School Dist. bonds. James P. Taylor, Dist. Treas.

Minneapolis, Minn.—Bids are wanted July 18 for erecting a mechanic arts building; also a veterinary building and additions to Girls' Dormitory at the School of Agriculture, University of Minnesota. Address J. S. Pillsbury, Pres. Bd. Regents.

Guthrie, Okla. Ter.—See "Water."

Boston, Mass.—Bids are wanted July 8 for installing a ventilating and heating system in the Winship school, Dighton Pl., Brighton Dist., Boston. Wm. F. Merritt, Chmn. Com. on New Bldgs., School Com.

Rapid City, S. Dak.—Bids are wanted July 16 for erecting a building for the State School of Mines at Rapid City; also separate bids for heating same. Address Dr. F. A. Spafford, Pres. Regents of Education, Flandreau, S. D.

Maineville, O.—Bids are wanted July 11 for erecting a school in Sub-Dist. No. 9, Hamilton Township. Jas. C. Redman, Clk. Bd. Educ.

Collinwood, O.—Bids are wanted July 24 for erecting a school. Allen H. Tyler, Clk. Bd. Educ.

Hartford, Conn.—It is proposed to erect an addition to the Wethersfield Ave. school, to cost about $65,000.

San Bernardino, Cal.—The citizens are stated to have voted to issue $20,000 bonds for 2 new schools.

Newport, Ky.—The Board of Education on July 1 rejected all plans received for the proposed new school to cost about $35,000.

Bloomington, Ind.—The contract for the erection of Science Hall of Indiana University has been awarded to Pulse & Porter, of Greensburg, Ind., for about $90,000.

Richmond, Va.—M. J. Dimmock, 1111 E. Main St., is preparing plans for a $15,000 annex to Fulton public school in this city.

STREET CLEANING AND GARBAGE DISPOSAL.

Long Island City, N. Y.—The following bids were received July 3 by P. E. Nagle, Commr. of Street Cleaning, N. Y. City, for street sweeping and the collection of ashes, etc., in the Boro of Queens; prices per month for the six months ending Dec. 31. First ward, Agnus Lausen, $1,094; Jno. A. Hicks, $1,300. Second ward, Frank Monteverde, $800; Matthew Hofeler, $799; Wm. C. Card, $640. Third ward, Patrick J. Griffin, $735; Thos. F. Touhey & Co., $750. Fourth ward, Thos. Foley, $800. Fifth ward, Louis Walters, $8,500 for the whole period.

San Francisco, Cal.—The Board of Public Works has awarded to the Market Street Ry. Co. the contract for removing street sweepings from bunkers at Eleventh and Bryant Sts. to Golden Gate Park. The price is 30 cts. per cu. yd. The yearly gross amount of the contract will be about $18,000.

New Brunswick, N. J.—The Board of Health favors the construction of a garbage crematory.

GOVERNMENT WORK.

Fort Strong, Mass.—Bids are wanted July 27 for erecting a coal shed at Ft. Strong, Long Island, Boston Harbor, Mass. W. H. Miller, Depot Q. M., 170 Summer St. Boston.

Boston, Mass.—The contract for constructing a coal storage and coal handling plant at the Boston Navy Yard has been awarded to Augustus Smith, of New York, for about $160,000.

Waldoboro, Me.—Bids are wanted July 25 for furnishing a heating apparatus in the U. S. Custom House and Post Office at Waldoboro. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

New Orleans, La.—Bids are wanted July 31 for the installation of an elevator plant in the U. S. Custom House and Post Office, New Orleans, as advertised in The Engineering Record.

Abilene, Tex.—Bids are wanted Aug. 7 for erecting (except heating apparatus, electric wiring and conduits) the U. S. Post Office and Court House at Abilene, as advertised in The Engineering Record.

Boise, Idaho.—Bids are wanted Aug 29 for erecting (except heating apparatus, electric wiring and conduits) the superstructure of the U. S. Public Building at Boise, as advertised in The Engineering Record.

Charleston, S. C.—Bids are wanted at the U. S. Engineer Office until Aug. 14 for building hull and furnishing and installing propelling machinery for sea-going suction dredge; bids will also be received at the same time for furnishing and installing pumping machinery for sea-going suction dredge, as advertised in The Engineering Record.

Columbus, O.—The following bids were opened June 21 at the Treasury Dept., Washington, D. C., for an electric passenger elevator at the Columbus Post Office: *a*, tandem worm gear; *b*, single worm gear. Kinkade & Liggett Co., Columbus, *a* $5,800. Otis Elevator Co., New York, *a* $5,790, *b* $5,425. Elektron Mfg. Co., Springfield, Mass., *a* $5,620. Winslow Elevator Machine Co., Chicago, *b* $4,750. Whittier Machine Co., Boston, *a* $6,400, *b* $6,000. Stokes & Parrish Elevator Co., Philadelphia, *a* $6,169, *b* $5,669. Marine Engine & Machine Co., New York, *a* $5,448, *b* $5,164. Eaton & Prince Co., Chicago, *a* $6,100, *a* $5,780.

Bremerton, Wash.—The following bids were opened June 29 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of a brick and steel boiler house 43 x 50 ft. at the Naval Station, Bremerton: M. J. Carkeek, Seattle, Wash., $7,750; Puget Sound Bridge & Dredging Co., Seattle, Wash., $6,900; W. R. Nichols, Tacoma, Wash., $8,240.

Bids received for the extension of fire protection at the Naval Station were as follows: Puget Sound Bridge & Dredging Co., $7,450; Jacobson, Bode & Co., Portland, Ore., $7,500; Julius Marks, Seattle, $8,200.

Joliet, Ill.—The following bids were opened July 2 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Joliet: Angus & Gindel Co., Chicago, $91,470; Adams Groth, Joliet, $78,350, Time 15 months; Peoria Stone & Marble Wks., Peoria, $102,000, 16 months; D. H. Hayes Co., Chicago, $92,685, 15 months; Harry Knerr, Pottsville, $79,080, 12 months; Galliard Bros., Chicago, $92,600, 12 months; Joliet & Sons, Peoria, $72,265, 16 months; Wm. Goldie Sons Co., Chicago, $99,740, 16 months; L. L. Leach & Son, Chicago, $86,000, 16 months; M. Yeager & Son, Danville, $75,486, 16 months; Congress Con. Co., Chicago, $86,051, 15 months; Chas. W. Guidelle Co., Chicago, $80,475, 16 months.

MISCELLANEOUS.

Greenville, Miss.—The Board of Mississippi Levee Commissioners has awarded contracts for approximately 1,500,000 cu. yds. of levee work at prices ranging from 10.80 cts. to 34⅛ cts.

Stockton, Cal.—The Board of Public Works has been authorized to construct 240 ft. of bulkhead (concrete on pile foundation). Estimated cost, $10,000. G. A. Atherton, Engr.

Charlestown, Mass.—Pier No. 5 of the Hoosac Tunnel docks is reported to have been destroyed by fire July 1.

Portland, Me.—Geo. N. Fernald, Commr. of Pub. Wks., writes that contracts for cement (bids opened June 27) have been awarded as follows: 1,000 bbls. Portland cement for street department, to Cox & Ward Co., of Portland, at $1.93 per bbl.; 1,500 bbls. American cement at $1.12 and 500 bbls. Portland cement at $1.92 for North Side intercepting sewer, to Cox & Ward Co.; 368,000 brick for North Side intercepting sewer, to Wm. Lucas, of Portland, at $8.50.

New York, N. Y.—Contracts, for which bids were opened on June 28th, have been awarded as follows by the Department of Docks & Ferries: Contract No. 707, for dredging on East and Harlem Rivers, to the Atlantic Dredging Co., 31 Pine St., at 28½ cts. per cu. yd. Contract No. 708, for furnishing about 10,000 barrels of Portland cement, to John P. Kane, 4th Ave. and 22d St.; Class I, slow setting, $1.35; class II, quick setting, $1.39. Contract No. 709, for building a new wooden pier foot of Burling Slip, E. R., to be known as Pier new 16, E. R., to John Gillies Co., Inc., 58 Broad St., for $27,564. Contract No. 710, for building two new crib bulkheads, between E. 131st and E. 135th Sts., Harlem River, and for dredging thereat, to James D. Leary, crib bulkhead $54,900, dredging 27 cts. per cu. yd.

Altoona, Pa.—City Engr. Harvey Linton writes that the contract for constructing a retaining wall, etc., has been awarded to Harney & Donahugh, of Altoona, as follows: Shale excavation, $1.03 per cu. yd.; concrete retaining wall, complete, $8.40 per cu. yd.; concrete coping, in place, 95 cts., per lin, ft.; concrete steps, in place, $9 cu. yd.; pipe sewers, complete, 45 cts. per lin. ft.; 4-in. drainage pipes, in place, 25 cts. per lin. ft.; dry rubble masonry, $4 per cu. yd.; rubble masonry in cement mortar, $5 per cu. yd.; vitrified brick masonry in cement mortar, $13 per cu. yd.; removing houses No. 1318 and 1320 10 ft. northwestward to foundations of rubble masonry (in cement mortar) constructed at above price, enclosing cellars as large as those now in use, $150 for each house; iron rails and balustrades for concrete steps, 4 ft. wide, $1.90 per lin. ft.; same for 6-ft. steps, $2.20 per lin. ft.; air inlets for sewers, $5 each. Award ratified by Select Council only (with the exception of concrete steps at 14th St. instead of stone steps, as specified in the original ordinance).

NEW INDUSTRIAL PLANTS.

Dodd & Struthers, Des Moines, Ia., makers of electric apparatus, will erect a 3-story, 48 x 70-ft. brick factory and install a 10 to 15-H.-P. steam engine and a 30 to 40-H.-P. boiler.

The Ashland, Wis., Iron & Steel Co., will add to its plant kilns for burning charcoal and a chemical plant to condense and recover the by-products produced in charring the wood. A 50 x 140-ft. boiler house suitable for generating steam for 1,200 H.-P. will be erected.

The Laidlaw-Dunn-Gordon Co., Cincinnati, O., is having plans prepared for a 106 x 200-ft. foundry having a daily capacity of 30 to 40 tons, to be equipped with electric cranes.

The Colorado & Southern Ry. Co., Denver, Colo., will erect new shops on the Fort Worth & Denver City line at some point not yet determined upon, to consist of a round-house; a 120 x 104-ft. machine shop; a 120 x 50-ft. boiler shop addition to the machine shop; a blacksmith shop; a 74 x 250-ft. car shop; a 48 x 160-ft. paint shop; a 34 x 40-ft. power house, to contain a 125-H.-P. engine belted to the main line shafting; a 30 x 110-ft. storehouse and a 2-story office building, about 48 ft. square. Plans will not be completed before the middle of August. H. W. Cowan, chief engineer.

The Newell Sanders Plow Co., Chattanooga, Tenn., will erect a new plant, but the plans are not yet ready.

The Geo. A. Adams Grain Co., Coffeyville, Kan., will erect an elevator to handle about 25 cars of grain daily, and the power plant will probably be 125 H.-P.

The Cleveland-Canton Spring Co., Canton, O., is erecting a 60 x 250-ft. factory, to have an annual capacity of 2,000 tons of carriage springs.

A. J. Dibble, Penn Yan, N. Y., maker of spokes, will erect a 27 x 96-ft. main building with a 30 x 40-ft. annex and 20 x 60-ft. dry kilns. The power plant will consist of about 150-H.-P., steam and water.

The Central Foundry Co., Fort Wayne, Ind., will build a new plant having a daily capacity of 10 tons to make Walda's patent sectional sash weight.

BUSINESS NOTES.

The Julian D'Este Co., 55 Canal St., Boston, has received a second order for its improved pressure regulators to go on warships for the Russian government.

The New England Structural Co., Boston, has been awarded the contract for furnishing the steel framework and ornamental ironwork for the New England Real Estate Trust Bldg., Boston.

The Stanley Electric Mfg. Co., Pittsfield, Mass., has voluntarily granted its employes a 9-hour working day with 10 hours pay, besides a 5 per cent. increase in wages. New shops have recently been completed at Morningside, one mile out on the Boston & Albany R. R., and sufficient orders are reported as already in hand to keep these running day and night for the ensuing year.

The H. W. Johns Mfg. Co., New York, has recently secured the contract for covering the cylinders, pipes and receiver at the plant of the Edison Portland Cement Co., Stewartsville, N. J., for the account of Allis-Chalmers Co.

The Stillwell-Bierce & Smith-Vaile Co., Dayton, recently shipped a 27-inch improved cylinder gate Victor turbine mounted on a horizontal shaft in a wroght iron flume, to the North Carolina Electrical Power Co., Marshall, N. C. The wheel was made entirely of bronze and under 60 feet working head of water will develop 750 H.-P. The power of this wheel will be used for driving the plant for operating one of the street railways of Asheville. The shipment also included 70 ft. of steel feeder pipe, three sets of head gate irons and the necessary water rack.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
July 9.	Reservoir, Boston, Mass	June 22
	Adv., Eng. Record, June 22.	
July 10.	Wickliffe Ky	July 6
July 10.	Mapleton, Ia	July 6
July 11.	Well, Grinnell, Ia	June 22
July 11.	Wilkinsburg, Pa	June 22
	Adv. Eng. Record, June 22 to July 6.	
July 11.	Ft. Wayne, Ind	June 29
July 11.	Laurel Md	July 6
	Adv., Eng. Record, July 6.	
July 12.	Hyattsville, Md	June 29
July 15.	Lewes, Del	June 29
	Adv., Eng Record, June 29, July 6	
July 15.	Wisner, Neb	July 6
July 16.	Linton Ind	June 29
	Adv., Eng. Record, June 29.	
July 16.	Clinton, Ind	July 6
July 18.	Columbus, Ind	July 6
July 19.	Salt Lake City, Utah	June 29
	Adv . Eng. Record, June 29, July 6.	
July 19.	Binghamton, N. Y	July 6
July 19.	Bonaparte, Ia	July 6
July 22.	Pipe, Atlantic City, N. J	July 6
	Adv., Eng. Record, July 6.	
July 22.	Paris, Mo	June 29
July 23.	Sanford, N. C	July 6
	Adv., Eng. Record, July 6.	
July 25.	Boston, Mass	June 29
	Adv., Eng. Record, June 29, July 6.	
July 25.	Pumps for sale, Lancaster, Pa	July 6
	Adv., Eng. Record, July 6.	
Aug. 1.	Rimouski, Que	May 25
Aug. 6.	Filter plant, Reading, Pa	June 15
	Adv., Eng. Record, June 15 to 29.	
Aug. —.	Reservoir, Dauphin, Pa	May 4
Oct. 1.	Burlington, Ia	June 29
	Adv., Eng. Record June 29.	

SEWERAGE AND SEWAGE DISPOSAL.

July 9.	Cleveland, O	June 22
	Adv., Eng. Record, June 22, 29.	
July 9.	St. Louis, Mo	July 6
July 10.	Houston, Tex	June 22
July 10.	Indianapolis, Ind	June 29
July 10.	New York, N. Y	June 29
July 10.	Jamestown, N. Y	June 29
	Adv., Eng. Record, June 29, July 6.	
July 11.	Spirit Lake Ia	July 6
July 12.	Lebanon Ind	June 22
July 12.	Simsbury, Conn	July 6
July 12	Merrill, Wis	July 6
July 12.	Irwin, Pa	July 6
July 13.	Pumping machinery, Washington, D C.	May 18
	Adv., Eng. Record, May 18.	
July 13.	Cambridge, O.	June 22
July 15	Kokomo, Ind	June 22
July 15.	Haddonfield N J	June 22
	Adv., Eng Record, June 22 to July 6.	
July 15.	Lewes, Del	June 29
	Adv , Eng. Record, June 29, July 6.	
July 15.	Swissvale, Pa	July 6
	Adv., Eng. Record, July 6.	
July 16.	Oshkosh, Wis	June 29
July 16.	Cleveland, O	June 29
	Adv., Eng Record, June 29, July 6.	
July 18.	Cleveland, O.	June 29
July 24.	New Orleans, La	May 11
	Adv., Eng. Record, May 11 to June 29.	
July 27.	Washington, D. C.	June 29
	Adv., Eng Record, June 29.	
July 27.	East Cleveland O	July 6
July 29.	Oshkosh, Wis	July 6
Aug. 3.	Galion, O	July 6
	Adv., Eng. Record, July 6.	
Aug. 10.	Visalia, Cal	June 22
Sept. 25.	Havana Cuba	June 29
	Adv., Eng. Record, June 29, July 6.	

BRIDGES.

July 8.	Boston, Mass	July 6
July 10.	Lowell, O	July 6
July 10	Rochester, Minn	July 6
July 10.	Monticello, Ill	July 6
July 11.	Belview, Minn	June 22
July 12.	Brice, O	June 15
July 13.	Melrose, Minn	July 6
July 18.	Oil City, Pa	June 15
July 19.	Battleford, N. W. Ter	July 6
July 23.	Oglethorpe, Ga	June 15
July 24.	Chicago, Ill	May 25
July 30.	Dublin, Ga	June 29
Aug. 5.	McRae, Ga	July 6
Feb. 28.	Sidney, N. S. W	June 22
	Adv., Eng. Record, June 22 to July 6.	

PAVING AND ROADMAKING.

July 8.	Gloversville, N. Y	July 6
July 8.	Mt. Vernon, Ind	July 6
July 9.	New York, N. Y	June 29
July 9	Binghamton N. Y	June 29
July 9.	St. Louis, Mo	July 6
July 9	Branford, Conn	July 6
July 10.	Coudersport, Pa	June 29
July 10.	Indianapolis, Ind	June 29
July 10.	Sioux Falls, S. D	July 6
July 11.	Meriden, Conn	June 29
	Adv. Eng. Record, June 29.	
July 11.	Paoli, Ind	June 29
July 12.	Denver, Colo	July 6
July 12.	Irwin, Pa	July 6
July 15.	Hasbrouck Heights, N. J	June 29
July 15.	Kentland, Ind	June 29
July 15.	Hackensack, N. J	July 6
July 15.	Aurora, Ill	July 6
July 16.	New York, N. Y	July 6
July 16.	Des Moines, Ia	June 29
July 17.	Scottdale, Pa	June 22
July 18.	St Paul, Minn	July 6
July 23.	South Bend, Ind	June 29
July 27.	Bellefontaine, O	July 6
July 29.	Springfield, O	July 6
Aug. —.	Houston, Tex	June 22
Sept. 25.	Havana, Cuba	June 29
	Adv., Eng. Record, June 29, July 6.	
———	Fowler, Ind	July 6
	Adv., Eng. Record, July 6.	
———	Windber, Pa	July 6

POWER, GAS AND ELECTRICITY.

July 10.	Toledo, Ill	July 6
July 15.	Indianapolis, Ind	June 22
July 15.	Lewes, Del	June 29
	Adv , Eng. Record, June 29.	
July 15	Winnebago City, Minn	June 29
July 15.	New York, N. Y	July 6
July 15.	Pub. bldg., Batavia, N. Y	July 6
July 19.	Cincinnati, O	June 22
July 22	Paris Mo	June 29
July 23.	Winton Place, O	July 6
July 27.	Ft. Washington, Md	June 29
July —.	Doylestown O	June 15
Aug. 1.	Rimouski, Que	May 25
Aug. 1.	Burlington, Ia	June 29
	Adv., Eng. Record, June 29.	
Aug. 2.	Cambridge, N. Y	June 1
Aug. 9.	Tampa, Fla	July 6

GOVERNMENT WORK.

July 9.	Life saving station, Monomoy Is., Mass.	June 22
	Adv., Eng. Record, June 22.	
July 11.	Hot Springs, Ark	June 15
	Adv , Eng. Record, June 15, 22.	
July 12.	Annapolis, Md	June 29
July 13.	Philadelphia, Pa	June 15
July 13.	Boston, Mass	June 22
July 13.	New York, N. Y.	June 29
July 13.	Washington, D. C.	June 29
July 13.	League Is. bldg., Philadelphia, Pa	June 22
July 15.	San Francisco Cal	June 8
	Adv., Eng. Record, June 8, 15.	
July 16.	Beacons Mobile, Ala	June 22
	Adv , Eng. Record, June 22, 29.	
July 17.	Albany, N. Y	June 29
July 19.	Elevator, New Orleans, La	June 22
July 20.	Ft. Hancock, N. J	June 29
July 22.	Ft. Mason, Cal	June 29
July 22.	Norfolk, Va	June 29
	Adv., Eng. Record, June 29, July 6.	
July 23.	Newport, R. I	June 29
	Adv., Eng. Record, June 29, July 6.	
July 24.	Norfolk Va	June 29
	Adv. Eng. Record, June 29	
July 25.	Waldoboro Me	July 6
July 26.	Pier repairs, Grand Rapids, Mich.	June 29
	Adv., Eng Record, June 29, July 6.	
July 27.	Ft. Washington, Md.	June 29
July 27.	Coal shed, Ft. Strong, Mass	July 6
July 31.	New Orleans, La	July 6
	Adv., Eng. Record, July 6.	
Aug. 1.	Rip rap, etc., Manila, P. I	Apr. 6
	Adv., Eng. Record, Apr. 6 to June 22.	
Aug. 1.	Dredging, Manila, P. I	Apr. 27
	Adv , Eng. Record, Apr. 27 to May 18.	
Aug. 2.	Washington, D C.	June 29
	Adv., Eng. Record, June 29, July 6.	
Aug. 6.	Los Angeles, Cal	June 29
	Adv., Eng. Record, June 29, July 6.	
Aug. 7.	Abilene, Tex	July 6
	Adv., Eng. Record, July 6.	
Aug. 14.	Propelling machinery for dredge, Charleston, S. C.	July 6
	Adv. Eng. Record, July 6.	
Aug. 14	Pumping machinery for dredge, Charleston, S. C.	July 6
	Adv , Eng. Record, July 6.	
Aug. 29.	Boise, Idaho	July 6
	Adv., Eng. Record, July 6.	
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I.	June 15

BUILDINGS.

July 8.	Htg. school, Boston, Mass.	July 6
July 8.	School, Philadelphia, Pa	July 6
July 9.	School, Ponsonby, Ont	July 6
July 9.	Bath house, Philadelphia, Pa	July 6
July 10.	Bus bldgs., Steubenville, O.	June 29
July 10.	Pub. bldg., Cedar Springs, S. C	June 29
July 10.	Pub. bldg., Mishawaka, Ind	June 22
July 10.	Courthouse, Greenville, Ga	May 18
July 10.	Courthouse, Luthersville, Ga	May 18
July 10.	Court house, Bainbridge, Ga	May 25
July 10.	Fire escapes on pub. bldgs., Austin, Tex	June 15
July 10.	Church, Greenfield, Ind	July 6
July 11.	Htg. school, Carthage, O	June 15
July 11.	School, Maineville, O.	July 6
July 11.	Lion house, New York N. Y.	July 6
July 12.	Court house addition, Seattle, Wash	June 29
July 15	Hospital, Randall's Island, N. Y.	June 29
July 15.	Bus. bldg., Atlanta, Ga	June 15
July 15.	Htg. school, Ypsilanti, Mich	June 22
July 15.	Hotel plans, Richmond, Va	June 29
July 15.	Bldgs. at Quarantine station, New York, N. Y	July 6
July 15	Cottage at hospital Newark, N. Y	July 6
July 16.	Court house Jeffersonville, Ga	June 22
July 16.	Hospital, Newberry, Mich	June 29
July 16	College, Rapid City, S. D	July 6
July 16.	Pub. bldg., Detroit, Mich	July 6
July 18	School, Minneapolis, Minn	July 6
July 18	Htg. school, Indianapolis, Ind.	July 6
July 18.	Pub. bldg., Dayton, O	June 29
July 20.	City hall, Janesville, Wis	July 6
July 24.	Pub. bldg., Minnehaha, Minn.	June 29
July 24.	School, Collinwood, O	July 6
July 25.	Pub. bldgs., Ionia, Mich	June 29
Aug. 6.	Courthouse, Crawfordsville, Ga	June 22
Aug. 12.	Jail, Statesboro, Ga	June 29
Sept. —.	Church, Bangor, Me	June 29

MISCELLANEOUS.

July 8.	Tunnel for El. Ry., Hazleton, Pa	June 29
	Adv., Eng. Record, June 29.	
July 10.	El. Ry., Parkersburg, W. Va.	June 22
July 10.	Dam, Columbus Ga	June 22
July 15.	El. Ry., Springfield, Mass.	June 29
Dec. 10.	Rosario, Argentine Repub	Apr. 13
———	El. railway, St. Louis, Mo	June 15

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Civil Engineer.

It has been said that the profession of the civil engineer is both the oldest and the youngest of all the professions. The art of construction in a number of its applications was certainly practised in pre-historic periods, and it is equally certain that the work of the civil engineer has been recognized as a full-fledged profession only in very recent times. These observations are prompted by two recent addresses, one by Mr. J. J. R. Croes, President of the American Society of Civil Engineers, at its annual convention in Niagara Falls last month, and the other by Mr. Henry G. Prout before the graduating class of 1901 of the Rensselaer Polytechnic Institute at Troy. The president of the American Society of Civil Engineers touched upon the antiquity of the civil engineer's work as well as his modern professional character, while Mr. Prout, suitably to his occasion, spoke more directly of the present duties and profession of the young civil engineer. Both laid particular stress upon what may be called the philosophical basis of civil engineering.

Mr. Croes developed most appropriately, though not to its full extent, the outline of the civil engineer's work at the present time. That work is undoubtedly largely, and possibly chiefly, concerned with the design and building of structures and machines and with the efficient operation of the latter as required by modern communities where industrial operations and public works are of the greatest magnitude and of the most advanced character. The profession of the civil engineer, however, has already passed beyond those limits, in spite of the widest interpretations which may be given to them. This is a fact beyond any question, but its significance has not yet been as fully recognized as it should be. Many of the great consolidated corporations recently formed for the purpose of improving transportation or carrying on manufactures are more or less of an engineering character; indeed, many of them are exclusively devoted to purely engineering work. In all such cases it is manifest that the conduct of those portions of the business involving production or extensive transformation and application of power must be intrusted to engineers. This is exemplified and emphasized by the occupation of many executive or administrative positions by engineers in some of the largest railroad and other corporations now existing.

It is, of course, well known that even at the present time some men prominent in these great modern corporations openly express their low estimate of the value of professional preparation for the discharge of this class of duties. Such expressions, however, constitute a small minority of the estimates openly placed by practical men of advanced character on professional training for almost all lines of transportation and manufacturing business. It is well known among those engaged in instruction in the best engineering schools of this country that the present demand for young civil and other engineers largely exceeds the supply, and it is equally well known that the percentage finding their way into what may be called business positions in manufacturing and contracting is constantly increasing; in fact, in some localities it seems to be rapidly increasing. Again, there are some large cities in which civil engineers have frequently been found occupying public office either by election or appointment, where the construction and care of municipal works form but a portion of their office duties.

Although the professional man has been often, if not generally, considered too little in touch with practical affairs to be intrusted with executive or administrative functions, it is perfectly rational that the educational and professional training of civil engineers should qualify them to an unusual degree for the discharge of administrative duties. A direct and understanding treatment of things as they are constitutes the exercise of good judgment, and it forms also the basis of practical efficiency. The whole trend and result of a civil engineer's training and experience make toward the acquisition of those valuable qualities. There is nothing whatever in engineering education or experience encouraging a devious or deceptive treatment of things or people, which is an observation that does not find universal application in at least one other learned profession. There is no opportunity ingeniously to place the elements of a question in a false relation to each other, for that is simply courting certain failure in all engineering operations. No transportation problem nor the design of any structure or machine will stand juggling of that sort, although legal success may sometimes result from it.

Furthermore, the extensive interests which so many times depend upon the successful management of their engineering features bring civil engineers into the most intimate practical relations with the management of men. In other words, much of their practice in certain directions is calculated to develop both business acumen of the highest order and a tactful attitude toward those with whom they have to deal. Finally, this direct and close analytical treatment of the things which constitute their professional work is a genuine search for the truth, even if it be the truth in material things, and that is a moral training of no mean order. Indeed, it may be stated in broad and general terms that no civil engineer can truly practice his profession without cultivating a business capacity characterized by a high moral tone. In touching upon the requisite qualifications for the administration of some of the greatest corporate interests of modern times, the president of the American Society of Civil Engineers pointed the way to a most important development of the profession which has already begun, and which is bound to become a marked portion of the field of civil engineering.

Good Roads.

Every few months reports are published concerning exhibitions of road-building machinery or mass meetings to discuss road construction, held under the supervision of railway companies. It is of no small interest to examine into the reasons which have led one railroad to appoint a permanent good-roads agent, another to transport over its lines a trainload of machinery with which object lessons in economical road-building are given at various towns, and many companies to offer special rates for the transportation of plant for highway improvement. Presumably these corporations are not doing this solely for philanthropic motives, but because they recognize that the high cost of transportation over poor roads diminishes the farmer's ability to market all but the most valuable part of his produce and his power of purchasing return freight; or, in other words, good roads are a necessity to wealthy farmers, and without wealthy farmers and many of them the railway revenues on local business are small.

The census returns for the State of New York show that the decrease in population in the last decade was 2,261 in Wyoming, Livingston and Allegany counties. The special train which took the New York members of the American Society of Civil Engineers to the recent convention at Niagara Falls passed through parts of these counties, and some of the members remarked on the fact that in spite of manifest advantages of soil and climate, farming is gradually decreasing, and lands formerly under cultivation are now going back to brush and weeds. The reasons for this may be complex, but one of the most influential is surely the defective roads, which not only put an additional burden on the cost of teaming but also isolate each farm and increase the difficulty of social intercourse. This latter influence is much greater than is usually recognized, for men, women and children are gregarious animals, and the hermit and recluse are rare.

Moreover, the lack of good roads is depriving these counties of a very considerable revenue from tourists and pleasure seekers. Their scenery is beautiful, their climate attractive, but their highways keep out the visitor. Switzerland learned this lesson long ago, and has built up an enormous income from tourists by good roads and good hotels. Western New York has, of course, no Chamounix, Zermatt or Interlaken, but it has more picturesque scenery than that to be found along the Oberalp and Albula Passes from Andermatt to San Moritz. Hosts of tourists take the latter tedious two-day journey who would never think of it if a magnificent highway did not make the long diligence ride as comfortable as the smoothest roadway and the easiest of stages permit. Throughout this entire distance, moreover, there is rarely a farm in sight, the hamlets are very small, and there are only a few villages. It is self-evident that without the high road and its well-kept branches the country would be deserted. If a similar road extended through the three retrograding New York counties, with less expensive but nevertheless good branches to the neighboring villages, it is safe to say that the income from travelers and summer visitors alone would soon pay the cost of maintenance and reconstruction, to say nothing of the increased wealth of the farmers through cheaper transportation.

The Water Supply Act passed in Illinois in 1899 has been declared ineffective by Judge Dibell of the Appellate Court, sitting on the Circuit Bench. The act was intended to allow cities already bonded to the legal limit to gain funds for water improvements by issuing certificates against the water-works earnings.

Notes on the Construction of the New Cincinnati Water-Works.

The new works for supplying water to Cincinnati are now well under way. Their general features were described in The Engineering Record of November 27, 1897, and may be briefly summarized as including an intake pier on the Kentucky shore of the Ohio River opposite California, an intake tunnel under the river to the foot of a shaft running down from a large pump pit sunk to such a depth that water will reach the pumps by gravity, large subsiding reservoirs to which these pumps will force the water for partial clarification by subsidence, a filter plant with a clear-water reservior, a tunnel over four miles long running to the city, where another pumping station will be constructed to force the water to the water tanks and reservoir of the distributing works. Certain features of these works have already been described in these columns, but no account of the methods of doing the work has appeared up to the present time. It is the purpose of these notes to describe a few features of the construction methods as well as give an outline of the design of the settling basins.

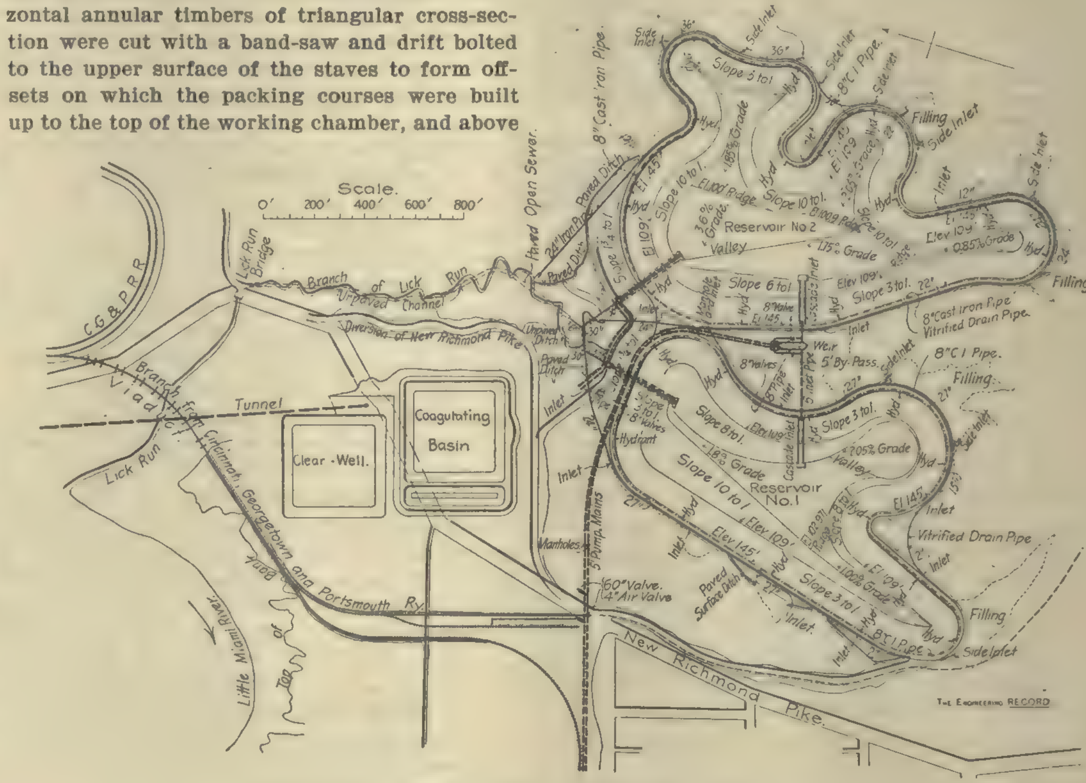
The masonry intake pier, in water about 90 feet deep at the high stage, was built on a pneumatic caisson about 58½ feet long, 30½ feet wide and 16 feet high. It had 4-foot timber walls, braced by two lines of longitudinal struts and tie-rods, and five similar transverse lines, and an 8-foot timber deck, as illustrated in The Engineering Record of December 9, 1899. After the caisson was built it was seated on a horizontal cradle and launched from steep ways. Before launching it was fitted with a 4-foot cofferdam, one air shaft which was closed at the bottom by a temporary diaphragm, and five 4-inch blow-out pipes which were left open. In launching, the cradle was caught and tilted the caisson so much that the cofferdam filled with water, which made it necessary to extend the sides before it could be pumped out. A lock was fitted to the air shaft after some masonry had been built, enough to land the caisson and sink it a little distance into the river bottom.

The bucket was hoisted between timber guides on one side of the shaft opposite the ladder, and there was a separate door in the lock for the men. All pipes passed through the air lock and shaft except three 4-inch blow-out pipes in the axis of the caisson and two in the corners, all of which had flexible hose connections at the bottom and discharged over the top of the cofferdam. The pipes were used for blowing out water only. All of the material was dug out and hoisted in buckets and dumped into barges. The caisson was sunk to solid rock, at one corner through 16 feet of decomposed limestone and shale rock.

From the bottom of the caisson a shaft was excavated about 35 feet deep under air pressure, lined with vitrified brick, and a short section of the intake tunnel to the Ohio shore was driven and similarly lined under pneumatic pressure. Afterwards most of the tunnel was built without air pressure, but when seamy rock was encountered the air lock at the top of the shaft was closed and the work was carried on under air pressure throughout. The tunnel has a circular cross-section 7 feet in diameter, lined with two rows of brick with concrete filling to the rock outside. The tunnel is 1,425 feet long and the invert is from 50 to 75 feet below the river bottom and about 30 feet below the surface of the rock. The center line was produced from the bottoms of plumb lines over 80 feet long, but the two heading started from the bottoms of the intake and pump well shafts met with only ⅝-inch eccentricity.

In constructing the pump well of the California pumping station, a pit 16 feet deep and about 140 feet in diameter at the bottom, was first excavated with steep sloping unbraced sides in the clay and loam. The bottom was carefully levelled and a ditch was dug around its circumference connecting with a deep open drain cut through the bank on one side of the river. The pit was made as deep as the contractors dared go for fear of trouble with ground water, and in it the timber caisson, about 127 feet in diameter and 20 feet high, described in The Engineering Record of November 12, 1898, was built. Four transverse and four longitudinal solid timber walls 3 feet thick and 7 feet high were built at the bottom of the pit, dividing the caisson into twenty-one working chambers connected by openings through the bulkheads. Then the circular steel cutting edge, 24 inches deep with an 8 x 8-inch bottom flange angle, was riveted in place around the cross walls and just beyond their outer ends.

The first course of roof timbers was laid on top of the walls and inclined timber staves forming the inside of the conical side-wall, were fitted between the bevelled edge of this course and the inside flange of the cutting edge. Horizontal annular timbers of triangular cross-section were cut with a band-saw and drift bolted to the upper surface of the staves to form offsets on which the packing courses were built up to the top of the working chamber, and above it a solid timber roof of crossed timber was built up to a height of 12 feet, forming a deck or pump floor 20 feet above the cutting edge. The ceilings of the working chambers and the sides of the bulkheads were sheathed, and all the outside and inside joints cleaned with compressed air and calked. Before putting on the sheathing all joints covered by it were calked.



Map of the Settling Reservoirs at California.

All materials were delivered on a circular railroad operated by cables and running around the caisson pit on the surface of the ground. Timber was handled by guyed mast and boom derricks outside the pit, which delivered it to a small truck on the deck by which it was easily rolled to the required position. The outside vertical staves of the caisson were about 20 feet long and reached from the cutting edge to the top of the deck. They were made of 12 x 16-inch timber, temporarily secured by pieces of timber spiked to the top, outside, and were braced with inclined shores to the sides of the pit. As fast as a line of timbers of each course of the deck were put in place, they were wedged tight and secured by a few drift bolts, and then 15/16-inch holes were bored for the drift bolts through every cross-timber, by a number of pneumatic augers connected by a flexible hose to the two lines of steel air-pressure pipe which crossed the caisson with several outlets on each. The drift bolts were 1 inch in diameter and 30 inches long, with long conical points and were not ragged. They were driven by an Ingersoll-Sergeant Baby drill operated by compressed air. The drill was suspended by a tackle between leads in a well-braced timber tripod with a T-shape base which was mounted on swivel rollers and, being easily moved over the deck, proved to be an efficient tool.

As the deck timbers were laid, thirteen steel shafts were built in to give access to the working chambers. The central one was 10 feet in diameter, and during construction was exclusively a man-shaft, and afterwards formed part of the connection to the intake tunnel; the others were 3 feet in diameter and were only used for materials during the sinking of the caisson, after which they were filled with concrete.

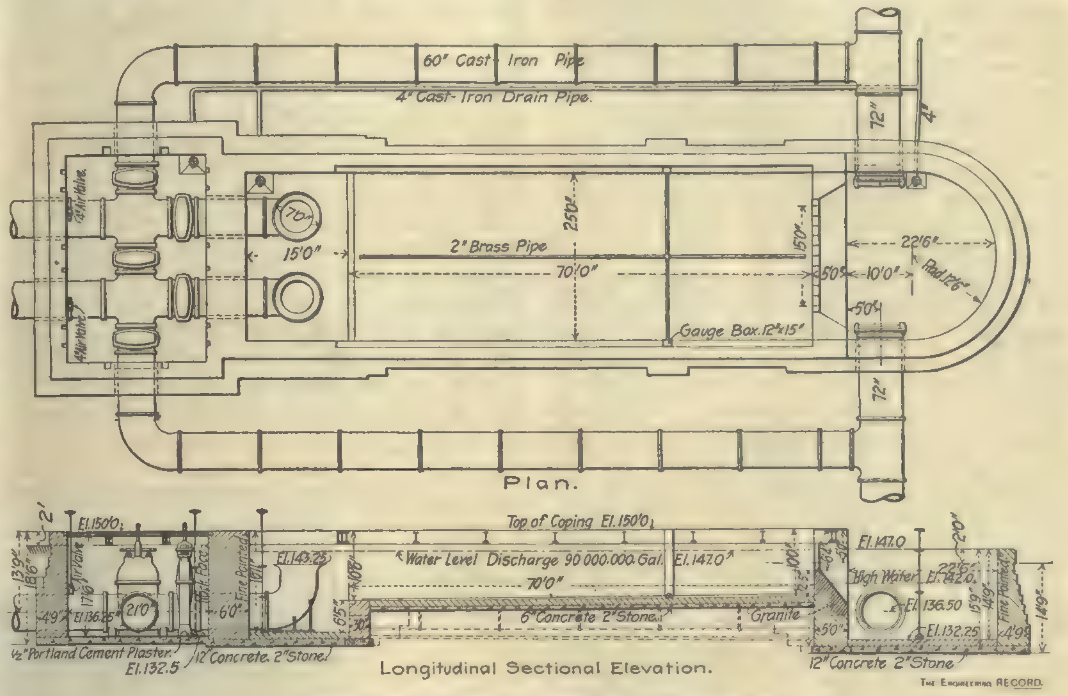
On the surface of the deck was bolted an angle-ring flange 104 feet in diameter, to which were successively riveted courses of ¼-inch steel plates forming a cylindrical shell 70 feet high. This shell was bedded in the solid masonry wall of the pump well which was built on the deck of the caisson, and was 14½ feet thick at the bottom and 4 feet thick at the top, having cut stone inner and outer faces, and a concrete hearting with large stones bedded in it. The steel center shaft was at first built up six courses, or about 40 feet above the deck by a mast and boom derrick adjacent to its base.

A four-post timber tower about 40 feet square and 48 feet high was built in the center of the deck and rigged with four 50-foot booms to handle the spoil excavated from the working chamber. This was mostly sand and gravel and was dumped on the ground outside the caisson pit and removed by teams and scrapers to make an adjacent fill. Some of the sand and gravel excavated was blown out dry through 4-inch pipes and was temporarily deposited on the deck of the caisson for ballast to help sink it. The blow-out pipes were always carried through the 3-foot material shafts and passed through the flanged steel diaphragms by which their bottoms were closed. The tops of these shafts were usually left open except where air locks were put on them and the bottom diaphragms removed.

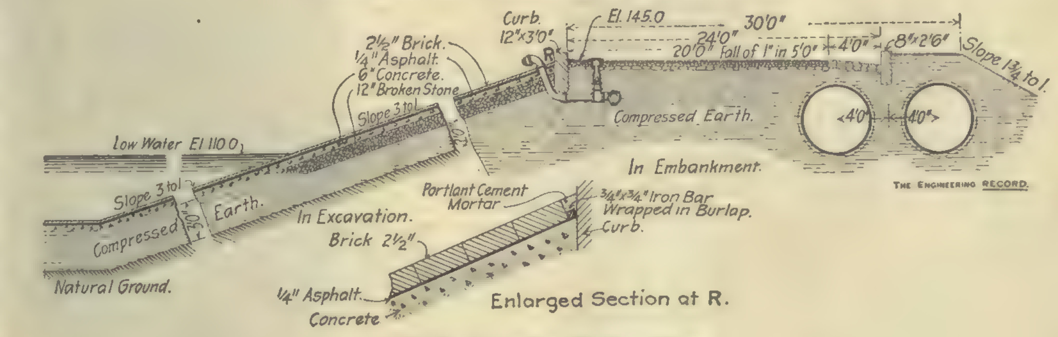
The masonry and the steel plates were handled partly by the tower derricks and partly by stiff log derricks outside the caisson pit, and the masonry wall was built up as the caisson descended so that its top was always about at ground level. When the wall became too high for the tower derrick to work over it, a second 45-foot section was added to the tower, and the booms were moved up and seated at the top of the first section. Within the square formed by the tower columns four hoisting engines, with one 70 horse-power boiler for supplying them with steam, were set up, to operate the derricks; the engine and boiler being occasionally lifted to keep them above the increasing pile of ballast.

Every morning levels were taken on twelve points of the circumference of the caisson and from thirteen other interior points above the working chambers, and the readings were plotted on lithographed sheets to record the progress of sinking and determine the exact deviations from the vertical, which were kept very small. Comparatively little water was encountered and the caisson was sunk the first 20 feet without air pressure. It was finally landed in a stratum of sand, and the working chambers were backfilled with moist sand rammed in 4-inch layers.

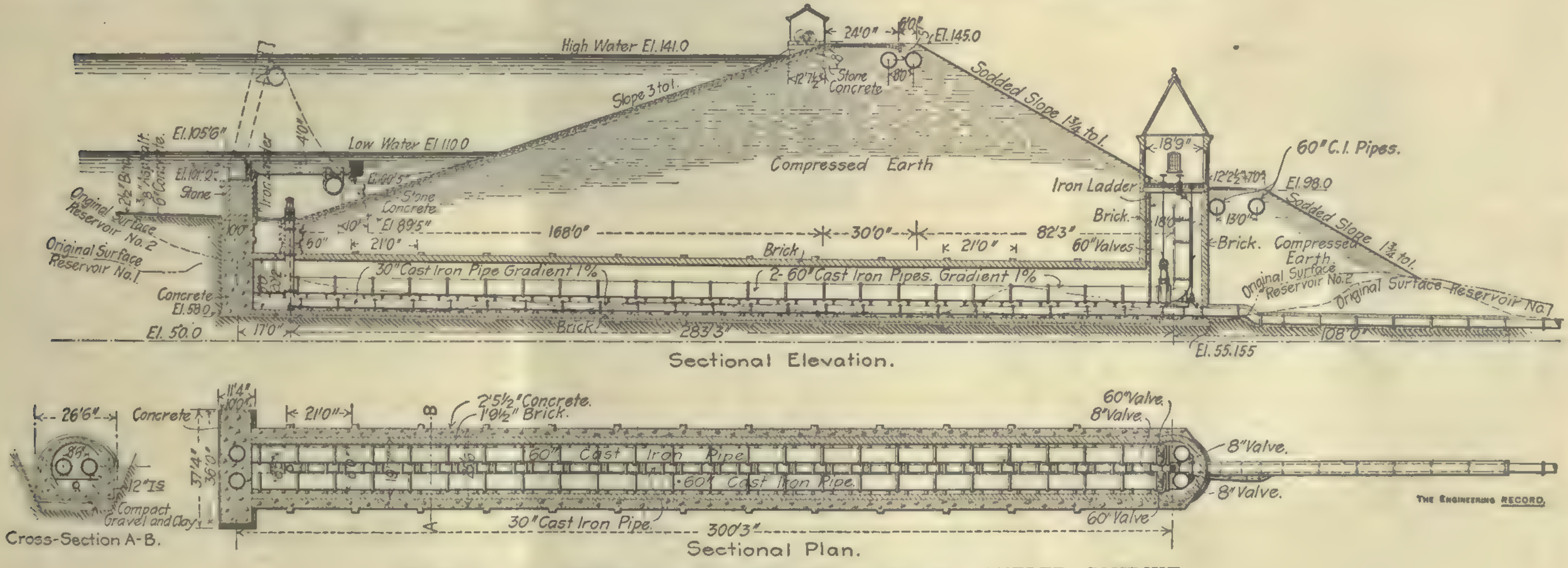
At first the filling was omitted in the central chamber under the 10-foot shaft, and in an adjacent chamber so as to leave a passage to the foot of one of the side shafts. The lower edge of the 10-foot shaft projected a few inches below the ceiling of the working chamber, and through it were ¾-inch tap bolts 2½ inches apart, with their heads outside and their ends projecting beyond the inside surface to support the lower edge of a telescopic steel shell 29 feet high and as large as would slip through the upper shell. When this innner tube was being lowered to rest on the bolts it became slightly distorted and jammed. It then suddenly started and fell, shearing off all the tap bolts and descending without injury to the bottom of the working chamber, from which it took two days' work with powerful jacks to raise it to rest on a new set of bolts.



DETAILS OF THE WEIR BETWEEN THE RESERVOIRS.



DETAILS OF LINING OF RESERVOIRS.



SECTION OF RESERVOIR EMBANKMENT THROUGH OUTLET CONDUIT.

MR. G. BOUSCAREN, CHIEF ENGINEER.

After the caisson was sunk, the tap bolts were screwed out and the inner shell lowered to the bottom of the working chamber and thence sunk by internal excavation under air pressure to a short distance below the surface of the seamy rock. The space in the working chamber around the top of the lower section of the shell was backfilled with sand, the side shaft sealed with concrete, and the excavation of the center shaft was continued through solid rock, under air pressure, to the bottom of the intake tunnel.

During the sinking of the caisson the central shaft was used exclusively for men, but when the excavation was continued below the caisson it was used for both men and materials, and was fitted with a combination air lock of larger diameter than the shaft and eccentric with it, which had a double-leaved 3 x 6-foot top door through which the spoil car was hoisted in a cage and a separate chamber and door for the men. After the excavation was completed the shaft was lined with brick up to the top of the caisson deck, the air pressure was released and the tunnel heading starting from the bottom of the shaft. While the caisson was being sunk and the tunnel was being excavated, the four 48-inch branches just above the caisson deck were closed by timber diaphragms, bolted to their flanges, over lead gaskets. After the shaft was completed, the upper part of its steel lining was continued to a height of 127½ feet above the deck of the caisson, the diameter for the last 12 feet being reduced to 6 feet so as to project above a rotating electric crane whose inner end will rest on top of the 10-foot part of the shaft and the outer end on the wall of the house to be built over the pump pit. The tie-rods of the roof of this house will be attached to the top of the 6-foot part of the shaft.

The four 30,000,000-gallon pumping engines to be installed in this pit are now being constructed at the Camden Iron Works. They are of the triple-expansion crank-and-flywheel type and will be supplied with steam at 150 pounds. Their maximum lift will be about 143½ feet plus the friction head in the force mains, which are two in number, each 5 feet in diameter. Near the pumping station there willl be a cross-connection between the mains provided with a 5-foot valve, and a 5-foot stop valve in each main. The stop valves are situated above the cross-connection and the necessary blow-offs, air valves and man holes are provided for draining and obtaining access to the mains above and below them.

The general plan of the two settling basins is shown in the accompanying drawings. The two have a combined capacity of about 350,000,000 gallons, and are partly in excavation and partly in embankment. The two 5-foot force mains terminate at a receiving basin between the reservoirs, where each pipe ends in a quarter bend with its upright portion splayed outward somewhat to form a slight bell. From the receiving basin, which is 15 feet long, 25 feet wide and nearly 17 feet deep, the water passes into a masonry runway or channel 70 feet long, 25 feet wide and from 10 to 10½ feet deep, having a measuring weir at the lower end. On each side of the channel about one-third of its length from the lower end, is a recess which will be fitted with boxes for hook gauges, these boxes being connected with a 2-inch bronze pipe laid down the center of the channel to serve as a piezometer tube. The masonry runway at the end has a cast-iron frame filled with bronze strips forming the weir proper, over which the water will flow to the distributing basin, 22½ feet long, 25 feet wide and 14 feet 9 inches deep, its end being semi-circular in plan.

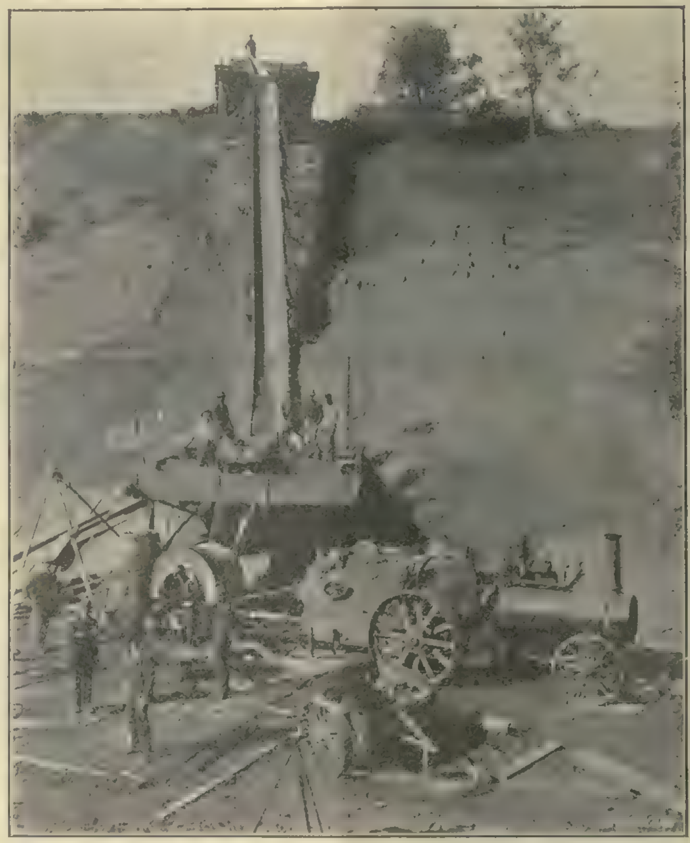
At the upper end of the receiving basin there is a valve chamber containing five 5-foot valves and cross-connections between the force mains and with the by-passes around the weir, which are indicated on the plan. The water is taken from the distributing basin through two lines of 6-foot pipe, one to each reservoir, which are carried through the tops of the embankments of the reservoirs to the receiving chambers on the inner slopes. From each chamber there is a runway and cascade built of masonry and 18 feet wide, down which the water rolls to the basin.

The embankments or dams across the main natural ravines which have been utilized for forming the reservoirs, will have a uniform width of 30 feet on the top, an inside slope of 1 on 3, an outside slope of 1 on 1¾, and bermes 30 feet wide and 12 feet below the water level on their outside slopes. The embankments or side fills across the lateral ravines which occur in places around the reservoirs have similar widths and slopes, but no bermes. The heads of these ravines are filled with waste excavation whose surface is given a slope toward the side fills. The drainage water is conducted in open paved drains to culverts connecting with the sewer lines around the reservoirs.

The earth is spread and rolled in 4-inch layers with careful attention to all the features which will influence the tightness and homogeneity of the bank; no core is employed on account of the plan of construction of the reservoirs, whereby the whole of the masonry part of the revetment is underlaid by a blanket of rolled selected material which is especially thick in the parts contiguous to the dams, which makes such a detail unnecessary.

The low water line in the reservoir is 110 feet above the datum of the work, and one foot lower, at elevation 109, is the contour which marks the change in the inner slopes. Above elevation 109 the slope is everywhere 1 on 3, but below that level it varies considerably, as shown by the accompanying plan. The character of the lining is also changed at this elevation; above it, the excavation is carried to a depth of 2 feet, measured perpendicularly to the slope, while below it the excavation is carried to a depth of 3 feet, below the surface of the finished grading. The areas thus excavated are consolidated by rolling and ramming and then refilled in the same manner as the embankments are constructed. Above elevation 109 the bottom layer of broken stone is first laid, as shown in the cross-section of the slope, a layer of concrete is next placed on the stone, then a covering of asphalt and burlap, and finally a brick pavement. Below elevation 109 the bottom layer of crushed stone is omitted. Where used it is 12 inches thick.

The concrete is to be a 6-inch bed, made with Portland cement and 1-inch stone, and will be given a step near elevation 109 to support the broken stone. It will be painted with a priming coat of Alcatraz asphalt dissolved in benzine and then immediately swabbed with a mixture of the best refined Bermudez lake asphalt and "F" grade liquid Alcatraz asphalt, or its equivalent. While the mixture is still hot it will be covered with a layer of coarse burlap, held at the top by ¾-inch bars laid on the concrete against the upper edge of the brickwork. A second coat of the asphalt mixture, at least an eighth of an inch thick, will be applied to the burlap. The bricks forming the surface will be laid flat; they will be warmed before laying and a wash of the asphalt priming will be given the surface of the slope just before the bricks are placed upon it. Portland cement grout will be used for the joints. At the top of the slope there will be a curb of sandstone.



View of Concrete Plant on Outlet Conduit.

The water will be taken from each reservoir through two floating pipes of riveted steel, 4 feet in diameter, connected by swivel joints with the tops of two 5-foot effluent pipes, which rise vertically in the masonry pier supporting the floating arms. This pier also forms the bulkhead of the 16-foot masonry gallery within which the outlet pipes are carried through the earthwork to a shaft on the outer slope. The pipes rise in this shaft and are finally connected with two lines of 5-foot pipes laid on the 30-foot berme of the outside slope of the embankment and leading to the coagulating basin. The construction of the masonry culvert or gallery is so well shown in the accompanying drawings that no description is necessary. The drain pipe in the bottom of the culvert has a special mud valve at its inlet, which is operated by water from pipes laid around the top of each reservoir to supply the numerous hydrants indicated on the plan. These pipes are 8 inches in diameter and will be supplied by a force pump.

The reservoirs are being constructed by contract. The earth is excavated by wheel scrapers and grading machines, and is put in the embankments and fills with the aid of road grading machines. The rollers weigh 14½ tons each and are operated by steam. The drainage from parts of the basins is carried in a wood flume along the hillside and finally discharged into a small creek. Water for the works is drawn from a deep well in the valley and pumped to a distributing tank on a hill-top high enough to allow the supply to be delivered by gravity wherever needed. At one place the supply was carried over a deep trench by means of a hose, suspended from a heavy wire about 250 feet long, which had beeen stretch from one bank to the other.

One of the outlet-pipe culverts was constructed in a trench about 65 feet deep in one place. All bad material in the bottom of the trench was excavated and then selected material was filled in and rolled to grade in 4-inch layers before the bottom bed of concrete was laid. The walls were constructed with molds having vertical outside walls braced from the earth banks, inside frames like ordinary arch centers, but inverted and made very light; their lagging was put in place only just before the concrete was laid so as to avoid any unnecessary hindrance to the rammers. The materials for the concrete were unloaded from cars and wagons at the top of the hill and delivered through chutes to the two mixing plants near the invert. In one plant, of which an illustration is shown, the broken stone was delivered through an open slide and the sand and cement through a covered chute alongside. They were received by men on a small working platform, who shoveled them into a tilting measuring box, from which they were dumped into a chute leading to a Ransome concrete mixer. This mixer was driven by a traction engine. The second plant had a cubical mixer set at a little higher level. All the materials for it were measured on the top of the hill and sent down together through a chute to the charging platform, where they were delivered to the mixer, which was driven by a small gasoline engine. The mixer discharged into a tilting box mounted on a flat car, which was pushed a few feet to the edge of a wheeling platform. The box was fitted with a spout on one side through which its contents were dumped into the wheelbarrows on the platform below. This platform was above the springing line of the arch and the concrete was dumped directly into the molds from the barrows. Each of the mixing plants had a capacity of about 50 cubic yards in 10 hours.

About 1,400 feet of the tunnel running from the purification works to the Western pumping station in Cincinnati have now been driven, and the lining completed for about 900 feet. The shaft at the California end is about 167 feet deep below the natural ground surface, and consists of a 12-foot steel shell down to the rock and a 12½-foot shaft the rest of the way. Both shell and rock shaft are lined with concrete and two rings of shale brick, the clear diameter being 10 feet. At two different elevations nozzles have been placed. One of these nozzles connects with the pipes through which water will be admitted to the shaft from the clear-water reservoir, and the other with a canal passing around the clear-water basin and enabling it to be put out of service in case of emergency. The shell willl be carried up to a height of 8 feet above the water-level in the clear well but the brick lining will stop 6 feet below its top.

At one of the intermediate working shafts a pit was dug 20 feet deep in the dry, hard, yellow clay, and thoroughly timbered and sheathed. The steel shell was built in it and sunk by men excavating in the open pit through blue clay and then gravel until water was encountered. The excavation was then continued without pumping by a clam-shell dredge, the shell descending very regularly, 1 inch for every bucketful of earth removed. The steel plates were riveted on two courses at a time, and the brickwork which was built up to keep even with the top of the steel provided sufficient weight to sink the shell without other ballast. The shell was wedged against the timbering in the pit to guide it.

The tunnel running from the foot of the California shaft to the foot of one of similar construction at the Western pumping station, will be about 22,700 feet long. There are three intermediate working shafts along its line, and operations are now being carried on at one shaft under compressed air, and in the open at the others. The excavation is being kept as close to a 9½-foot circle as possible, and the lining will be concrete and two rings of shale brick with a fire-glazed surface for the part forming the surface of the tunnel. The conduit will have a grade of 1 in 2,000 toward the pumping station shaft, and will deliver water to the pumps by gravity, thus avoiding any suction lift here as well as at California. The construction of the tunnel has offered no serious difficulties yet, but it is possible that there may be some trouble in crossing below the bed of the Little Miami River. At this place it is proposed to hoop the brickwork with ¾-inch steel rods spaced 2 feet apart.

The steel shell of the shaft at the west end of the tunnel will be carried about 90 feet above ground, but the nozzles of the suction pipes of the pumps will be attached 93 feet below its top. There will be two sets of three pumps each, for which bids were opened a few days ago. The pumps of one set will have a capacity of 25,000,000 gallons each, while those in the other set are to be of 12,000,000-gallons capacity. All will be of the vertical triple-expansion crank-and-flywheel type.

The new works are constructed under the direction of a special Board of Trustees, "Commissioners of Water-Works," of which Mr. August Herrmann is president, and Mr. G. Bouscaren is chief engineer. The intake tunnel, pier and pump pit were under the direction of the late Alfred Petry, as resident engineer, until his death and since then under Mr. Wm. C. Jewett; the contractors were F. H. Kirchner & Company, of Cincinnati. The resident engineer at the settling reservoirs is Mr. Jewett and the contractor is Mr. August Henkel, of Cincinnati. The resident engineer on the tunnel from the clear well to the Western Pumping Station was Mr. Petry until his death, and is now Mr. John A. Hiller; the contractors are W. J. Gawne & Company, of Cincinnati. Mr. C. N. Miller is the assistant engineeer in charge of the engineering offices.

The Boone Viaduct.

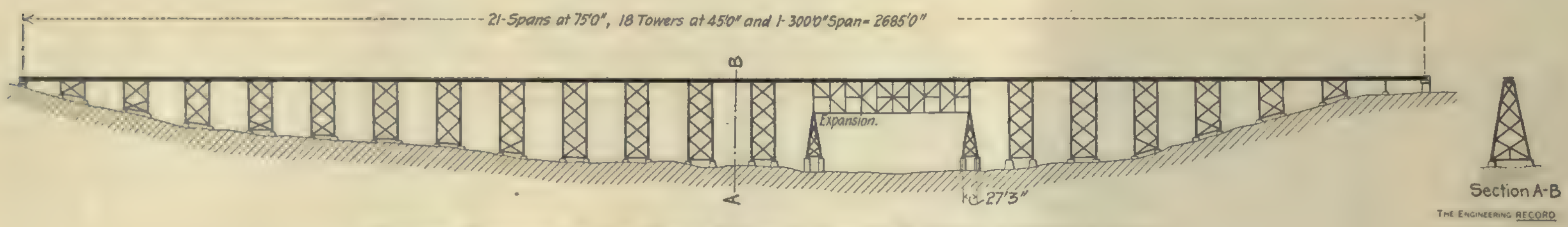
The Boone viaduct carries the new short line of the Chicago & North Western Railway between Boone and Ogden, across the Des Moines River. It is a double-track steel structure, 2,685 feet in length, 185 feet maximum height, and weighs 6,196 tons. It has a 300-foot deck channel span and thirty-six viaduct trestle-bents, braced together in pairs to make towers 45 feet long and 75 feet apart, which are 19½ feet wide on centers at the top and batter 1 : 6 transversely on each post, giving a width of 69 feet 7 inches between centers of pedestals of the tallest tower. There are four lines of plate girders of a uniform depth of 7 feet. The tracks are 13 feet apart on centers, and it is 35 feet from out to out of the two cantilever sidewalks and refuges. The length and weight of this structure gives it first place among all viaducts which have yet been built. The single-track Loa viaduct in Bolivia is the highest of all, 336 feet, but it is much shorter and lighter. The new Kinzua and the Gokteik viaducts are higher than the Boone viaduct and are nearly as long. They are comparable in weight, and are both very recent structures with similar features.

The old and new single-track Kinzua viaducts, 2,053 feet long and 301 feet high, were illustrated in The Engineering Record of December 1, 1900. They were botn built on the same foundations and each had forty trestle bents about 10 feet wide on centers at the top, with colums battered 1 : 6 transversely, and about 103 feet apart on centers at the bottom of the tallest bent. They were braced together in pairs to make towers 38½ feet long and 61 feet apart. The old viaduct had lattice girder spans 6 feet deep, was proportioned for an engine load of 161,340 pounds and weighed about 3,500,000 pounds. In the new viaduct the towers have X-bracing in the longitudinal planes and horizontal braces but no diagonals in the transverse vertical planes. There are two lines of longitudinal plate girders 9 feet apart, those in the tower spans being 5 feet deep and those in the connecting spans 6 feet deep. The viaduct weighs 6,700,000 pounds and is proportioned for two 247,000-pound locomotives, a train load of 4,000 pounds per lineal foot and a track weighing 600 pounds per lineal foot. It was erected from both ends simultaneously by movable combination spans 208 feet long, which extended over one tower and two adjacent spans and from which the members of the old viaduct and the new one were hoisted and lowered.

The double-track and roadway Gokteik viaduct for the Burmah Railways Company is about 400 miles from Rangoon, and was fully illustrated in The Engineering Record of January 12 and 26, 1901. It is 2,260 feet long, 320 feet in maximum height, and weighs about 9,700,000 pounds. There are thirty-two trestle bents with the posts 24½ feet apart on centers at the top and battered transversely 5 : 24 so as to make them over 156 feet apart at the piers for the tallest bent. Fourteen pairs of trestles are braced together to make towers 40 feet long and 60 or 120 feet apart. Three bents are braced together to make a double tower in the deepest part of the valley, and there is one single bent at the end of the viaduct. The towers are built in stories about 40 feet high, and are braced in transverse and longitudinal planes with horizontal struts and stiff diagonals in every panel. All the connections, like those of the Kinzua viaduct, are riveted solid. There will eventually be four lines of main longitudinal girders, only enough of which for one track and the roadway are yet in place. For the 40-foot and 60-foot spans respectively these are plate girders 3½ feet and 5 feet deep, and for the 120-foot spans they are lattice girders about 12 feet deep. The roadway platform is decked over solid with steel plates, and the viaduct is proportioned for a load of 1,712 pounds per lineal foot on each track. It was erected from one end by a trussed steel pin-connected traveler, over 220 feet long and 60 feet high. The trolley hoists moved on the 166-foot overhanging arm and handled the viaduct members which were delivered to the rear of the traveler on top of the finished structure.

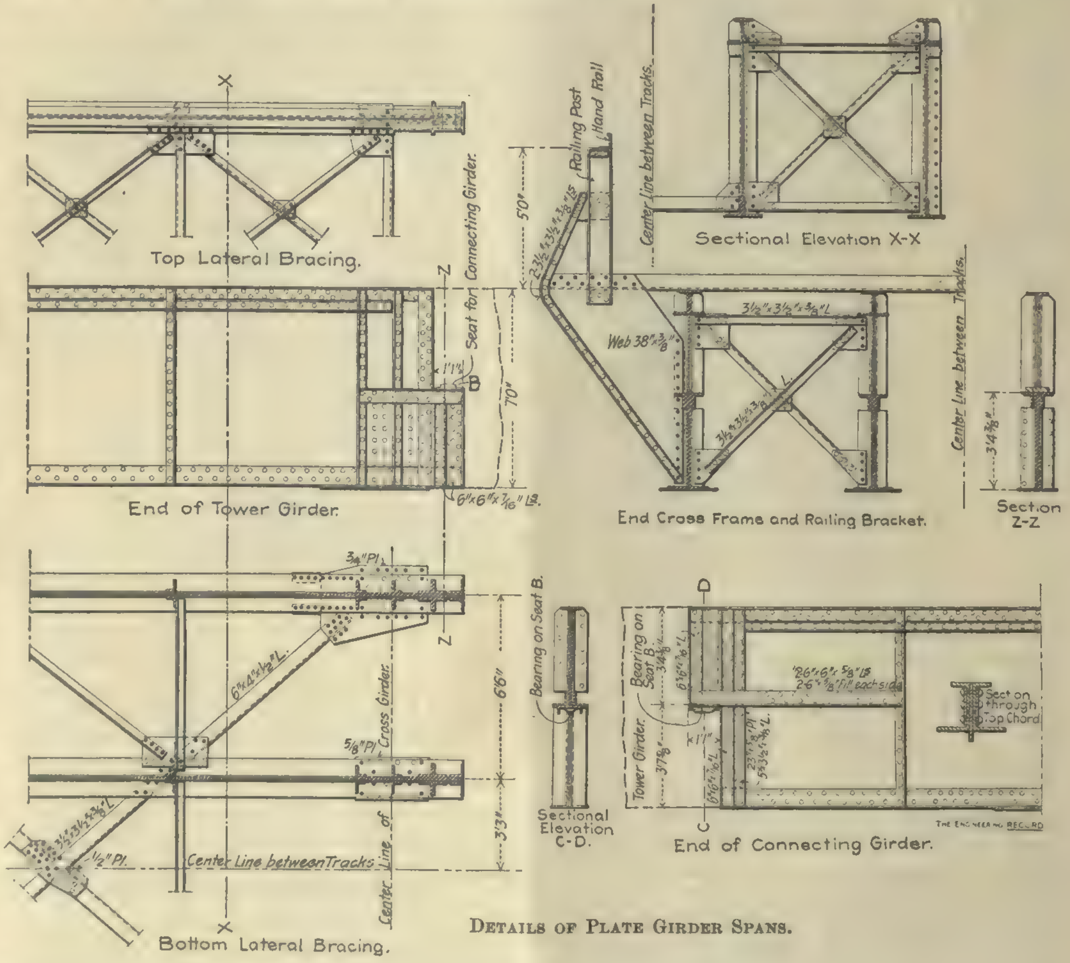
In designing the Boone viaduct such dimensions were chosen for the towers as would assure a base large enough for the resultants of all applied external forces to fall within it. This prevents any uplift at the feet of the columns either from brake action or wind pressure. The lengths of spans are such that the uniform depth of longitudinal girders is a mean between the greater theoretical economic depth of the long girders and the smaller one of the short girders. The 75-foot spans are proportioned for live and dead loads of 6,100 pounds and 1,400 pounds, respectively per lineal foot, and the 45-foot spans for 7,600 pounds and 1,250 pounds per lineal foot. Soft steel was used throughout, and it and the workmanship was as required by the specifications of the Chicago & Northwestern Railway Company. The trestle columns are made up of three I-beams riveted together with four lines of rivets to form an H-shaped cross-section and spliced in lengths of from 30 to 42 feet with web and flange plates. Between splices the flanges on each side of the column are stayed together by two 22-inch batten plates, with double rows of rivets, but they are not latticed together. The flange splice plates extend to form gusset connection plates for the field rivets of the diagonal braces in the transverse vertical planes. The diagonal tower braces in longitudinal planes are field riveted to jaw plates which are bent around the flanges of the columns and shop-riveted to their webs.

Transverse plate girders 4 feet deep are seated on side bracket shelves near the tops of the trestle columns, and are riveted across both the column flanges on both sides, thus making double girders on top of which the longitudinal girders are seated. Base plates are riveted to the foot of the columns and take bearing on cast-iron shoes 15½ inches high and 3½ feet square at the bottom. The columns are secured to the shoes by four bolts which, on one side of the tower, pass through close-fitting holes and retain it in a fixed position; on the other side of the tower these bolts pass through slotted holes which allow the column to slide transversely on a planed ⅝-inch phosphor-bronze plate which is there interposed between the base plate and the shoe.


21-Spans at 75'0", 18 Towers at 45'0" and 1-300'0" Span= 2685'0"
B
A
Expansion.
27'3"
Section A-B
The Engineering Record

General Elevation of the Boone Viaduct, Chicago & North Western Railway.

Each shoe is anchored to the coping by four 1¼-inch wedge bolts nearly 3 feet long, and has in the center a long 1½-inch vertical bolt which engages a heavy bearing-washer built into the concrete footing under the pier masonry. This bolt has an upper nut bearing on a washer in the bottom of a hole countersunk below the top of the shoe, as shown in the sectional detail, so as to clear the base plate of the column. There are no horizontal struts in the towers except one on each side at the bottom. These and the X-braces are made of pairs of channels, latticed. Four longitudinal plate girders 7 feet deep and 6½ feet apart on centers, are seated across the top flanges of the transverse girders in each tower. Each girder has a 7/16-inch web and two 8 x 8 x ⅝-inch bottom chord angles 50 feet long, which overhang the outsides of the transverse girders about 1 1/3 feet clear at each end. The top flange is composed of two 6 x 4 x ⅜-inch angles 47 feet 10 inches long, with their horizontal flanges up, and two 6 x 3½ x ⅜-inch angles, about 45 feet long, with their horizontal flanges down. The upper half of the web is notched out at the ends of the 6 x 4-inch angles and the lower part is reinforced by a pair of ⅝-inch plates. Five pairs of vertical stiffener angles are riveted on to it, and across them a pair of horizontal shelf angles make a seat, at the outer end of which there is a beveled steel casting to receive the bearing of the drop-ended connecting girders.



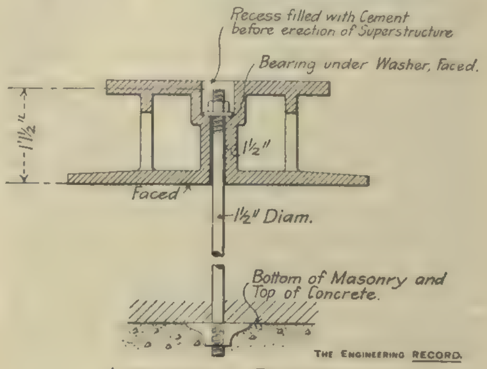
Details of Plate Girder Spans.

The girders are divided into intermediate panels about 7 feet long by pairs of 5 x 3½ x ⅜-inch vertical web stiffener angles which are milled to end bearings on the horizontal flanges of the 8 x 8-inch and the 5 x 3½-inch flange angles. These stiffeners are continued to the upper edge of the girder by short pieces about 9¼ inches long which are lined in with them and fitted in between the 6 x 3½-inch and 6 x 4-inch flange angles. The girders of each pair are braced together by transverse struts and X-bracing of single angles in the vertical transverse planes at each panel point, and by zig-zag lateral bracing in every panel in the planes of the top and bottom flanges.

The inside girder of one pair is braced to the inside girder of the other pair by two panels of X-brace angles and five transverse angles at the intermediate panel points in the plane of the bottom flanges. At each end of the span a 6 x 4-inch angle, 29 feet 4½ inches long, is riveted across the top flanges and to the upper edge of a solid-web knee brace on the outside of each outer girder. This knee brace receives the 10-inch channel vertical post for the hand rail, which consists of a 10-inch horizontal channel, with the flanges turned down, and a bulb angle riveted to the upper side of the web, as shown in cross-section.

The 75-foot spans are similar to the 45-foot spans, except in the details of the end bearings of the girders, the dimensions of materials and the sections of the flanges. The 8 x 8 x ⅝-inch lower flange angles are 69 feet 11 inches long, and are reinforced by two 18 x ½-inch cover plates, one of them 50 feet 6 inches long and the other 36 feet 5 inches long. The top flange has two 6 x 4 x ⅝-inch angles, 72 feet 1 inch long, two 7 x 3½ x ⅝-inch angles 68 feet 2½ inches long, and two 8¼ x 9/16-inch side plates 39 feet 11 inches long, which cover the middle parts of the vertical flanges of the top flange angles. The lower part of the ½-inch web is notched out at both ends of the girder even with the ends of the bottom flange angles, and the overhanging upper ends are reinforced with four pairs of vertical web stiffener angles. The under side of the drop end has a forged steel bearing to be seated on the cantilever end of the lower girder. Vertical flanges are riveted on all four sides of each bearing plate to lock it over its support and prevent lateral or longitudinal displacement.

In the spring of 1899 field work was commenced with three gasolene engines operating drills with which test holes were made to explore the site for a considerable width on both sides of the center line of the viaduct from end to end. Clay, shales, sandstone, fire clay and bituminous coal were encountered. At the ends of the viaduct the foundation pits were dug about 14 feet deep in a very thick deposit of hard blue and yellow clay, and concrete footings from 4 to 6 feet deep were laid in them of such dimensions that the pier load above them would not cause a foundation pressure greater than 4,000 pounds per square foot. Nearer the river where the clay stratum was not so deep the excavations were carried through it and the footings generally laid on black shale on which a pressure of 6,000 pounds per square foot was allowed.


Recess filled with Cement before erection of Superstructure
Bearing under Washer, Faced.
1'1½"
1½"
Faced
1½" Diam.
Bottom of Masonry and Top of Concrete.
The Engineering Record

Anchorage of Pedestal.

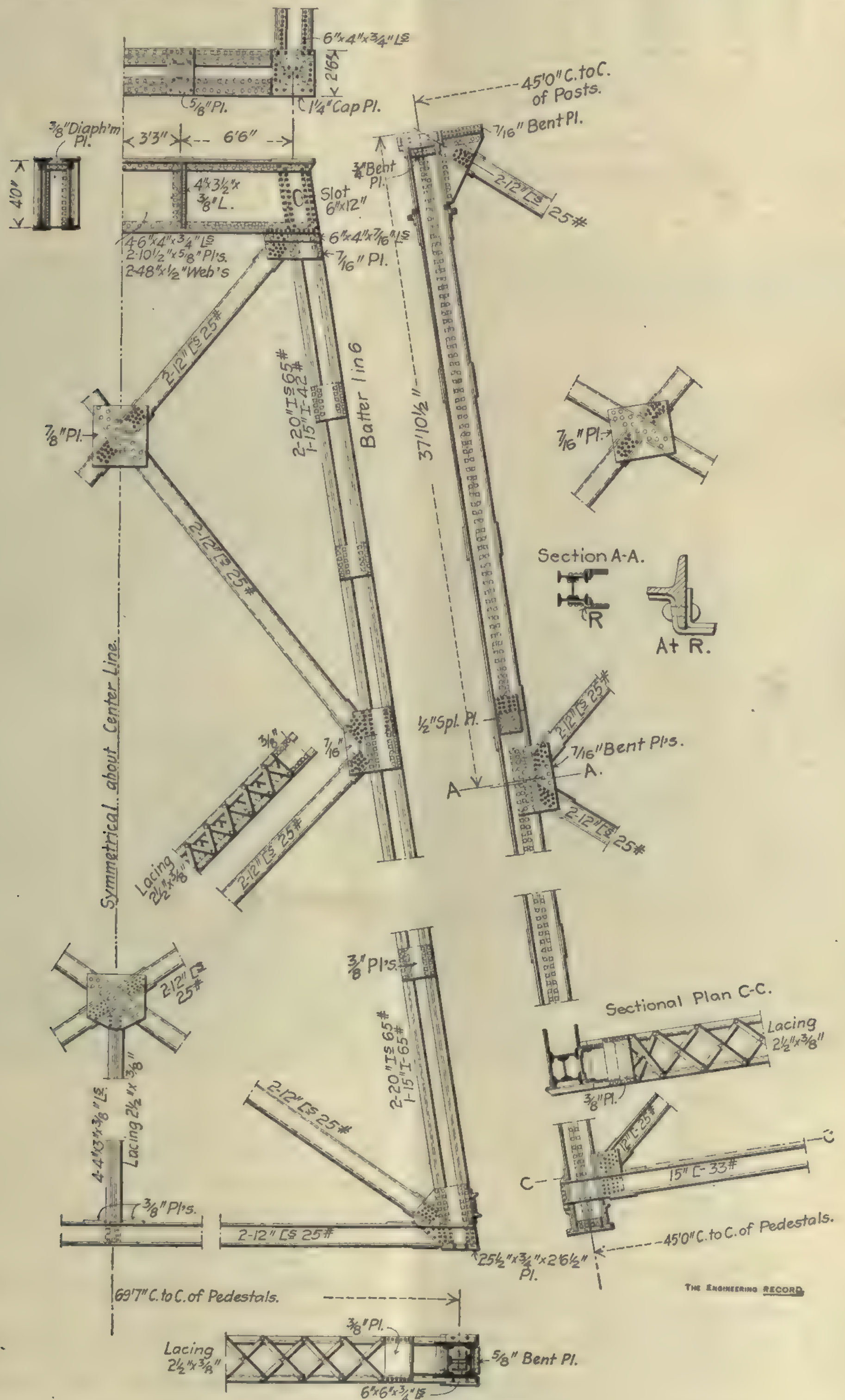
Beyond these piers piles were driven in a deep deposit of sand, cut off at water level, capped with concrete, and loaded up to 30,000 pounds each. Square piers of Mankato limestone, laid in Portland cement mortar were built on all the concrete footings. Each side was battered 1 : 6 to a top width of 5 feet and pedestal blocks of Ableman's sandstone were set on top of the coping and secured to it by anchor bolts through the column bases. The abutments have 50 x 30-foot rectangular bases and battered faces, reinforced, on the front side with three wide wedge-shaped buttresses. When first built they rose 30 or 40 feet above the surface of the ground, but afterward the embankment was filled in around them up to the coping in front.

The 300-foot channel span is supported at each end on a wedge-shaped steel tower, with longitudinal and transverse center lengths of about

27¼ feet and 43¼ feet at the base. Each of the four inclined columns is supported by a separate cylindrical pier, 10 feet in diameter, which is founded on sandstone from 42 to 46 feet below water level. The piers are of concrete enclosed in a steel shell ⅝ inch thick, which was built in successive sections 5 feet high. The lower section of each is 8 feet high with a steel diaphragm 1 foot below the upper edge to form the roof of a working chamber when the section was sunk as a pneumatic caisson. A 3-foot steel air shaft was built up from the middle of the diaphragm and the space between it and the steel shell was filled with concrete to sink the caisson. The upper sections of the 10-foot shell thus served as a cofferdam, and with the sections of the air shaft were successively added as the caisson sunk, so as to keep the upper edge always above water level.

A Moran air lock was used on top of the air shaft and was shifted from pier to pier when the shafts were extended. The excavated material was hoisted from the working chambers in buckets and the caissons were sunk as much as 16 feet a day through sand and an average of 2 feet a day through hard shale. The caisson work was commenced February 7, 1900, and the piers were all completed and the coping set June 6. A temporary service bridge on pile and trestle bents was carried across the river, about 25 feet above water level, alongside the permanent structure, and served for the distribution of materials. A power plant with two 60-horsepower boilers, pumps, electric light dynamo and two Ingersoll-Sergeant air-compressors was established on one side of the river and the pipes and wires were carried across to the opposite pier under the roadway of the service bridge.

The viaduct was designed and constructed under the direction of Mr. E. C. Carter, chief engineer, and Mr. W. H. Finley, principal assistant engineer of the Chicago & North Western Railway Company, and Mr. G. S. Morison consulting engineer, and was built by the Chicago Branch of the American Bridge Company. This description has been prepared from the official blue prints and from an article by Mr. W. C. Armstrong in "The Iowa Engineer."



DETAILS OF VIADUCT TOWER

An Interesting Old Suspension Bridge.

The highway suspension bridge across the Guyan River at Guyandotte, W. Va., was built about 53 years ago, and its design includes some quaint details very different from present standards of construction. It has a span of about 450 feet and an 18-foot roadway, which is suspended from four main cables about 3 inches in diameter, passing over stone towers. Each cable is made of straight charcoal-iron wires about ⅛ inch in diameter, laid continuously around U-shaped shoes similar to those now used. At each splice, the ends of the wires were flattened like the shanks of a fish-hook, and after being lapped past each other were tightly wound with fine wire, which made a strong joint. The cables were laid on shore and then carried across the river on men's shoulders and erected on falsework built for the purpose. The cable shoes engage flat pins about 3 x 6 inches in cross-section, and were adjusted by driving several pairs of iron wedges, if necessary, between the pin and the end of the shoe. The pin engages two iron loops which in turn are pin-connected to a single eye-bar, and that is connected at the opposite end to two eye-bars, and so on, down into the masonry anchorage.

The top of each tower is capped by a flat cast-iron plate about 6½ feet square with vertical flanges enclosing the top of the masonry on each side. On the upper surface of the plate are two longitudinal flat ribs on which three transverse pins roll between projecting tranverse guard ribs front and back. The middle pin is 12 inches and the two outside pins are each 6 inches in diameter, and all of them have flanges at both ends. The two cables are flattened to a width of about 9 inches each at the towers, where they take bearing on these pins instead of on expansion saddles. The main cables are wrapped for lengths of about 3 inches a foot apart, and all their wires are clamped together with flange collars which have a horizontal bolt through the lower ends to receive the upper end of the suspender. The suspenders are ¾-inch wire ropes made like the main cables, of continuous straight wires wound around beckets at both ends. At the upper end there is a single becket engaging the bolt in the cable collar, but at the lower end the wires are divided into two equal strands, each of which is laid over a separate becket. These strands are separated to form a forked end which engages the eye of a vertical bolt with a nut on the lower end to support the floorbeam and provide vertical adjustment for it.

Some fighting was done around the bridge in the civil war, and many of the cable wires are flattened and marked where they were struck by bullets. The bridge was recently examined by Mr. S. A. Cooney, engineer of the bridge department of the John A. Roebling's Sons Company, which has repaired many similar suspension bridges in that section of the country, evidently designed and built by the same people and of the same materials. Mr. Cooney reported the bridge as safe and serviceable and in excellent preservation. There was no serious corrosion and the wires appeared to be the same as those of some of the other bridges mentioned which he had tested after many years service and found to have a breaking strength of 88,000 pounds or over per square inch and to develop 95 per cent. of the strength of the wire in the splice.

Wood Block Pavement on 6 inches of concrete and 1 inch of sand will be laid on the leading street of Springfield, Mass., at a contract price of $2.85. The blocks will be treated by the creo-resinate preserving process at the plant of the United States Wood Preserving Company, described in The Engineering Record of September 2, 1900.

Some Tests of Very Large Water Meters.

About two years ago a brief note was published in The Engineering Record concerning a unique meter-testing plant built by the National Meter Company at its large manufacturing establishment in Brooklyn. This plant was designed by Mr. Lewis H. Nash and Mr. John H. Norris of the staff of the company to afford means for making accurate tests of meters up to 48 inches in size. The most important test made with this apparatus was on one 20-inch and two 36-inch Gem meters for the Jersey City water-works. It was superintended by Mr. Arthur S. Tuttle, as the representative of the city, and Mr. C. D. Ward, who was associated with the engineers of the company. Reports from both these engineers have recently been published by the company, but the data are so important that some of them are reproduced here; it is probable that the company will send a copy of the full report to applicants interested in such investigations.

The testing plant is a masonry basin about 24 by 40 feet in plan, divided by interior walls so that the water may be made to flow continuously around its sides. Meters of such large size as even the smallest, 20-inch, tested in these experiments would use far more water than could be allowed to run to waste, so the principle of the plant is to admit to the basin enough water to fill it partially and then put this in continuous circulation. The water is raised at one point by a centrifugal pump to an elevation which will give sufficient head to force the desired amount through the meter. It passes from the pump through a screen into a small forebay and thence flows into and through the meter to be tested. From the meter it is discharged into a small chamber where it is deflected to the right and flows about 8 feet and is again deflected to the right. It then enters the main weir chamber, which is 33 feet long, 12 feet wide and 6 feet deep below the level of the weir crest. The water passing over the weir falls into the pump well and is again elevated so as to pass over the same route. The depth of water on the weir is measured by a hook gauge and by an automatic float which keeps a record on a sheet of paper fastened on a drum rotated by clockwork. In order to prevent eddies baffle boards are placed in the main weir chamber.

The weir crest is of cast iron with a planed edge ¼ inch thick, with the ends vertical and of the same thickness. In testing the two 36-inch meters the weir was 7.993 feet long, which left a distance of 2 feet between each end and the adjacent side of the chamber. The weir for the 20-inch meter was 3.5 feet long, giving 4.25 feet from each end to the wall. A piezometer pipe 2 inches in diameter was placed 6¼ feet back from the weir and 6 inches above the floor of the chamber; it was perforated on the top with eighteen 3/16-inch holes about 6 inches apart and was connected with the measuring boxes of the hook and automatic gauges by 24 feet of pipe having six right-angle bends.

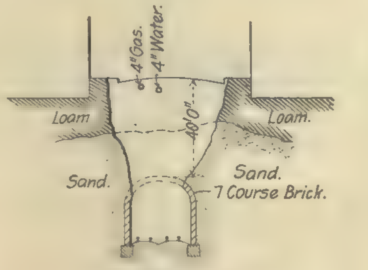
On account of the low range of head which it was possible to secure on the weir and because the latter did not agree in dimensions with any of those used in the Francis experiments, the Hamilton Smith formula was used for the weir computations. Readings of the hook gauge were taken every thirty seconds, and these results were used in calculating the discharge over the weir. Each meter was tested with different speeds, ranging from that due to a head on the weir of about 0.3 foot to one of about 0.7 foot. The records of the automatic gauge agreed closely with those of the hook gauge.

The results of the experiments are given in the accompanying table.

Summary of Tests of Large Meters.

Meter.	Duration, minutes.	Head on weir, ft.	Gallons measured. Meter.	Gallons measured. Weir.	Meter error, p.c.		Veloc. in pipe, ft.
36-in., A	60	0.3277	134,170	134,500	0.25	+	0.71
"	60	0.4624	[illegible]	222,000	0.3	—	1.17
"	60	0.6043	330,940	328,100	0.9	—	1.72
"	60	0.7069	417,960	413,900	1.0	—	2.17
36-in., B	50	0.3452	120,660	121,300	0.5	+	0.77
"	50	0.4787	195,300	196,700	0.7	+	1.24
"	52	0.6147	294,190	296,600	0.8	+	1.80
"	51	0.7036	352,770	355,100	0.7	+	2.19
"	[illegible]	0.3940	117,270	117,500	0.2	+	0.93
"	52	0.6889	348,490	349,800	0.4	+	2.12
"	25	0.5670	125,460	125,700	0.2	+	1.58
20-in.	50	0.3212	47,240	47,900	1.4	+	0.98
"	50	0.7056	150,090	150,890	0.5	+	3.08
"	[illegible]	0.5958	117,070	117,620	0.5	+	2.40
"	50	0.5005	90,570	91,210	0.7	+	1.86
"	30	0.4041	39,670	40,150	1.2	+	1.37

The Pennsylvania Railroad Tunnel at Baltimore, which caved in for a short distance on June 29, is a double-track structure about thirty years old. The accompanying diagram of the location of the break has been furnished by Mr. Alfred M. Quick, water engineer at Baltimore, who states that it was prepared by one of his men from rather incomplete data. The tunnel was built from the plans of Charles P. Manning. Mr. John C. Wrenshall, who was his assistant engineer, has stated that during construction quicksand was encountered about where the recent accident occurred and part of the green masonry caved in. The theory that the accident a fortnight ago was caused by a broken water main seems untenable when the position of the single little pipe in the street is considered. It is probable that the brick arch had been slowly failing for some time, for there are statements that sand had been found on top of cars after passing through the tunnel. At the time of the accident the engine of a passenger train had just been derailed by striking some soft mass on the track, probably sand from cracks in the arch above. The impact of a heavy train stopped suddenly in this way below the weakened arch doubtless jarred the masonry enough to let it fall.



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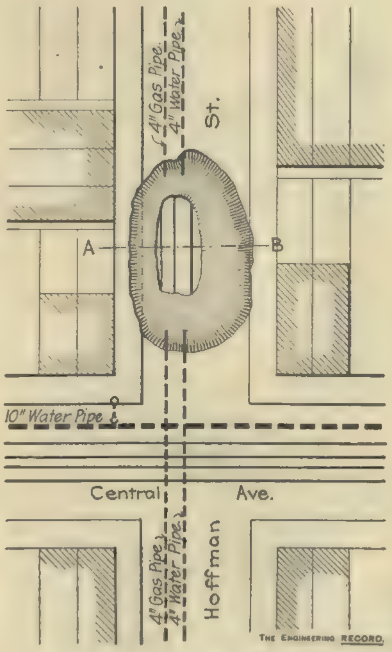


Sketch of Tunnel Accident.

The Cultural Value of Engineering Education.

The Presidential Address of Prof. F. O. Marvin before the Society for the Promotion of Engineering Education on June 29.

At the very outset of this discussion is encountered a great difficulty. What is culture? The writer has been asking this of his friends. An answer has been sought for in the printed page where is recorded the best thought of the best minds. Great thoughts and lofty ideals have been disclosed, but nowhere has been found a satisfactory definition, a phrase or paragraph that succinctly and clearly sets forth the heart of the matter. People often recognize, appreciate and reverence its possession without being able to fully analyze and set down its elements. There is something subtile and emotional about it that eludes a close pursuit. The reason for this perhaps lies in its essential individual quality, in its being the result of a personal life, developed, it is true, on lines similar to those used in other lives, yet including something that pertains exclusively to a human unit that is different from all other units. Nevertheless, there seem to be certain fundamental qualities which must be possessed before a man can be classed with cultured people, qualities which are only acquired after a considerable experience in life, but which are influenced greatly by the years of student training, and therefore fit subjects for discussion here. Far be it from the purpose of this paper to attempt a definition of culture or a setting forth of its elements in any completeness; rather the emphasizing of some things that relate to it, especially with reference to the education of young engineers.

First: The man of culture must be a thinking and reflecting being. There must be not only the ability but the habit, and this is no easy thing to acquire. Modern American life is full of hurry, full of affairs that demand instant attention, and one matter follows another with rapid succession. We get news from Pekin to-day, from Havana to-morrow and from the Philippines within a few hours. We build railways, erect bridges and fill large orders for locomotives for foreign shipment in such short space of time as to astonish the world. Men seek short cuts to fortune. In the popular opinion the men who act quickly, the men of decision, are those who succeed. But there is a danger here, for, back of the action, behind the sharp decision, must lie a mature judgment, and how else is this to be formed except as a result of deliberate reflection. However quickly one may reach a conclusion its correctness or faultiness will depend, not on intuition but on the degree of true comprehension. The decisive act which is also right rests on a process of thinking and judging that has been long fostered, until it has become a habit, until there are established certain standards by which things are to be measured.

The early steps of this training are necessarily slow, and we, as teachers of engineers, must recognize this and not yield to the temptation to crowd our students over too much ground on the one hand, or on the other to lead them through short cuts across country by empirical paths that may give them ease and quickness of travel but little or no reason why the path is chosen. Let them go the long road. I do not by any means wish our teaching to be non-practical—rather more practical in the best sense; but first, last and all the time let students be trained to do their own thinking and to form their own judgments; to test the statements of others by the workings of their own mental processes.

Second: There is another element of culture that comes in here—an ethical one—that of forming right judgments. Men may have the appearance of culture without its true spirit, which is essentially honest. This is especially important as culture seeks to make a man's life satisfactory to himself when measured by his own conscience as well as successful in the field of affairs. So his standards must be based on sound principles of right and wrong; and it is only when these are so placed that his life becomes one of freedom—fredom from the bondage that wrong thinking and acting always bring. A class room is no place to preach a sermon, but there can be there imparted a respect for truth and perfect honesty. A teacher's attitude should always be open and frank—that of a sincere seeker after truth. He should never dodge an honest question, and be ever ready to say "I do not know" if he does not. There is an incalculable power that "makes for righteousness," and the happiness of the after life of the student in the true teacher's conduct of even such a material subject as mechanics.

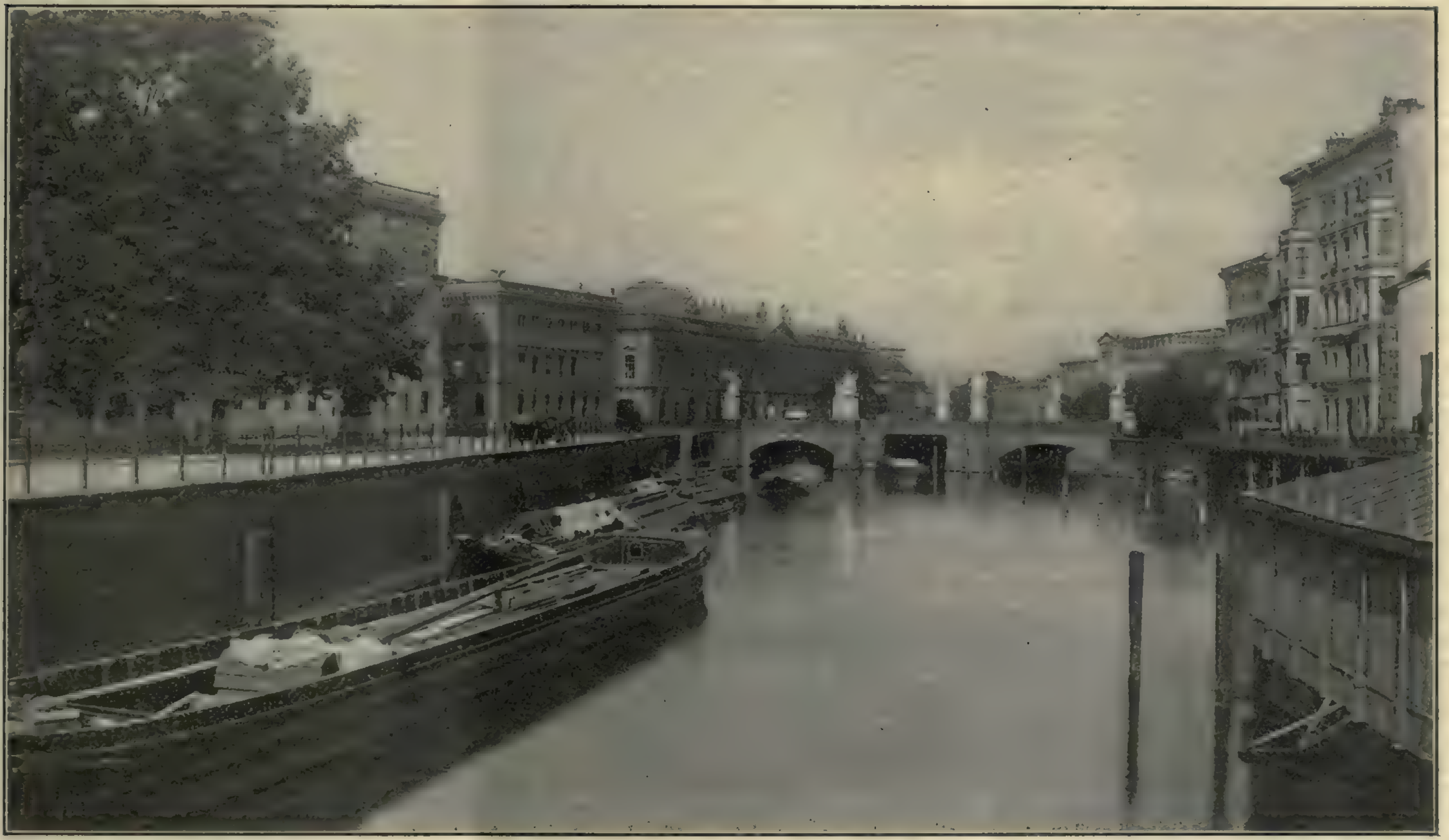
Back behind the subject, with its subdivisions, its formulae and rules, lies something larger—a sort of spiritual quality that binds it to all other subjects, to the universe as a whole, and makes it a part of the truth of God's realm. The student that gets hold of this significance learns much more than facility in the manipulations of processes or the application of principles. He gets something that makes his life richer and better and his mastery of the subject more complete.

Third: There can be no true culture for a man that does not work, that does not put his cultivated powers to some useful service; and here there must be such degree of mastery over the chosen profession or business as will result in a special skill and dexterity—a doing of some one thing better than others can do it. A man expresses himself through his work, and whether he will or no he thus discloses to all who know him his own peculiar qualities. It is this intensity of application, this concentration of purpose and directness of aim that gets the world's work done. Here in early years the engineering student has the advantage of the student in arts. Study for knowledge's sake may be stimulating to the few, but for the many there is needed the goal of a special calling to secure the close application that results in ability to concentrate one's energy to the attainment of a certain end. But here again comes a danger, that of too early or over-specialization, and the following of short cuts to professional life that are advocated by some who, in the eyes of the world, as well as in their own, have been eminently successful as specialists. Whether these can be called men of culture of the highest attainments is another matter. The extreme specialist may be supreme in his own line of details but may fail when there comes up a question involving the relation of his speciality to other things. Even within his own domain his conclusions will be modified by his general knowledge and experience. All one-sided people, whether they be linguists or naturalists, poets or merchants, preachers or engineers, are quite liable to the forming of erroneous judgments. To the few geniuses, whose capacities and powers seem to be abnormally developed, though of limited scope, much is forgiven; but for the average man of the day there is demanded an ability to form good and wise conclusions.

Fourth: In order to form those that are appropriate and correct there is needed then breadth of view—a quality that has been expressed by the word poise. A man of poise, of even balance, will see things in their right relations and due proportions; he will weigh matters, giving to each component part its just degree of importance. He will the better understand the motives that underlie other men's actions and the more readily use them to suit his own purpose. He will be more apt to rightly interpret the new movements in the world of thought or action, and can seize opportunity for a personal advantage or a larger sphere of service before others see that there is such.

This demands a considerable range of knowledge. Not the close mastery of many lines in all their details, but a fair degree of familiarity with their general phenomena and principles; and there is scarcely any field that will not contribute something to the result. It is admitted at once that the average man is of limited capacity and unable to grasp a comprehension of all knowledge that may influence his life and work; what is pleaded for is such degree of breadth as may be needed to make one of great efficiency in his chosen profession and of most value to himself, not only in a financial way but also in the sense of gaining a joyful recognition of the worth of developing all the powers that one has.

The value of mathematics and the physical



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXIV, BERLIN, THE SCHLOSS BRIDGE.
This structure, designed by Schinkel in 1822, shows a happier treatment of piers and arches than any other Berlin example, but here again the statuary were better omitted. The drawbridge is no longer used, as all barges on Berlin waters have removable or hinged masts.

sciences with their applications to technical things needs no discussion here, for these are the engineer's tools; but it is a fair question whether in our desire to graduate students who can be early useful we do not place too much stress on technical things to the exclusion of others that give greater breadth of training. We must not forget that we are educating men for a life—that we must look forward to the time when these young people will be fifty years old, and at the period of their maximum productiveness as workers and of maximum value in society and as citizens.

Engineers have to deal with other things beside materials and physical laws; they must manage men and matters of finance. If they are to rightly influence those whose capital they are employed to expend they must be able to meet them socially and intellectually, to discuss intelligently matters outside of the pale of strictly professional life. Evidence of professional ability and skill is of course first demanded, but breadth of culture creates an added confidence in the wisdom of the conclusions reached and the advice given.

Heretofore much of our engineering work has been concerned with the opening and developing of new country or new business and industrial enterprises. So engineers have found their work away from contact with men. But engineering practice is changing as conditions become older and more settled, and more and more practitioners find their work in communities and busy centers of trade, where they are constantly thrown into close contact with strong and cultured men. Present engineering courses do little to prepare a man for this thorough instruction concerning human nature and human relations. Some thing of history, economics and sociology should be included.

Fifth: It is not sufficient to form correct judgments only; there must be added a skillful and effective presentation of them in well-chosen and fitting English. The ability to do this involves more than training in the writing of compositions, themes, forensics and reports. The cultured man should have a taste for reading the best that has been written in his mother tongue, and for several reasons: The great thoughts of great minds are stimulating and broadening to his own mind; he thereby absorbs a knowledge of words and their shades of meaning; he gains an appreciation of style and insensibly better knows how to form his own; and not least by any means he makes of his books friends that are life-long, that cheer and console him under all happenings, adding much to his internal resources for happiness.

The time given to English in our courses is not enough to properly train students in its use and at the same time open the doors to our best literature. It may be said that all of this English work should be done in the preparatory school, and it is probably true that the character and quality of the high-school English is better to-day than it has been heretofore. Yet it seems to me that engineering students should have some training of a college grade along the line of literature.

Sixth: To the writer's mind there is another element of culture that should enter into an engineer's training, viz; an appreciation for beauty. As he has said at another time, the engineer is a designer, and it is important that he should embody his design in artistic form if he is to fulfill his whole mission and please and gratify others by the perfection of his work. The engineering student devotes a good share of his time to the drawing board, and much can be done here toward the cultivation of this quality by an instructor who possesses it, without lessening at all the amount or force of the technical exercises for which the process is primarily used. There should be, however, something further by way of giving instruction in elementary aesthetics and by opening the student's eyes to what is beautiful in nature.

Seventh: The possession of agreeable manners and tact is another evidence of culture. Not merely the conventional bearing of polite society, though this has its value. This alone is but a husk which must cover the real kernel —refined and gentle feeling; and such feeling is the result of moral and intellectual convictions. Manners then, are not to be taught from a text or by lecture; they rather follow as a consequence from the whole course of training, and are crude or refined, just as the character of the instruction makes them. The teacher's personality has very much to do with this matter. If he is of coarse grain, of domineering or selfish disposition, his influence will not tend toward the production of true gentlemen.

And now for the real question—does engineering education tend to produce culture? According to old standards, when men limited culture chiefly to knowledge of language, literature and philosophy, the reply would be in the negative. However, standards are not the thing itself, only methods of measurement; moreover, standards change. Science has modified and is still changing the ideas of culture that men hold and this evolution makes it all the more difficult to find a common ground upon which all can stand when considering things concerning it. This much is clear, however, that no one existing course of educational training has a monopoly of cultural methods; nor will the completion of any college course necessarily secure its attainment because of its personal quality. Further, culture is the result of a life, and the most that can be expected of a college course is to open the student's eyes to its real worth, to start them rightly with certain leanings and aptitudes and furnish them with the means of a continuous growth toward its maturity.

It is maintained that an engineering course can tend in this direction, and that in some of our best colleges, under the instruction of people themselves cultured, it does so tend to-day. Our best engineering courses are stiffer and more exacting both as to time and effort than those in the college of arts, and the resulting acquisition of mental power and the ability to focus it proportionately greater.

The fixed course with its correlated parts and the certain definite end to be strived for are advantageous. The training is a continuous testing and trying of the truth of knowledge, and teaches the student to ask "why" and to reflect. He gains respect for nature's laws, and learns that his professional success will depend on his ability to work in harmony with her. He gathers a fair degree of knowledge of himself, his strong points as well as his limitations. He acquires a habit of thought and action that leads to further growth. He learns how to adapt means to an end, and within what limits of precision to work that it may be reached with economy. In short, he becomes a trained and educated man, cultured to a certain degree, but with limitations; just as the arts student who has specialized to a like degree in language and literature, with little of science training, becomes cultured, but also with limitations. Let the latter retain his A.B. On the other hand let it be recognized that the engineering B.S. stands for culture as well, of equal worth and value, though of different kind. As between the two specialists, I think the advantage lies with the engineering graduate as being on the whole, better equipped for a life of useful service and one that will possess the greater capacity for further development.

As one looks forward ten or twenty years and attempts from present tendencies to forecast the work and social standing of engineers, he must see that the profession will be doing a larger work and exerting a greater influence. Further, that an engineering training will be more and more recognized as the one best fitted to lead to positions of an executive nature in connection with industrial enterprises, and in the administration of public works. Everywhere will be demanded expert skill, sound judgment and broad views, primarily because these will be found to be economical. The entire class of men that a recent writer has called "mattoids," the ill-trained, narrow and egotistic, will be pushed out because their service is costly.

There are two tendencies in the present day engineering education that are, in my judgment, opposed to the desirable result. First, a tendency to crowd too much of the foundation work back upon the preparatory school, already overloaded. This Society's Committee on Entrance Requirements has advocated a standard which is high enough. Second, the allowing of technical subjects to crowd the fundamental general ones from the college course, in a vain attempt to do what from the very nature of the case cannot be done, to make an engineer by college study. The result of this in some institutions is further seen in a too early differentiation between the various engineering courses; so that, for instance, the civil student knows nothing of applied electricity and the electrical nothing of surveying, while neither has a chance to acquire a taste for literature.

The whole problem is an involved and complicated one, but there is a way out that must be found if the engineer is to fill the important place that awaits him. One part of the solution will be found probably in a refining of the methods of instruction, so that better results may be reached in the same time. In the end, however, the writer thinks that there must come a deeper sense that after all life is long, that it should be taken with more of deliberation, and that it is the end that is important, rather than the beginning. The feverish rush and haste to be earning must be replaced by a recognition of the real necessity for a full, rounded-out preparation if the largest and best service is to be given. Then the student will be glad to spend the one or two extra years in college that may be demanded. The wise student now will do this without its being required.

The Chief Justice of the writer's State has said: "The spirit of an age is that which makes finally for the happiness of the race. I have absolutely no fear as to the final end of things, nor as to the steps and incidents of evolutionary development. The aspirations, the great universal possessions of a people, can never move them to other ends than their happiness and good. The spirit of this age is commercial enterprise and conquest, and as to it I have an unspeakable conviction, that it will, as the spirits of other ages have done, work itself into forms and institutions of beauty and eternal worth to man."

It is largely through the engineer that this is to be done. The finest result requires the most skillful labor; the noblest workman demands the most fitting training. Herein lies our responsibility.

An Unusual Lighting Unit has recently been installed at the Tower plant of the Chester water-works, where it is used for lighting the works and the filter beds. It consists of a small high-speed steam engine and Pelton water-wheel mounted on the same shaft, and driving the dynamo by belt. It was furnished by Mr. Percy Pitman, Halifax, England.

Structural Details of the Manhattan Railway Power House, New York.

The main power house of the Manhattan Railway Company, New York, is a steel building designed to contain the plant and offices for the present development of 100,000 maximum horsepower, and intended to provide for a future extension of 50 per cent. of the original capacity. A general description of the building and its equipment was published in The Engineering Record of January 19, 1901, and the present article supplements that one by some typical details of the structural steel work.

The building is trapezoidal in plan, 204 1/3 feet wide, with sides 395 and 413 feet in length, outside. The entire area of the building was excavated to solid rock from 0 to 20 feet below the sloping street level, and covered, as illustrated in The Engineering Record of September 8, 1900, with a continuous thick bed of concrete which provides footings for all foundations. The framework of the building is constructed entirely of medium steel and is independent of the main walls. An interior longitudinal wall divides the building into a basement and one-story engine house 93½ feet wide inside, and a basement and three-story boiler house about 104 feet wide.

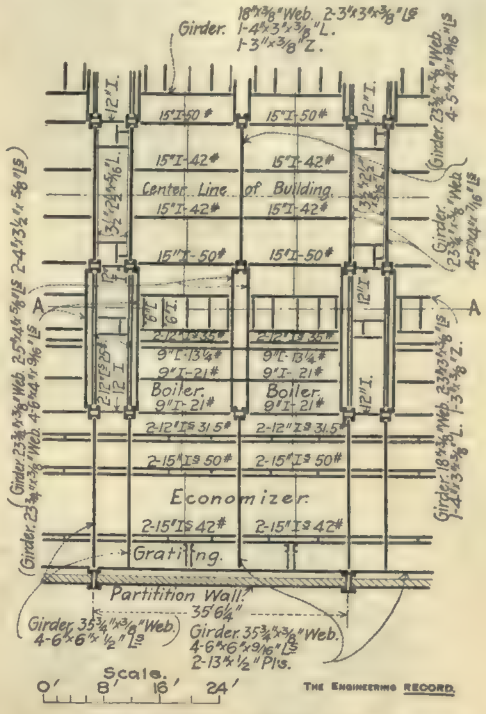
The building is 128½ feet high from basement floor to monitor skylight, and the engine house columns are made in single sections, 69 feet long. There are in all eight longitudinal rows of columns, one in each main wall, one interior row in the engine house, and four interior rows in the boiler house. The rows are from about 15 to 23 feet apart except in the engine house, where there are nearly 80 feet apart under the crane girders. The interior columns in the boiler house are in general about 15 feet apart in the rows, except in alternate panels, where, in order to provide separately for the boiler loads, there are double columns as close together as they can be conveniently set, and the wall columns are set in every third transverse row, so that the roof and wall are about 35½ feet apart.

All columns have closed rectangular sections, the interior ones being nearly square and built of two channels and two plates, minimum, and those in the wall having four angles and two webs wider than the thickness of the brickwork in which they are enclosed and two narrower flange cover plates. All the columns have cast-iron bases bedded in the concrete below the basement floor level. The boiler house columns are made in single-story lengths spliced a few inches above floor lines, with a horizontal diaphragm, and two flange cover plates. They have unit stresses up to 13,000 pounds maximum and carry total loads up to 1,000,000 pounds.

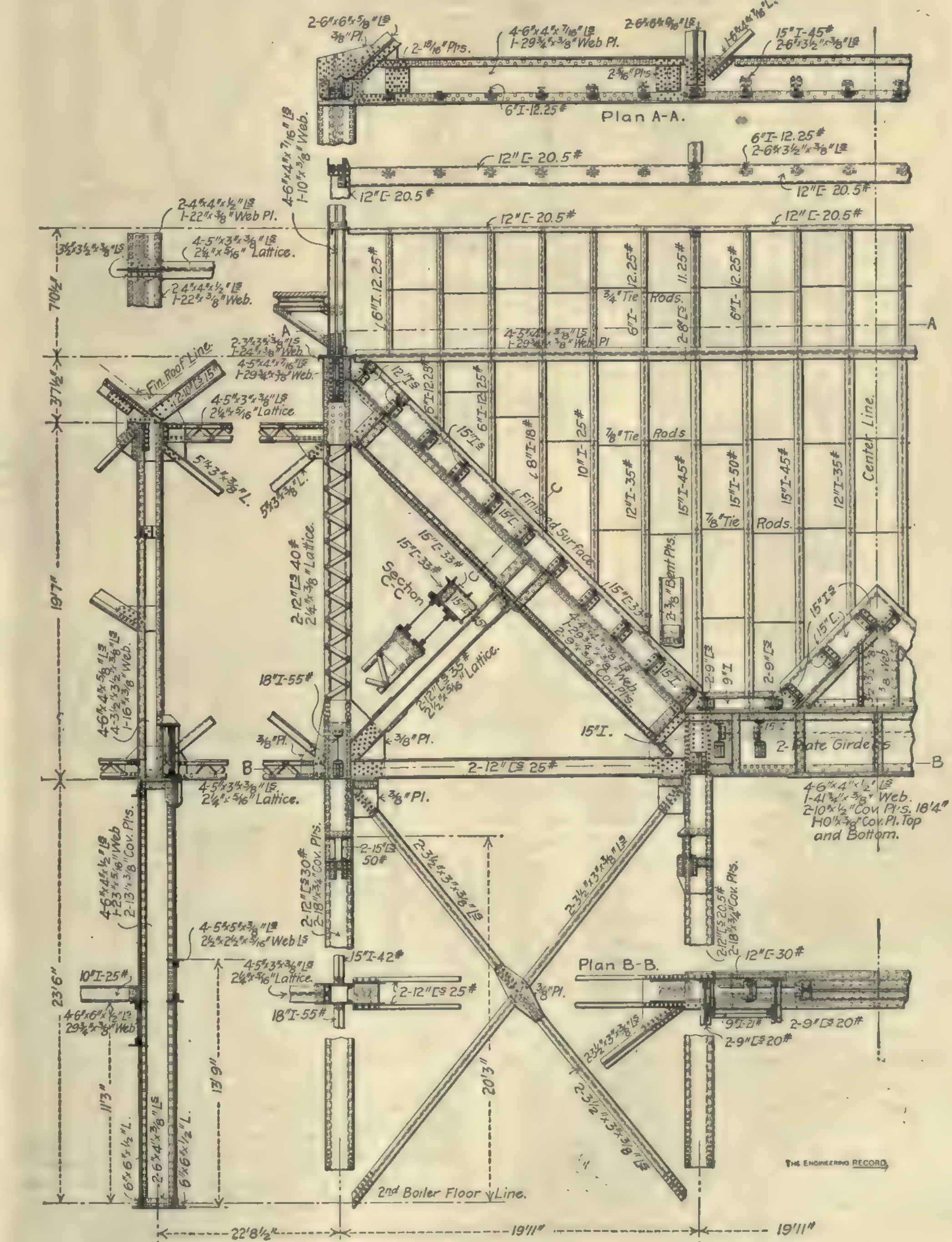
The boilers are arranged in batteries of two, in two longitudinal rows on two floors of the boiler house. The suspended weight of each pair of boilers is 304,000 pounds, and is supported by a group of six interior columns connected together and to the wall columns by beams and girders arranged as shown in the diagram of a portion of the second-floor beam plan. The open floor in the boiler house is calculated for a total load of 375 pounds per square foot and is constructed with 6-inch three-rib segmental terracotta arches of 6-foot span and 10-inch rise, levelled with 2 inches of cinder concrete and 2 inches of cement finish, and has endured test loads of 2,000 pounds per square foot without signs of failure. Under the boilers and economizers the floors are proportioned for the actual loads and are finished with hard-burned bricks laid flat in cement mortar. The solid floors terminate 4½ feet from the longitudinal walls and the remaining space is covered with a grating of steel bars, edgewise, to provide for ventilation.

The boiler house is divided into three similar sections by the two pairs of chimneys, which, up to about roof level, are octagonal brick towers 26½ feet wide. They were built before the steelwork was erected, and bearing stones were set in their faces to receive the floorbeams. After the beams were seated the brickwork was filled in solid around their webs. All longitudinal members of the floor and roof have slotted hole connections for sliding joints in transverse lines opposite each pair of chimneys, thus dividing the roof into three expansion sections. The four interior columns in each transverse row in the boiler house are X-braced together in two pairs, and in each pair there is a heavy solid portal bracing in the lower panels. In the side panels the 36-inch girders are seated on shelf angles on the columns, but in the middle panels the girder webs are riveted across the column flanges and clear the flange angles of the portal braces. The lower section of each wall column terminates at the second boiler floor and has a horizontal cap plate on which a narrower upper section of the column is seated.

The four rows of interior columns which support the two tiers of boilers are continued to the third story to carry the 15,000-ton coal pockets which are long troughs with inclined sides, A-shaped bottoms, and vertical ends, and have an approximately W-shaped cross-section.

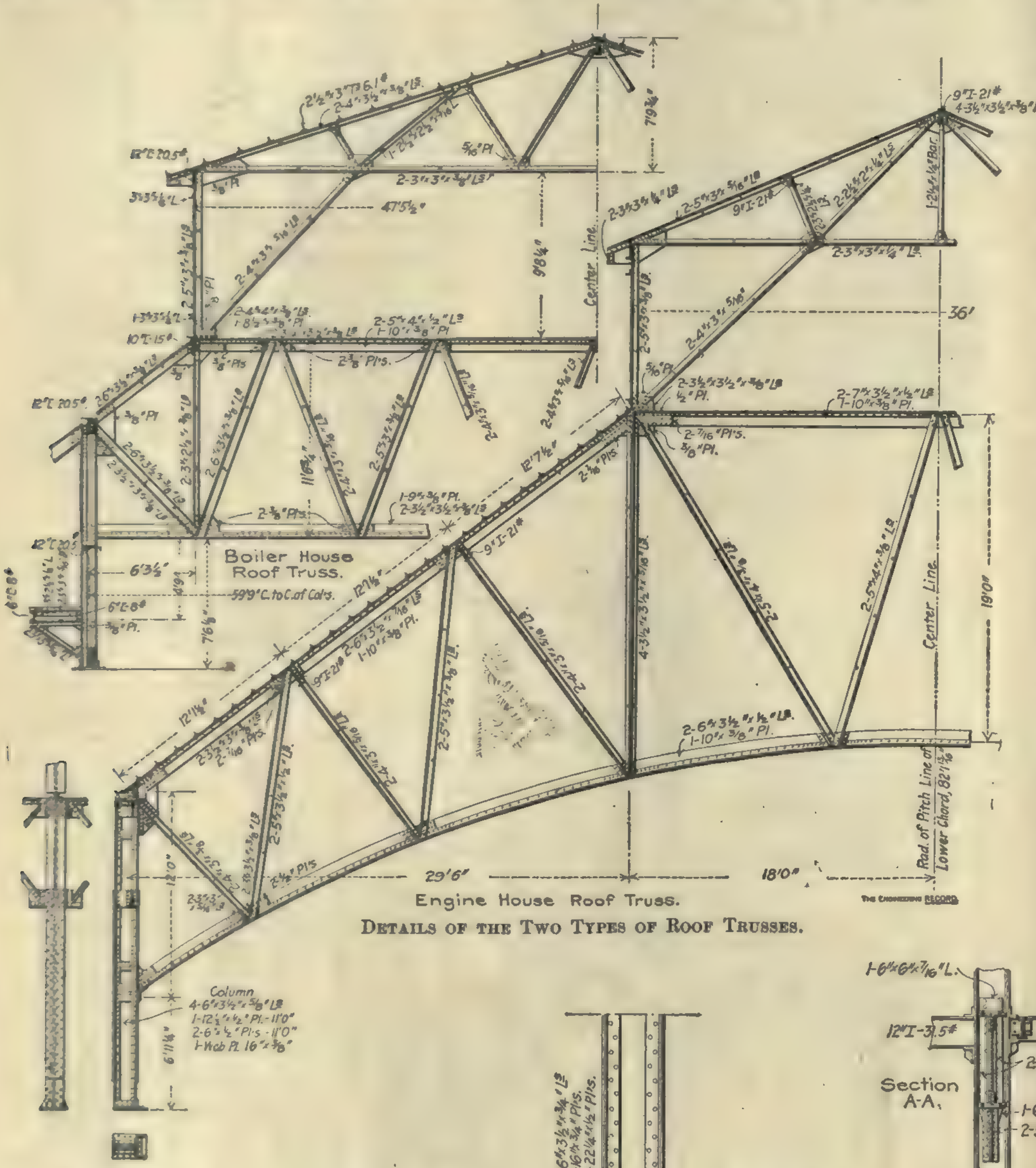


PART OF BOILER-HOUSE FLOOR.

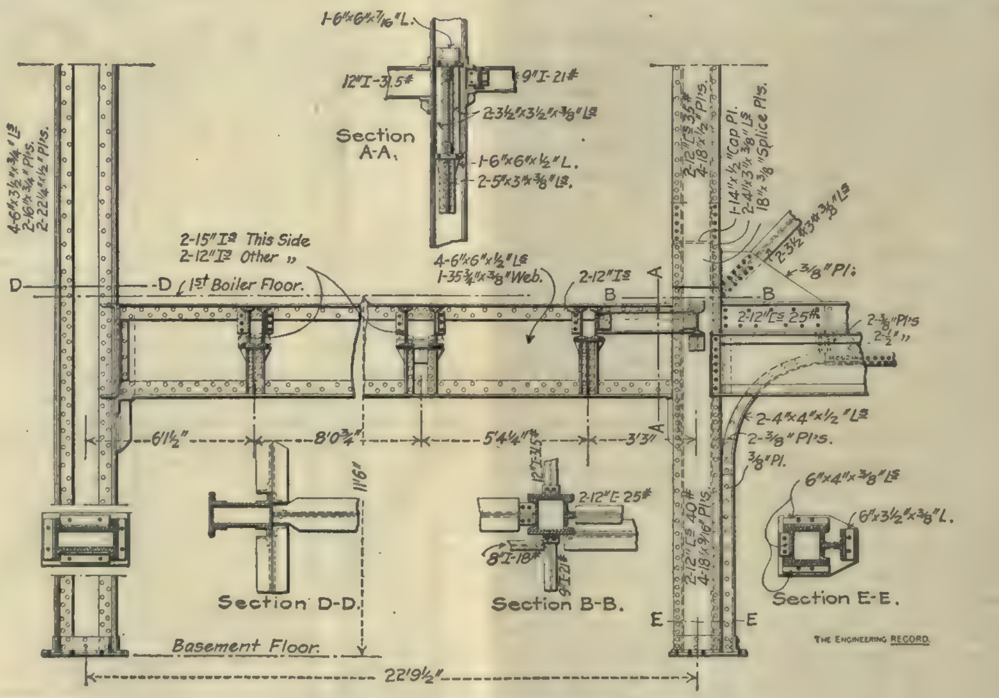


PART SECTION THROUGH COAL BIN.

They are made in three sections, one between the stacks and one at each end of the building beyond the stacks; one of the end sections being intended for future extension to the same length as the middle sections. The pockets are each about 25 feet deep, 60 feet wide, and respectively 70, 137 and 66 feet long. The two middle rows of columns terminate at the bottom of the pockets and have the webs of double transverse horizontal plate girders riveted across their flanges and spliced to the webs of inclined double plate girders similarly connected at their upper ends to the tops of the third sections of the side rows of interior columns. The middle points of the side girders are braced by oblique struts to the side columns, below which level the side and middle columns are solidly X-braced together by pairs of angles which provide a sway system carried down between the batteries of boilers, to the rock foundations. A triangular plate girder is seated on the middle of the top flange of each horizontal girder, and forms a summit from which the coal is diverted to scuppers on both sides at the bottoms of the inclined girders. All the angles made by the inclined girders and their braces are of 45 degrees, and their connections are simply and rigidly made with double gusset plates riveted across both flanges of the columns. Excepting around the scuppers the floorbeams are 15-inch 50-pound horizontal I-beams 3 feet apart on center. The flooring is of concrete arches with concrete filling and cement finish.



Details of the Two Types of Roof Trusses.



Columns and Girders of Boiler House.

At the ends of the bins, a 15-inch channel is riveted, web down, across the top flanges of the floorbeams and receives the bent plate web connections of the vertical I-beams which form the end wall framework. These beams are from 6 to 15 inches deep, according to length, and are riveted at the top to the horizontal web of a 30-inch plate girder, connected to the side columns and braced by a horizontal truss, from the opposite side of which inclined braces are run to the tops of the vertical I-beams which project above the girder. The truss is made of pairs of 6 x 4-inch and 6 x 6-inch angles, riveted to wide connection plates, which, in one set, are connected by bolts in slotted holes to the cap plates in the middle longitudinal rows of columns.

Each end of the web of the 30-inch girder is connected by a large ⅜-inch gusset plate to the horizontal web of a similar longitudinal girder over the top of a vertical web plate girder at the side of a coal pocket. These four horizontal web girders thus make a rectangular frame around the top of the inclined part of the pocket, and are designed to give rigidity to the sides and to have sufficient tensile strength to sustain the balanced outward pressures of the maximum amount of coal which which can be put in the pocket. The longitudinal girders have only two flange angles, and are riveted to the top flanges of the vertical web plate girders, making T-shaped cross-sections. The end walls of the coal pockets are carried 7 feet above the horizontal girders by 6-inch vertical I-beams, 3 feet apart, connected at the top to a 12-inch channel with horizontal web. The tops of the columns which support the upper ends of the inclined plate girders in the bottoms of the coal pockets are braced by one panel of transverse struts and diagonals connecting them with the wall columns.

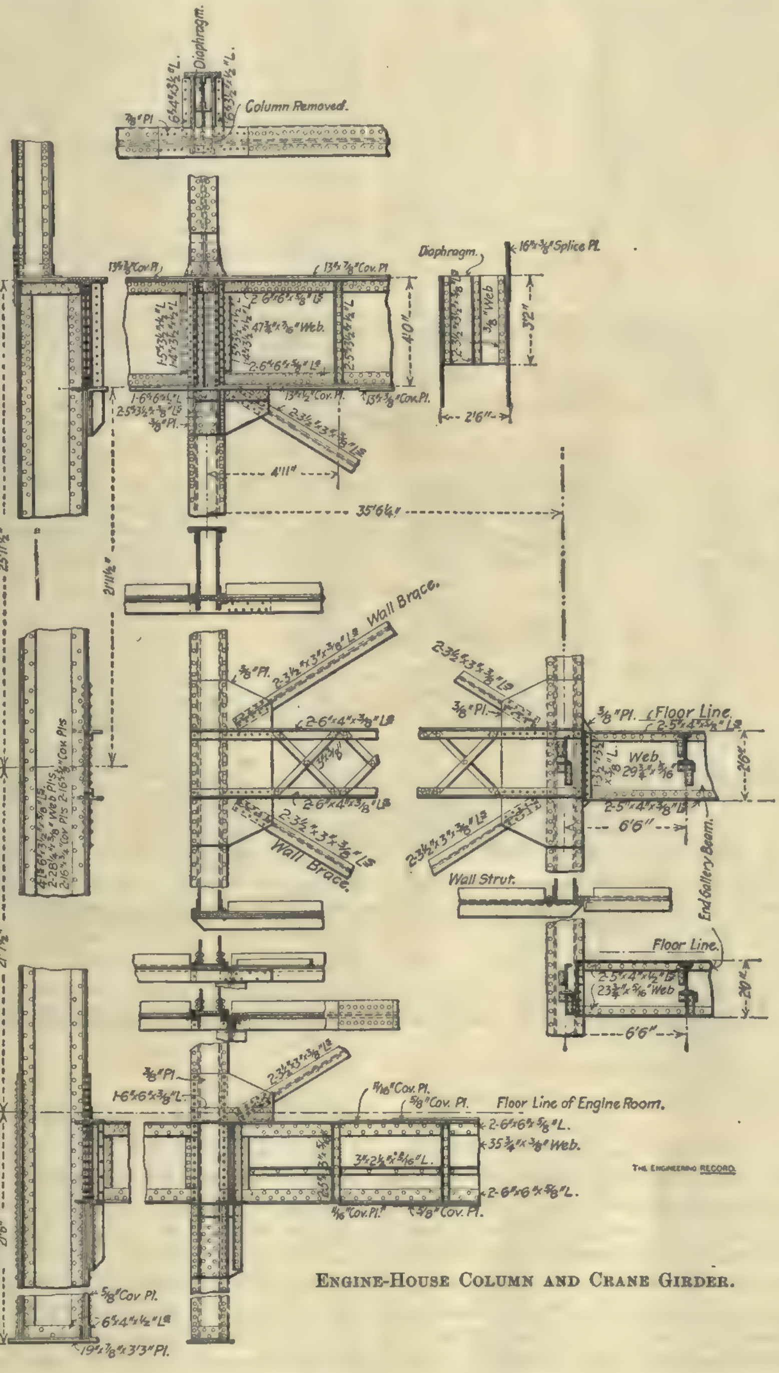
There are no complete floors above the second tier of boilers, but a 3-foot wall is bracketed out all around the sides of the coal pockets just above the horizontal girders. The framework is designed to carry a floor load of 300 pounds per square foot on each side of the coal pockets, and the beams are many of them erected for this floor on the south side of the coal pockets, but none on the north side. A floor for the conveyor machinery, and for tanks and other apparatus is carried on the top chords of the main roof trusses.

The main roof trusses are 59¾-foot lattice girders, 11½ feet deep, riveted at the ends to short upper sections of the outer rows of interior columns. The T-shaped chords are made with two angles and a web plate, and the diagonal web members are all pairs of angles placed back to back. The end panels are only 6¾ feet long, and have vertical posts supporting the top chords on which are seated the 9-foot vertical posts which carry the ends of the monitor trusses and knee-braced to their bottom chords at the first panel points. The monitor trusses are 47½ feet span and about 7½ feet deep, made of pairs of angles from 2½ to 4 inches wide. Between the wall columns and the interior rows the roof is carried on untrussed rafters riveted to the tops of the columns, and forming continuations of the end panels of the main truss top chords.

In the main floor of the engine house there are three lines of longitudinal girders supported by the columns, and carrying on one side the transverse 12-inch I-beams, and on the other side the outer ends of transverse girders which are supported at the inner ends on the concrete engine foundation piers, and carry 18-inch longitudinal floorbeams about 21½ feet long and 5½ feet apart. The plate girders are nearly all 3 feet deep, are web connected to the columns and to each other, and have angle brackets with reinforced flanges for the I-beam connections. Between the lower flanges of the I-beams there are double rowlock arches of red bricks, levelled up with stone concrete and paved with vitrified tiles, the whole being proportioned for a total load of 425 pounds per square foot. There are two longitudinal switchboard galleries and one cable gallery, about 13 feet wide, supported by the interior columns and those in the division wall. Their floors are proportioned for 300 and for 150 pounds per square foot, respectively, and have concrete arches and filling.

A 50-ton electric girder crane of 78-foot span traverses the engine house from end to end, on longitudinal rails about 48 feet above floor level. The track girders are 4 feet deep with 7/16-inch webs, 6 x 6 x ⅝-inch chord angles and 13-inch flange cover plates. They are supported on the inner faces of wall columns about 35½ feet apart on centers, and have their webs riveted to the column cover plates. The end vertical stiffener angles are also field-riveted to the flanges of vertical connection angles shop-riveted to the faces of the columns. The top flanges of adjacent girders are spliced by a short field-riveted section of the cover plate, and the end of one bottom flange cover plate is cut, in alternate panels, to clear the top of the gusset plate connection for the wall diagonals. Each column is made with two 28¼ x ⅝-inch web plates, two 16 x ¾ and two 16 x ⅝-inch cover plates, and four 6 x 3½ x ⅝-inch angles. The top of the column is flush with the top flange of the track girder and is stiffened by a diaphragm which takes the rivets of the track girder connections and forms a seat for the foot of the upper section of the column which joins the roof truss. In the middle of the column a large gusset plate is riveted over the inside cover plate to receive the longitudinal strut and diagonals in alternate panels. The wall stringers in the main floor have the ends of their webs field-riveted to the outside cover plates of the columns, and are reinforced there to receive the floorbeam connections. The floorbeam web is field-riveted between two vertical web stiffener angles, one of which is shop-riveted to the stringer web, and the other is field-riveted to both stringer web and column cover plate and flange angle. The floorbeam and stringers are also supported on a reinforced bracket angle. The end gallery floorbeams have their webs field-riveted to the column cover plate, except where they come at the connection for the wall strut and are riveted to a separate vertical connection plate on the opposite side of the inner flange, as shown in the detail.

The engine house roof trusses are about 19 feet deep and 95 feet long on centers, and their bottom chords are curved to a radius of about 82 feet and have a rise of 14½ feet. The 19-foot upper sections of the wall columns form the end vertical members of the trusses and are extended 7 feet long below the lower chords. These columns have an I-shaped section made up of a web plate and four angles and are proportioned for the bending moment from a horizontal force at the top of the crane girder. The T-shaped top and bottom chords are each made of a 10-inch web plate and two 6 x 3½-inch flange angles, and the truss is calculated to act as a strut to brace the crane track girders in the engine house to the rigid framework of columns and struts under the coal pockets. The triangular monitor trusses are about 8 feet deep and 36 feet long, with the members all composed of pairs of angles shop-riveted to gusset plates. The ends of the trusses are seated at the hips of the main trusses on light braced vertical posts 8 feet high. The main trusses are about 35½ feet apart, and there are intermediate trusses between them which are supported on longitudinal lattice girders between the tops of the wall columns. There are 9-inch I-beam purlins with their webs normal to the roof slope, which are riveted to the trusses at panel points and carry 6-inch I-beam rafters 6 feet apart. The roof is proportioned for 30 pounds wind pressure, which is assumed to be equivalent to a load of 15 pounds per square foot normal to the monitor roof, and 25 pounds normal to the main roof. The monitor roof over the engine house is glazed, and over the boiler house it is sheathed with 16 x 24-inch terracotta blocks 3 inches thick, carried on T-bars 25 inches apart, and covered with slag roofing. The main roof is covered with red Celadon vitrified tile of the Conosera pattern, laid on 12 x 16-inch book tiles 2 inches thick, fastened to 2¼ x 2¼-inch T-bars 17 inches apart. Both boiler house and engine house main roofs are hipped at the ends, and the monitor is carried across continuously from one to the other so as to make, in plan, a complete rectangle. The clere-story walls of all monitors are glazed and the sash are pivoted in the middle and can be opened and closed in sections from the main floors.



ENGINE-HOUSE COLUMN AND CRANE GIRDER.

The main columns were erected by gin poles and derricks, and the roof and monitor trusses of the engine house were riveted together complete on the ground and erected by a two-boom tower traveler. The trusses were riveted to the short upper sections of the wall columns before erection, and the traveler moved over the tops of the engine foundation piers. The total weight of structural iron and steel in the power house is about 6,000 tons, and its erection was commenced in June, 1900.

The power house was designed and built under the direction of Mr. George H. Pegram, chief engineer of the Manhattan Railway Company, with Mr. W. C. Phelps in charge of the structural iron drawing room, Mr. C. W. Smith in charge of the architectural drawing room, and Mr. Thomas S. Clark in charge of the field work. The contract for structural iron was let to Post & McCord, that for masonry and other work to M. Reid & Co., and that for fire-flashed brick to the Columbus Brick and Terra-Cotta Company.

Some Enormous Waves have been roughly measured at Peterhead by Mr. William Shield, who described them in a brief paper recently issued by the Institution of Civil Engineers. The measurements were taken by means of sights fixed on the breakwater and indicated crests rising at times fully 22½ feet above the still-water level or 40 feet 9 inches above the trough. The waves had periods of 13 to 17 seconds and were 500 to 700 feet long.

The Power Plant of the Newark Public Library.

The Engineering Record regrets to have to ask the indulgence of its readers for an error in its article last week on the mechanical plant of the Newark Public Library. Owing to the excessive heat, vacation absences and a holiday in the printing offices, the usual checks on the publication had to be omitted in order to go to press on time, and as a result of this condition there was printed as the plan of the basement of the building a cut of an entirely different plant. The true plan, herewith printed, with the following notes, will, it is hoped, make the discrepancies in the former article of little annoyance to The Record's readers.

The building is heated by direct, indirect and direct-indirect radiation, with steam supplied on a two-pipe system and circulated under gravity return. As usual, the exhaust of the electric-lighting engines is utilized, with provision for the additional supply of live steam at reduced pressure, when necessary. There are two boilers at present installed, of the horizontal return tubular type, with shells 66 inches in diameter and 16 feet long, containing 4-inch tubes. These are placed in a setting which is provided with hollow tile beneath the firebrick in the bridge wall, by which air may pass from the ash pit into the combustion chamber; and the gases are made to pass backward over the shell into a smoke connection at the rear. This is of hard-burned brick lined with firebrick and supported overhead on heavy iron bars built from the boiler setting into the powerhouse wall and connecting with a square brick chimney. The boilers are located in a room 24 x 34 feet with 6 feet firing space, opposite which is the coal storage space. This is under the rear court yard and coal is dumped directly into it through ordinary chutes.

The boilers feed a 10-inch header by copper bends 6 inches in diameter, rising from a dry pipe in each boiler and entering the header at the top. The header is carried on the boiler setting and passes into the engine room, pitching slightly in that direction and terminating in a curved elbow pointing downward and closed with a blank flange from which a drip pipe is taken to a steam trap. The engine room is 31 x 34 feet in plan and contains two generating units, pumps, and feed-water heater and the switchboard. The engines are Watts-Campbell Corliss engines of 16 x 30-inch cylinders, and each drives a Crocker-Wheeler generator of 100 kilowatts capacity to which it is directly connected, running at a speed of 120 revolutions per minute. The engines are provided with two fly-ball governors, the second one serving to shut off steam to the cylinder at an increase of 10 per cent. in the speed. The average steam pressure carried at present is 85 pounds. The fly-wheel in each case is 10 feet in diameter and is mounted between crank and generator. A 7-inch pipe for the engines is taken from the top of the steam main, passing to a point overhead between the engine cylinders where it subdivides into an inverted Y breaking into two 5-inch pipes, one for each engine. The exhaust is carried under the floor in trenches to the feed-water heater.

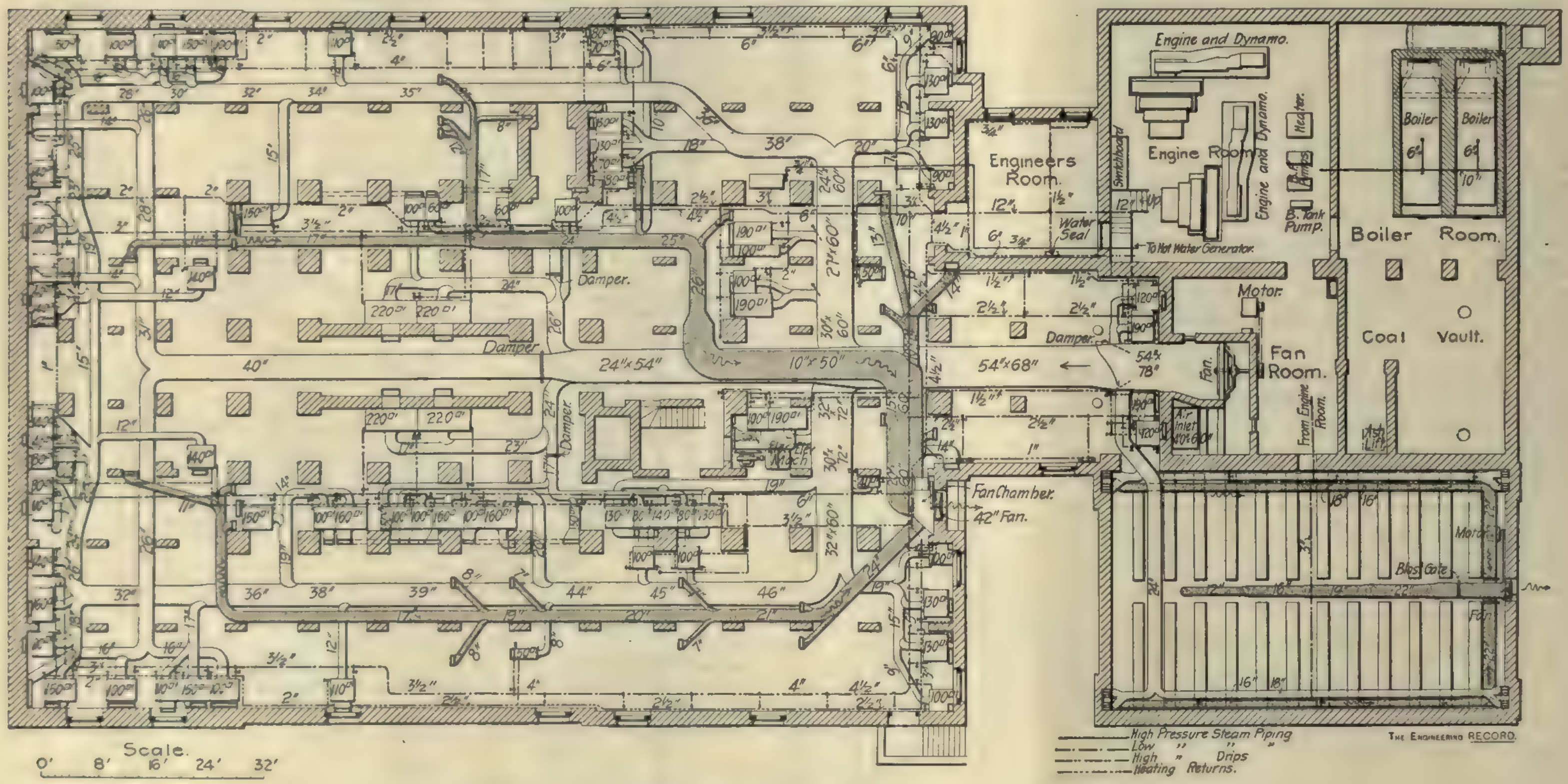
The low-pressure steam piping system, for heating, is, as stated, a two-pipe one with the mains in the basement. The exhaust steam pipe at the feed heater rises from the trench toward the ceiling, where it branches into two 10-inch pipes extending in opposite directions, one leading to a free exhaust riser to the atmosphere alongside the brick smoke chimney, fitted with the usual back-pressure valve, which provides an escape of an excess of exhaust steam during the heating season, and the other branch feeding the heating system. This it does at a cross, the second arm of the cross receiving an 8-inch pipe which brings live steam, reduced in pressure, from the boilers, and the third and fourth, 6 and 12 inches in diameter, being the heating mains, the former for the main tempering coils, in connection with the plenum system, and the book stack building, and the latter for the rest or the main building.

Steam mains or returns are located in the basement, where most of the radiation is, and the radiators distributed on the various floors above are supplied by risers, the horizontal branches to the risers being taken from the bottom of the steam main and the base of the steam risers being provided with a bleeder to the return lines, which are carried on the cement floor, so that steam mains and steam risers are drained by the same pipes.

The steam main subdivides into a number of smaller mains, as indicated, and the returns travel back parallel with them, finally collecting into a 6-inch main which is run toward the engine room. Before dropping to the floor of this room and connecting with the feed-water heater, which is arranged for use as a receiving tank for the heating system, it has a water seal of the inverted U type with the vertical pieces of the pipe forming the U about 4 feet high, provided with a by-pass or direct continuation of the main, controlled by valve, so that it can be blown through at any time. The feed-water heater is a Cochrane heater, provided with oil separator. The water is delivered from this to the boilers by feed pumps, of which there are two, of the Barr make and 6 x 4 x 6-inch duplex type, cross-connected, the suction being taken from the return main, which extends across the pumps in a trench, and which terminates in the feed-water heater. These pumps and a 4 x 4 x 5-inch single-acting pump for lifting the contents of the blow-off tank to the sewer whenever necessary, are located side by side in the engine room near the feed heater. The blow-off tank, which is 5 feet in diameter by 12 feet long, is located in a brick pit built under the coal vault.

The plenum system starts from the rear court where the fresh air is taken through a hooded inlet. It drops into a brick chamber in which there are two banks of cast-iron indirect radiators, two tiers each, provided with by-pass underneath, for allowing such a portion of the air, as desired, to pass through without warming. Altogether there are about 600 square feet of surface in the four groups. The air passes directly to a fan, which is of the Seymour disk type, 96 inches in diameter, motor dirven by belt.

Immediately beyond the fan a small branch is taken from the duct on each side and some distance beyond two large ones start. These pass in opposite directions around the outside of the building, supplying practically all the indirect radiators. Grouped around the center of the main building, however, are a number



PLAN OF BASEMENT OF THE NEWARK PUBLIC LIBRARY.

of other indirects that are supplied from the continuation of the main duct, this finally subdividing into two small main ducts which supply tempered air to flues for the lecture room on the top floor. Some of the indirect radiators in the center of the basement provide a hot-air supply for the other rooms of the top story. At branches from the main duct, there is, in general, a wedge or diverting damper at the junction of the main and branch to direct the desired proportion into the branch. An interesting feature in connection with the basement duct system is that the two main branch ducts—those supplying the indirect radiators distributed about the outside of the basement—are connected at their far ends, across the front of the basement, so that there is a continuous circuit and the distant indirects may surely receive their proper proportion of air, regardless of wind conditions likely to influence the pressure in the different rooms.

The indirect radiators are suspended from the ceiling at the flue bases they supply and each of the branch ducts feeds tempered air which passes through the stack and thence into the warm-air flue. Some of the large and much-used rooms—the children's and newspaper rooms on the ground floor, the reading room and the delivery working space with the biography and fiction departments of the main floor—are designed for thermostatic control, the intention being to vary the temperature of the inflowing air by a mixture of tempered and heated air. In these cases, the tempered air branch duct splits, one part leading, as before, to the indirect casings and the other passing underneath it in an independent path to the flue. A damper at the split is arranged to vary the amount admitted to the two air channels. The thermostats are to be grouped, in the reading room, for example, so that two will control four flues each.

All rooms on the ground floor and the entire book-stack are connected by flues leading down into the basement and delivering to fans which discharge directly out of doors, the apparatus serving the book stack comprising a dust removing system.

Volume of Water in Hot-Water Heating Apparatus.

One of the papers presented to the American Society of Heating & Ventilating Engineers at its summer meeting in Chicago this week took up the subject of the volume of water required per square foot of radiating and heating surface in the radiators, mains and heater in a hot-water heating apparatus. Its author, Mr. W. M. Mackay, thought that the differences of opinion as expressed by manufacturers of heaters in the various constructions in use for the past 25 years was evidence alone of the lack of a standard in this particular.

In the manufacture of radiators, particularly for hot-water use, however, he said that a standard had generally been accepted of providing for one pint of water for every square foot of surface, being approximately the volume of water contained in one square foot of surface of 1-inch ordinary wrought-iron or steel pipe. He considered this standard best suited for all classes of buildings, except, perhaps, all-glass structures, in which he had found it an advantage, on account of the greater and quicker cooling effect in such constructions, and the variable temperatures at which the water in the system is sometimes maintained (on account of irregular firing, lack of fire-box capacity or lack of capacity in the heater, and on account of friction due to the long lines of piping usually employed), to use a surface that contained from 50 to 100 per cent. more water. Were a uniform temperature maintained in the water in the heater, and the radiating surface arranged as in other buildings, with short circulations and an ample arrangement of mains, he believed it would not be necessary to increase the body of water in the radiating surface above one pint to the square foot of surface.

The author described a test made some years ago in two greenhouses of uniform construction, each 16 x 100 feet in size, containing approximately 2,000 square feet of glass and about 650 square feet of heating surface or running feet of 4-inch greenhouse pipe. Each house was heated by a separate heater located in the same pit with separate 8 x 12-inch brick flues extending 20 feet above the ground; each heater had about 4 square feet of grate area and about 90 square feet of fire and flue surface (about half fire and half flue surface). The radiating surface was arranged in the usual way, in 4-inch greenhouse pipe on each side of the house, below the benches, with one flow and two return pipes on each side, an open expansion tank at the extreme end of each line and each side connected separately to the heater with a 4-inch flow and return connection. In one house 2 x 2-inch oak strips were inserted in the center of the 4-inch pipes, reducing the waterway about 40 per cent., while retaining the same external surface. In a six-hour test, maintaining a 60-degree temperature in each house with an outside temperature of from 25 to 30 degrees, an average temperature of 160 degrees Fahrenheit was maintained on the flow mains and 130 degrees on the return mains at each heater. The consumption of fuel was 130 pounds of anthracite coal, stove size, for the house with full waterways in the radiating surface, and 110 pounds of the same coal for the house with reduced waterways, while the temperature on the flow main on the heater with reduced waterways was frequently 5 degrees higher than that on the other heater, and the dampers on this heater had to be partially closed to prevent a higher temperature. Later this house was lengthened 25 feet and piped in the same way, and the temperature maintained with the same average consumption of fuel, as that used in the other heater with 25 per cent. less surface and glass area.

Since that time the author has used largely 1¼-inch pipe with a little over one pint of water to the square foot of surface, in small conservatories, 1½-inch pipe with about 1½ pints of water to the square foot of surface, in medium-size conservatories, and 2-inch pipe with about one quart of water to the square foot of surface, in large conservatories and greenhouses, in preference to 4-inch greenhouse pipe with about a half-gallon of water to the square foot of surface, and has found better and quicker results, a greater possible variation of temperature and greater economy, from the use of 2-inch pipe with manifolds, than from any other size of pipe, either larger or smaller.

The greatest difference of opinion as to the volume of water required per square foot of its surface, in hot-water heating, seems, according to the author, to exist in the heater. Boilers of the Cornish type, he said, contain about 3 gallons of water per square foot of boiler surface; the ordinary horizontal and vertical tubular boilers arranged for hot water have about 1½ gallons of water per square foot of surface; a number of cast-iron one-piece and sectional heaters have about one gallon of water per square foot of surface; some have three quarts, and others have half a gallon; then some heaters of this type and water-tube heaters contain from three pints to one pint of water per square foot of surface, and in some heaters, constructed of 1-inch pipe, while the volume of water to the foot of surface is not materially reduced, the friction is increased by inserting a sheet metal circulating division reducing the pipe to half its area. Concluding, the author said: "Now if we do not consider the Cornish boilers, which are more largely used in other countries, and commence with the horizontal tubular boiler, which is largely used in this country, we have a variation in the hot-water heaters all the way from 1½ gallons to 1 pint of water per square foot of surface; and while all of these different constructions, with their varying amounts of water, will accomplish certain results with more or less efficiency and economy, certainly some will produce better results than others, and on that account would be considered a proper standard. While the arrangement and location of the surface to the fire and heated gases would make some difference as to the volume of water which should be back of it, I have obtained the best results from an average of a half gallon of water per square foot of heating surface in a hot-water heater with an average of from 20 to 25 square feet of heater surface to each square foot of grate area, the surface being arranged about 50 to 60 per cent. of fire surface and about 40 to 50 per cent. of flue surface."

Tests of Radiators with Superheated Steam.

Extracts from a paper presented to the American Society of Heating & Ventilating Engineers by Prof. R. C. Carpenter.

In making a series of radiator tests during the spring of 1901, superheated steam was inadvertently used in several cases. To my surprise the capacity for heat transmission of the radiator was thereby reduced. I did not have sufficient time to investigate the phenomena exhaustively but the data which were taken seemed to be of such general interest that I have concluded to present the results of the test to the Society for discussion.

The radiators tested were named No. 1 and No. 2. No. 1 was 18 inches in height and contained 10 sections, each 11 inches wide, constructed so as to have very little air space between the sections, the least distance between sections being ¼ inch. No. 2 was 38 inches in height and contained 10 sections, each 7 inches wide and spaced so as to give abundant room for air currents around the sections; the least distance between sections was ¾ inch. The radiators were both tested with steam, which was taken through a single inlet. No. 1 was of the hot-water type with top connection as well as bottom connection of the sections, whereas No. 2 was of the steam-heating type with no top connection of the sections.

The radiators were arranged for testing on a platform having an elevation about 2 feet above the floor and sufficient for inserting vessels underneath the radiators to obtain the water of condensation. Steam for the test was obtained from a high-pressure main which passed through a steam separator to remove any free water, thence through a reducing valve set to maintain the desired pressure, thence to a receiver located between the two radiators. From the receiver a pipe was led to each inlet of the radiator. The water of condensation was taken off at the inlet end and permitted to drip into a receiver provided with a water glass arranged in such a manner that the water in the receiver could be held at a uniform level, which was about one foot below the bottom of the radiator. The water of condensation was cooled before being weighed. Temperatures were taken of the outside air and at several places of the compartment in which the test was conducted. Temperatures were also taken of condensed steam and of the surface of the radiator on two sides. In taking the temperature of the surface of the radiator the bulb of a thermometer was fastened against the metallic wall of the radiator and protected from external radiation by hair felt. This test does not give the temperature of the radiator because of the cooling of the thermometer bulb, but it gave useful information as to the distribution of heat in the radiator. The two radiators tested were kept at a distance of about 6 feet and the effects of radiation from one to the other was counteracted by a partition midway between the two. The radiators were shielded from any currents of air and the room was kept, as nearly as the outside conditions would permit, at a temperature of 70 degrees.

The writer has observed in previous tests of radiators that when testing a high and a low radiator, the low radiator would always show a greater heat transmission for the same surface exposed. In these tests we have an apparent exception to this rule, as it will be noted that the higher radiator gave a higher rate of heat transmission per square foot of surface than the lower. An examination, however, of the dimensions of the radiators will show that the air space surrounding the sections in the low radiator was very much less than in the high. While I have not an accurate measurement of air space it is probable that the air space per unit of surface in the low was about four times that in the high radiator. The test is interesting as showing that by properly proportioning the air spaces between the sections, the heat transmitted per unit of surface in high or low radiators may be equalized. This also shows that the air space doubtless plays an important office in carrying away the heat from the radiators.

Expressing the final results in terms of the number of heat units transmitted per hour per square foot per degree, we have the following results as applicable to the case where there was either no superheating of the steam or only a very slight amount. These results indicate a substantial uniformity in heat transmission per degree difference of temperature from 2 pounds to 10 pounds.

Steam Pressure, lbs.	Superheat, Degrees.	B. T. U. per sq. ft. per hour per degree. Radiator No. 1.	B. T. U. per sq. ft. per hour per degree. Radiator No. 2.
2	0	1.48	1.83
2	0.13	1.50	1.92
10	0.30	1.50	1.91

The process of reducing the pressure wire-drew the steam, thus liberating a considerable amount of heat energy which expended itself in superheating the steam. The effect of liberating this heat energy without work was to superheat the steam and this, contrary to our expectations, was to reduce the amount of heat transmitted. Thus with radiator No. 1 with no superheat the heat transmission per hour per square foot of surface per degree, which we will term hereafter the heat transmission, was 1.48 British thermal units; with about 36 degrees superheat this was reduced to 1.16 British thermal units. With radiator No. 2 there was a corresponding reduction from 1.83 to 1.41 British thermal units. With 5 pounds of steam pressure and when steam was superheated 13.1 degrees, the heat transmission was 1.41 for the low radiator and 1.74 British thermal units for the high. When the degree of superheat was increased to 24.1 degrees the heat transmission of the low radiator fell to 1.23 British thermal units and that of the high to 1.45 British thermal units. With 10 pounds of steam pressure the heat transmission for 0.3 degree of superheat was for the low radiator 1.5 and for the high radiator 1.9. When the steam was superheated to 26.7 degrees the heat transmission fell to 1.24 for the low radiator and 1.62 for the high radiator. Several check runs were made, the results of which show a variation of less than 2 per cent. This run is given uncorrected, although the results are probably 2 or 3 per cent. high because of some condition which could not be determined. Possibly the radiator may have been in a slight draft of air, although measures were taken to prevent such an occurrence if possible.

The conclusions from the tests made with superheated steam would be that it is a poor medium to employ for heating purposes, the reason doubtless being that superheated steam is much more nearly like a perfect gas in its nature than a saturated vapor, and when in this condition parts with its heat much less readily than saturated or wet steam. It is not probable that the amount of superheat was sufficient in any of the cases described to fill the entire radiator with steam of this character, and this, I take it, accounts for the continued falling off in heat transmission as the degree of superheat increased. The accompanying table gives the general results of the radiator tests.

General Results of Radiator Tests.

Radiator No. 1: height, 18 inches; measured surface, 38.6 square feet.

Pressure, lbs.	Temp. air, degrees.	Temp. steam, degrees.	Degree superheat.	B. T. U. per hr. per sq. ft. per deg. diff.	Lbs. of steam cond. per hr.
2	71.3	217.0	0	1.48	8.33
2	77.1	217.1	.13	1.50	8.13
2	74.0	252.8	35.83	1.16	7.88
5	70.2	239.0	13.10	1.41	9.18
5	75.5	252.7	24.10	1.23	8.38
10	72.5	264.7	26.70	1.24	9.18
10	75.8	238.4	.30	1.50	9.25
30	74.1	274.5	1.10	1.83	14.07

Radiator No. 2: height, 38 inches; measured surface, 49.1 square feet.

Pressure, lbs.	Temp. air, degrees.	Temp. steam, degrees.	Degree superheat.	B. T. U. per hr. per sq. ft. per deg. diff.	Lbs. of steam cond. per hr.
2	73.5	217.0	0	1.83	13.00
2	80.3	217.1	.13	1.92	12.75
2	77.0	252.8	35.83	1.41	12.25
5	73.5	239.0	13.10	1.74	14.16
5	76.7	252.7	24.10	1.45	12.63
10	74.2	264.7	26.70	1.62	15.00
10	77.3	238.4	.30	1.91	15.16
30	76.8	274.5	1.10	1.97	18.94

Trade Publications.

The publishers of pamphlets mentioned below will be glad to have The Engineering Record mentioned by its readers who apply for copies.

The book "Steam," published by the Babcock & Wilcox Co., 85 Liberty St., New York, is known to many engineers as the catalogue of the Babcock & Wilcox water-tube boiler; also that it contains a good deal of useful information upon steam engineering matters. This work relates to stationary boilers, but a new one, called "Marine Steam," is just off the press, which is devoted to the marine type of boiler made by the company. The new book reviews the history of water-tube boilers and describes the requirements of a marine boiler and the particular advantages of the Babcock & Wilcox design. The advantages of water boilers for marine service are discussed, and the results of numerous tests upon the Babcock & Wilcox marine boiler, among them the famous trials of the boilers for the U. S. S. "Cincinnati," are given. The book contains a good deal of useful information to all engineers interested in steam engineering; also a large number of handsome illustrations of war vessels, merchant steamers, dredges, tugs, etc., in which the Babcock & Wilcox boilers are used.

For many years the Fairbanks cement-testing apparatus has been widely known, but this fact in no way lessens the value of a pamphlet on cement testing just issued by the Fairbanks Co., New York. It is a fully-illustrated description of the construction and method of use of the various appliances of a cement laboratory, from the sieves and trowels to the briquette-breaking machine. Every engineer, architect and contractor who uses cement will find the pamphlet of value.

The Chicago Bridge & Iron Co., Washington Heights, Chicago, has published a book of 62 pages containing many excellent engravings of water towers and standpipes, together with a few views of the company's shops and some of the bridges and steel stacks which it has erected. The water towers are noteworthy for their hemispherical bottom, a type of construction which the company favors. The book also contains an abridgment of the fire-stream data published by Mr. John R. Freeman some years ago.

The Indiana Road Machine Co., Fort Wayne, Ind., has prepared a new edition of its catalogue of the Indiana reversible road grader and other machinery. The grader is described in unusually complete detail, the construction of the several parts where adjustments are made being illustrated and their operation explained. The company also makes a stone crusher, revolving screen, conveyor, portable engines, reversible road rollers, and acts as agent for scrapers, plows, street sweepers and other tools, all of which are fully described.

The Jeanesville Iron Works Co., Jeanesville, Pa., has issued advance sheets of the portion of its new catalogue relating to steam and electric sinking pumps. The latter type is a triplex pump with double reduction gearing to a motor on the top of the frame.

Five types of universal milling machines are described in a 24-page pamphlet just received from the Garvin Machine Co., 135 Varick St., New York. The frontispiece consists of two engravings showing the milling machine made by the company in 1862 and the type put on the market for the first time in 1901. The book fully describes and illustrates the details of construction of its present line of these tools and explains the purposes of their many special features.

The type of metallic packing made by A. W. France, 6512 State St., Philadelphia, is described in a profusely-illustrated catalogue which gives a clear description of the construction and its various forms for different situations. It consists in brief of rings cut into three pieces on lines so placed that the pieces expand and contract radially; the pieces are held together by a spiral spring of composition metal around their center periphery.

The flanged steam fittings made by the Crane Co., Chicago, have recently been revised, and the company has issued a 40-page circular to take the place of all previous lists and dimension sheets. It describes a line of such fittings from 2 to 18 inches in size, suitable for a working pressure of 125 pounds, and another line 12 to 36 inches in size, suitable for a working pressure of 50 pounds. The dimensions of flanges in both cases are those recommended by the American Society of Mechanical Engineers. The book also gives dimensions of standard straight-way valves with wedge gates. It is hardly necessary to say that such a pamphlet is of the highest value to engineers and contractors interested in steam piping.

The Four-Track Series issued by Mr. George H. Daniels, general passenger agent of the New York Central Railroad, has had a new addition in a large map of the Chinese Empire, with accompanying text on China and the Chinese, written by Mr. Guy Morrison Walker, who lived in the country for about twenty years. Both map and articles will be found of much interest. New editions of three other pamphlets of this series have also been published recently; two of them relate to the Adirondack Mountains, and the third is a description of summer resorts in various parts of the country reached by the New York Central lines. They are all fully illustrated and provided with good maps, and each will be sent to any address on receipt of a five-cent stamp.

Although a dating stamp is not to be classified as a trade publication, it may be mentioned here that Baker & Co., Newark, N. J., are sending out a handy little appliance of this sort as a substitute for the usual circulars concerning platinum wares.

A pamphlet of well-printed views of bridges, buildings and other structures painted with Carbonizing Coating, together with letters concerning the durability of the paint on them, has been published by the Goheen Mfg. Co., Canton, O.

Personal and Obituary Notes.

Mr. H. Shaner has been elected city engineer of Lynchburg, Va.

Prof. James M. Porter of Lafayette College was badly injured recently in an automobile accident.

Mr. Robert L. Johnson has been re-elected superintendent of public works and city engineer of Columbus, Ga.

Prof. Tudor Anderson of the University of Mississippi has accepted the chair of electrical engineering at Tulane University.

Mr. Olaf Hoff has been appointed engineer of structures of the New York Central road, and will have supervision of bridges, elevators and similar works.

Mr. Y. Nakajima, engineer of the Tokio water-works, will spend about a year in studying municipal works in the United States and Europe. He expects to leave Japan in about a month and will first visit this country.

Mr. H. J. Clark has resigned the office of chief engineer of the Syracuse Rapid Transit Company. The duties of that office and of the master of transportation have been united in the new office of superintendent, to which Mr. John Duffy has been appointed.

Recent promotions in the Corps of Engineers, U. S. A., are: James G. Warren to be major and George P. Howell to be captain. Captain William E. Craighill has been assigned to the command of Company A, First Engineer Battalion, now in the Philippines, and is ordered to accompany his command to the United States.

The architectural commission which will plan the Louisiana Purchase Exposition at St. Louis is as follows: Isaac S. Taylor, Eames & Young; Barnett, Haynes & Barnett; Widmann, Walsh & Boisselier; Theo. C. Link, of St. Louis; Cass Gilbert and Carrere & Hastings, of New York; Walker & Kimball, of Boston, and D. H. Burham & Co., of Chicago.

Napoleon Le Brun, who died in New York on July 9, was born in Philadelphia in 1821, where he was educated professionally in the office of T. H. Walter, the architect of Girard College. During his residence in Philadelphia he designed the Roman Catholic Cathedral and the Academy of Music. In 1864 he moved to New York and designed the Epiphany Church, the Masonic Temple, the Foundling Asylum and numerous other buildings, and, in partnership with his sons, the office buildings of the Home Insurance Company and the Metropolitan Life Insurance Company and other well-known structures.

John E. Tegmeyer, who died in Baltimore on July 4 at the age of 80 years, was at one time one of the best-known engineers in the country. In 1842 he was a member of the engineering corps of General Latrobe, which located the Baltimore & Ohio line from Cumberland to Wheeling. He was connected with the road for some time, and, during this time, with Wendell Bollmann, became interested in iron bridge building. Finally he and Mr. Bollmann formed a company to build iron bridges, which carried on a profitable business for a number of years and secured contracts in Cuba as well as the United States. Later he left this business and eventually became city commissioner of Baltimore, an office which he held for many years.

Ashley B. Tower, for many years the leading designer of paper mills in this country, died at Montclair, N. J., on July 8, from heat prostration. In partnership with his brother, D. H. Tower, he had his headquarters at Holyoke, Mass., for many years. He designed sixteen of the paper mills in that city, and had more or less to do with 25. In the famous suit betwen the Holyoke Water Power Company and the city, he testified he had designed 55 mills and been consulted in work on about 100 all told, figures which give some idea of the extent of his practice. For many years he was the consulting engineer of the American Sulphite Company. Some years ago, in connection with Mr. Joseph H. Wallace, he organized the corporation of Tower & Wallace, which designed a number of very large plants, including the large mills at Rumford Falls. After Mr. Wallace withdrew from this corporation some months ago Mr. Tower was mainly interested in designs for a large plant in New Brunswick.

P. B. Winston, who died in Chicago on July 1 was born in Virginia in 1845. He was educated under private tutors for the most part until the death of his father made it necessary for him to assist in the management of the family estate. In the fall of 1862 he enlisted as a private in the 5th Virginia Cavalry, and after a year of hard service, during which he rose to the rank of First Lieutenant, he was assigned to the staff of Gen. T. L. Rosser. This post he held until Lee's surrender, when he returned to the old homestead and again engaged in farming. This was too unprofitable, however, and in 1872 he went to Minneapolis with the little money he had succeeded in saving. There he engaged in engineering work on the Northern Pacific Railroad and for the government. In 1875 he formed, with his brother, F. G. Winston, the firm of Winston Brothers; in the following year W. O. Winston, another brother, was taken into partnership, and very soon the firm was executing some of the largest railroad contracts in the northwest. At the time of his death he was in Chicago to consult with the Chicago & North Western Railroad concerning several new lines which his firm was building.

A Small Sewage Disposal Plant of considerable interest is described in a recent issue of "Indian Engineering." It was designed by Mr. C. C. James for a leper asylum with 400 inmates near Bombay, where the sewage originally drained into two large cesspools. These became a nuisance, so a disposal farm was laid out with settling tanks for liming the raw sewage, but the lime injured some of the crops and it had to be abandoned. Finally the land became "sick," and the septic system was introduced preliminary to the land treatment. This has been successful, and the sale of the farm crops yielded last year a profit of 21 per cent. above working expenses. The septic tanks have a capacity of about 19,000 imperial gallons, and the sewage passes through them at a rate of about 20 feet an hour. The leathery scum on the surface is 1 to 3 inches thick and there is some sludge at the bottom. The septic effluent has been used in experiments with a number of filters. One which gave a good result was made with pieces of coal. Another filter, which received raw sewage, was made of pieces of brick with pipes to distribute air through it in accordance with the principles advocated by Colonel Ducat. The sewage was 45 minutes in passing this filter and was well purified by the process.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Whitewright, Tex.—Bonds are stated to have been voted for the purpose of extending the water-works.

Tullahoma, Tenn.—Granbery Jackson, Mt. Pleasant, Tenn., is now designing a system of water-works and electric lights, for which $35,000 has been voted.

Detroit, Mich.—W. H. Ashwell & Co., Engrs. of Detroit, write that the County Superintendent of the Poor has awarded contracts as follows for furnishing and laying 550 tons of 8-in. pipe, etc., for a water supply for the Wayne County Poor House & Asylum: To the U. S. Cast Iron Pipe & Fdy. Co., Cincinnati, O., 8-in. pipe at $22.90 per ton delivered, and special castings at $44.50 per ton; to the Galvin Valve Co., of Detroit, valves and valve boxes for $246; to T. C. Brooks & Son of Jackson, Mich., for digging trench, laying pipe, etc., 24 cts. per ft.

Pittsburg, Kan.—City Engr. C. G. Waite writes that it is proposed to extend the water mains to Frontenac, a distance of 4 miles.

Knox, Ind.—The Town Clerk writes that a water-works franchise has been granted to a company of which John B. Reed of Kankakee, Ill., is president, and J. A. Gamer of Knox, engineer. Cost of works, $44,000.

Loudonville, O.—Corp. Clk. John E. Bird writes that an election will be held July 17 to vote on the question of constructing water-works at a cost of $30,000. Mr. Chapin of Massillon, O., has prepared the estimates.

Jersey City, N. J.—Bids are wanted July 16 for furnishing and delivering 100 lengths of 6-in. pipe, to weigh 33 lbs. per lin. ft.; 700 lengths of 8-in. pipe to weigh 48 lbs. per lin. ft., also for furnishing and laying 1,050 lin. ft. of 36-in. cast-iron water pipe. Wm. A. Tolson, Clk. pro tem. Bd. Street & Water Commrs.

Baker City, Ore.—Bids are wanted July 22 for furnishing and laying 48,800 ft. of pipe for the purpose of extending the water mains of the distribution system in connection with the gravity water-works. W. H. Bentley, City Aud.

Mantua, O.—A. W. Russell writes that an election will be held July 22 to vote on the proposition to construct water-works at a cost of $16,000. L. E. Chapin of Canton, Engr.

Tiffin, O.—The City Council on July 1 passed a resolution declaring the intention of asking for competition for supplying the city with water, the present franchise expires in 1903.

St. Charles, Mo.—A correspondent writes that the injunction applied for by the St. Charles Water Co. to prevent the city from constructing a municipal water-works plant, has been denied and the contract to construct the plant having been awarded by the city to C. A. Stoakey of Belleville, Ill., for about $85,000, work will commence at once.

Sparta, Ill.—L. J. Sexton, W. H. Pinkerton and others are interested in the proposed construction of water-works at an estimated cost of $2,000.

Graettinger, Ia.—Town Clk. S. R. Stedman writes that the contract for constructing water-works has been awarded to W. D. Lovell of Des Moines, Ia., for $4,808.

Lompoc, Cal.—Town Clk. G. W. Meals writes an election will be held to vote on the issue of $30,000 bonds for water-works and $10,000 bonds for an electric light plant. J. K. Harrington of Santa Barbara, Cal., Engr.

Sackville, N. B.—P. S. Archibald, Engr. of the Sackville Water & Sewerage Co., writes that a gravity water system is to be constructed at an estimated cost of $40,000. Work is now being done by day labor, but contracts may be let later.

Carbondale, Pa.—Bids are wanted July 29 for $145,000 bonds for the purpose of constructing a municipal water plant. N. L. Moon, City Clk.

Moline, Ill.—In a report as to the most satisfactory pure-water supply for Moline, Engr. Daniel W. Mead, of Chicago, recommends artesian wells. Contracts are about to be let for water main extensions to Stewartville, estimated cost $20,000.

Fairhaven, Wash.—The City Engineer is stated to have submitted plans for a pipe line estimated to cost $18,000.

Morton, Minn.—Press reports state that the Council has adopted plans for a water-works system.

Winthrop, Minn.—A water-works system is said to be under consideration.

Shawneetown, Ill.—The Council is said to have under consideration the question of constructing water-works.

North Yakima, Wash.—Press reports state that the Water, Light & Power Co. has plans under consideration for improvements estimated to cost $16,000.

Gettysburg, S. D.—Bonds to the amount of $6,000 have been voted for sinking an artesian well.

Columbus, O.—The contract for water pipe has been awarded to the United States Cast Iron Pipe & Foundry Co. at their revised bid of $23.30 per ton for pipe and $46 for special.

Worcester Mass.—The Board of Aldermen and the Common Council have adopted the order authorizing the Water Department to construct a dam on Kettle Brook at a cost of $120,000.

Highbridge, N. J.—Smith & Jenkins, of Dover, N. J., are stated to have been engaged to prepare plans and specifications and to supervise the construction of a 2,000,000 gal. storage reservoir.

Marshfield, Wis.—The Council is reported to have voted to extend the water mains.

Joliet, Ill.—Judge Dibell on July 8 issued an injunction restraining the city from building a new water works system.

Englishtown, N. J.—Boro. Engr. E. F. Ried writes that it was voted on July 9 to issue $5,000 bonds for water-works.

Centralia, Ill.—Local press reports state that bids will be received by the Water Committee until Aug. 6 for constructing, on site of proposed reservoir, a dam 360 ft. long, 100 ft. through at the base, 20 ft. at the top and 18 ft. high.

Hattiesburg, Miss.—City Clk. A. Fairley writes that on July 2 bonds were sold for water-works.

Hempstead, L. I., N. Y.—The resolution to purchase the Hempstead Water Companies' plant for the sum of $50,000 carried at the special village election held July 5.

Lebanon, Pa.—Bids opened July 1 for a water pipe line between Red Bridge and Poplar Run were from Hawman Bros., of Reading (awarded), and Thos. J. Humphreys, the totals being, according to local press reports, $37,940 and $35,884 respectively.

Pontiac, Mich.—The proposition to issue $50,000 water-works improvement bonds is stated to have carried at the election held July 8.

Norfolk, Va.—The Common Council has voted against the recommendation to adopt water meters.

Huntington, W. Va.—The Citizens' Water Co., of Huntington, has been incorporated for the purpose of building and operating a water-works plant; capital, $100,000; incorporators, J. L. Hawkins, J. W. Valentine, and others of Huntington.

Hull, Que.—Press reports state that the City Council has awarded the contract for 2 sets of duplex power pumps, each having a capacity of 3,000,000 gal. per day, with turbine wheels, shafting, etc., for the new pumping station, to the Caledonia Foundry Co., of Montreal, for $25,727.

Mitchell, Ore.—Water-works construction is said to be contemplated.

Harrisburg, Pa.—The Finance Committee has reported in favor of an appropriation of $10,000 for new boilers at the water-works.

Pittsburg, Pa.—Bids are wanted July 19 for furnishing and delivering 2 pulsometer steam pumps at the Brilliant pumping station. Edw. M. Bigelow, Dir. Dept. Pub. Wks.

Waitsburg, Wash.—The Town Council has authorized the construction of 4,200 ft. of new water mains.

Park River, N. D.—Water-works and electric light bonds to the amount of $19,800 were sold recently.

Springfield, O.—President Schuster, as Chairman of the Water-Works Committee, in a report to the Council recommends the sinking of more wells.

Kansas City, Mo.—Bids are wanted July 26 for furnishing material and laying 5,700 ft. of 30-in. water pipe. Harry B. Walker, Secy. Bd. Pub. Wks. & Water Commrs.

Sardis, Miss.—It is stated that contracts are about to be let for the construction of a water-works plant.

Norristown, Pa.—The stockholders of the Norristown Insurance & Water Co. have voted to increase the capital stock from $300,000 to $450,000.

Hawkesbury, Ont.—A vote of the people will be taken on the proposition to construct water and light plants at a cost of $100,000.

Barrackpore, Calcutta, India.—Bids will be received by the Commissioners of the corporation of Calcultta Water-Works Dept., until Sept. 2 for the supply, delivery and erection of a pumping plant at the Pulta pumping station, near Barrackpore, consisting of 2 pumping engines and 4 steam boilers, capable of delivering 1,000,000 gals, of water per hour, to a maximum height of 33 ft. Specification, general condition and plan of pumping station may be obtained upon application at the office of "Engineering," London, Eng. Fred Gainsford, Secy. of the Corporation.

SEWERAGE AND SEWAGE DISPOSAL.

Passaic River Valley, N. J.—The State Sewerage Com. has divided the valley into three districts, and appointed Jas. Owen engineer of the lowest and middle districts, and Messrs. William Ferguson, Colin R. Wise and Robert Watson joint engineers of the highest district. They are to report by October 1 on the advantages and cost of a number of different methods of disposing of the sewage of the cities and boroughs in the valley.

Cincinnati, O.—The Board of Public Service has adopted plans for a sewer system in Riverside to cost $15,000.

Battle Creek, Mich.—City Recorder G. W. Hamm writes that on July 1 it was voted to issue bonds for sewers and bridges.

Medford, Mass.—The Sewer Commissioners have ordered the construction of sewers in 4 streets, work to be done under the supervision of the City Engineer.

Burlington, Ia.—The City Council has ordered the construction of Franklin St. sewer, length 2,500 ft., 24 to 8-in. tile. Emmet Steece, City Engr.

Lockport, N. Y.—The contract for constructing about 2,000 ft. of 12-in. sewer and 6-in. water main in Prospect and other streets has been let to C. B. Whitmore for $5,950. The contract for constructing concrete box culverts over portions of Eighteen Mile Creek has been let to the Sherrill Contracting Co. for $10,850.

South Portland, Me.—City Clk. Wm. E. Allen writes that surveys are being made for sewers in several streets. F. W. Richardson, Chmn. of Com. C. W. Fenn of Portland, Engr.

Springfield, Mass.—City Engr. Chas. M. Slocum writes in regard to the proposed extension of Mill River Valley sewer, that surveys and borings are now being made to determine the cost;. the sewer may not be built this season and it is still uncertain whether it will be constructed by day labor or contracted for.

Campbellton, N. B.—Willis Chipman, of Toronto, Ont., Engr. in Charge, writes that the contract for constructing a sewer system has been awarded to Murdock Mann, of Campbellton, for $42,000. 18 to 9-in pipe will be used; trench to average 10 ft. in earth and rock.

Rochester, N. Y.—City Engineer Fisher is said to be in favor of deepening the present Clifford St. sewer, estimated cost $7,000, and constructing a new sewer in Ave. A from Conkey Ave. to Loomis St., estimated cost $32,000.

St. Joseph, Mo.—The Council has passed an ordinance appropriating $8,000 for the construction of the 24th St. sewer.

Findlay, O.—City Engr. John W. S. Riegle writes that the contract for sewer construction in Liberty and Sandusky Sts. has been awarded to McGarry & Isbell, of Akron, for $27,991. The work includes 16,829 ft. of 54-in. to 6-in. brick and pipe sewers, 25 manholes, 67 catch basins and 1 flush tank. The trench to average 12 ft. in depth and be excavated in earth and rock .

Grand Forks, N. D.—The only bid received for the construction of the Fifth District sewer was from P. McDonnell, of Duluth, and is said to have been approximately $43,000 for the main sewer and $5,000 for the single lateral.

Port Clinton, O.—City Clk. Wm. Cleaver writes that the contract for constructing a sewer in Sewer District No. 8 has been awarded to A. M. Slaymaker, of Port Clinton, for $3,602. The work includes 2,400 ft. of 10 to 24-in. pipe sewer, 8 manholes and 20 catchbasins. Average cut, 7½ ft.

Mt. Vernon, O.—Bids are wanted July 20 for a lateral tile sewer in portions of Sewer Districts No. 1 and 2. W. A. Hosack, City Clk.

Wabash, Ind.—City Engr. Robt. P. Woods writes that bids will be received Aug. 12 for a sanitary sewer in Wabash St.

Concordia, Kan.—Bids are wanted Aug. 5 for a sewerage system. E. C. Witcher, City Clk.

Laramie, Wyo.—Local press reports state that bids will be received by the City Council until Aug. 6 for sewers in portions of 3 streets.

Woodbury, N. J.—Press reports state that the following bids were opened July 9 for the construction of a system of sewers: American Artificial Stone Pavement & Construction Co., $48,825; A. Costa, $60,734.34; Harrison Construction Co., $53,792,60; George W. Ledlie, of Philadelphia, $53,950.

Livermore Falls, Me.—John A. Jones of Lewiston, Me., has been engaged to make a survey and plans for a complete sewer system.

Coraopolis, Pa.—Bids are wanted July 15 for constructing 10-in. lateral sewers in portions of 5 streets. H. W. Burns, Chmn. Street Com.; Edeburn, Cooper & Co., Boro. Engrs., 410 Grant St., Pittsburg.

Dunkirk, N. Y.—Contracts for the construction of two sewers will be let July 16, each sewer to be 350 ft. long, 10-in. tile, average cut about 8 ft. Jas. P. Morrissey, City Engr.

Spring Garden, Pa.—Bids are wanted July 18 for constructing about 1,200 ft. of sewer and 1,200 ft. of stone wall on Spring Garden Ave. Knopf & Milholland, Boro. Engrs., 413 4th Ave., Pittsburg.

Cleveland, O.—Bids are wanted by the City Auditor Aug. 5 for $400,000 intercepting sewer bonds.

McMinnville, Ore.—H. S. Maloney, City Surveyor will receive bids for constructing a sewer.

Akron, O.—J. W. Payne, City Engr., writes that all bids opened July 6 for a main trunk sewer in District No. 9 have been rejected and new bids will be opened Aug. 5. Estimated cost $7,900.

Gainesville, Ga.—The Sanitary Sewer Co. of Philadelphia, is in correspondence with the city officials in regard to the construction of a sewerage system for Gainesville.

Montevideo, Minn.—Recorder J. M. Severens writes that there has been some talk of constructing a sewer system, but nothing definite has as yet been done.

Beaumont, Tex.—Press reports state that $75,000 bonds have been voted for sewers and $40,000 bonds for paving.

Dubuque, Ia.—Bids are wanted July 18 for 1,500 lin. ft. of tile pipe sewer in W. Locust St. For specifications address the City Recorder.

Stanley, Wis.—Preliminary surveys for a sewerage system are said to be under way.

Waynesburg, Pa.—Bonds to the amount of $17,000 were sold recently for a sewerage system.

Alpena, Mich.—The Common Council has decided to build a 25 x 30-in. brick sewer from Thunder Bay River to the bay. Estimated cost, $7,766.

Birmingham, Ala.—Bids are wanted Aug. 7 for sanitary and storm sewers, estimated to cost $25,000. Julian Kendrick, City Engr.

Milwaukee, Wis.—Bids are wanted July 18 for a pipe sewer in a portion of 11th Ave. Chas. J. Poetsch, Chmn. Bd. Pub. Wks.

Gloversville, N. Y.—Bids are wanted July 15 for 2,118 ft. of 10-in. pipe sewers, 53 10-in. specials, 1,040 lin. ft. trenching, 8-9 ft. deep; 2,224 lin. ft. trenching, 17-18 ft. deep, 8 manholes and one lamphole. M. V. B. Stetson, City Clk.

Sault Ste. Marie, Ont.—Sewer contracts are stated to have been awarded as follows: Section A, to M. McCarty, of Sault Ste. Marie, for $24,495, and Section B to J. H. McKnight, for $19,000.

Bowling Green, O.—The Council has passed a resolution declaring necessary the construction of sewers in several streets. Alex. Williamson, City Clk.

La Grange, Ill.—The Village Board on Aug. 5 will receive bids accompanied by plans and specifications for the purification of the sewage of La Grange. Wm. B. Ewing, City Engr.

New York, N. Y.—Bids are wanted July 24 for vitrified pipe sewers in 2 streets and receiving basins in 1 street, Boro. of Bronx; also for a stoneware pipe sewer in a portion of 18th St., Boro of Brooklyn. Jas. Kane, Commr. of Sewers.

Lancaster, Pa.—The Street Committee of the Councils has under consideration sewer extensions estimated to cost $200,000.

Redwood Falls, Minn.—City Recorder C. G. Johnson writes that the contract for sewer construction (bids opened July 2) has been awarded to Frasier & Elliott of Rochester, Minn., as follows: 3,720 ft. 8-in. pipe at 18 cts. per ft.; 6 straight manholes at $32.50; 3-junction manholes at $35; 10 lampholes at $5; 1 flush tank, $50; 580 ft. 6 to 8-ft. excav. at 25 cts.; 1,800 ft. 8 to 10-ft. excav. at 30 cts., and 1,340 ft. 10 to 12-ft. excav. at 40 cts.; total, $2,290.

Monroe, La.—The City Secretary writes that the following bids were opened June 28 for sewer construction; the work to include 58,000 ft. of 6 to 15-in. pipe sewer, 121 manholes and 42 catch-basins; the trench to average 16 ft. in depth: Fudicker & Duffey, Monroe, La., $36,511; Robt. C. Storey, Ft. Worth, Tex., $38,068; P. J. Mooney & Co., Nashville, Tenn., $38,165; Guild & Co., Chattanooga, Tenn., $50,092; C. M. Burkhalter & Co., Birmingham, Ala., $34,569. Engineers, Shurman & Brown of Nashville, Tenn.

Schenectady, N. Y.—J. Lehland Fitz Gerald, City Engr., writes that the following bids were opened July 2 for the construction of Briggs Plot sewers: John McDermott, $31,235; John Allen (awarded), $24,773; Beckwith Bros., $25,375; G. W. Van Vranken, $35,885; Brayer & Albaugh, $25,848. The detail bid of John Allen was as follows: Sewer pipe, 2,000 ft. 10-in. at 24 cts.; 9,600 ft. 8-in. at 20 cts.; 26 manholes at $48; 6 flush tanks at $60; rock excava., 3,000 ft. at $2.95. Excavation: 2,500 ft., 0 to 7 ft., 65 cts.; 2,000 ft., 7 to 9 ft., 90 cts.; 2,000 ft., 9 to 11 ft., $1; 2,000 ft., 11 to 13 ft., $1.40; 1,000 ft., 13 to 15 ft., $1.45; 1,000 ft., 15 to 17 ft.; $1.50; 400 ft. 17 to 19 ft., 55 cts.; 400 ft., 19 to 21 ft., 60 cts; 400 ft., 21 to 23 ft., 70 cts.

Sacramento, Cal.—The following bids were opened July 1 for the construction of 25th St. sewer, work to include 3,170 ft. of egg-shaped sewer:

Items and Quantities.	Williams, Belser & Co.	T. M. Burns.	A. L. De Roza.	Geo. Murray & Son.	City Street Imp. Co.
545,000 brick, per M...	$19.80	$24.00	$25.75	$32.00	$24.27
1,200 lin. ft. 18-in. pipe	1.56	1.20	1.20	1.49	1.05
12 m. h. fr'm's & cov's	8.95	9.00	15.00	9.00	11.00
Sewer pipe:					
1,000 ft. 8-in..........	.35	.50	.50	.35	.30
1,000 ft. 6-in..........	.10	.02	.40	.25	.08
100 cu. yds. loose rock	.75	.10	3.00	3.00	2.00
Total	$13,295	$15,158	$16,854	$20,236	$15,199

The contract was awarded to Williams, Belser & Co., of San Francisco.

Fond du Lac, Wis.—The contract for building an intercepting sewer and purification plant was awarded June 26th to Richard J. Bloedel for $33,000, although the itemized statement given below of bids opened June 24th does not give his name as a bidder. Geo. S. Pierson, of Kalamazoo, Mich., engineer:

Bidders.	24-in. pipe sewer.	Manholes.	S. W. overflows.	Grit chamber.	Iron pipe.
J. H. McCarthy, Chicago..........	$3.10	$48	..	..	$52
Jas. Healy & Son, Morgan Park, Ill.	3.05	30	$25	$50	65
C. L. Pierce, Fond du Lac..........	2.92	40	..	..	55
Harding & Nelson, Racine..........	2.79	54	65	80	60
H. J. Christianson, J. P. Peterson, Oshkosh	3.07	43	60	..	..
Chris. Johnson, Oshkosh..........	3.00	49	55	..	..
Hansen & Thomson, Racine........	3.04	45	90	60	50
Reichert Const. Co., Racine........	3.06	46	90	60	50
J. Rasmussen & Son, Oshkosh....	3.35	60	..	70	70
J. H. Green & Son, Appleton, Wis.	3.18	60	..	..	65

Bids received at the same time for, *a* pumping station, *b* pumping machinery and *c* purification plant were as follows: Matt Dries, Fond du Lac, *a*, $2,528; E. Yoemans, Chicago, *b*, $2,923 vertical motor (awarded); C. L. Pierce, *c*, $12,200; Harding & Nelson, *c*, $14,000.

BRIDGES.

Manhattan, Kan.—County Clk. C. M. Breese writes that the County Commissioners on July 3 appropriated $3,500 toward the construction of a bridge to cross Kansas River.

Somerville, Mass.—The Metropolitan Park Commission, Boston, proposes to construct a bridge over Mystic River between Somerville and Medford, definite plans have not yet been prepared. Appropriation, $200,000. Wm. T. Pierce, Engr. of Com.

Perry, N. Y.—The proposition to construct a $7,000 iron bridge across the outlet of Silver Lake carried at the recent election.

Everett, Mass.—A report and estimate has been submitted to a Commission appointed by the court for the abolishment of the grade crossing over Boston & Albany and Boston & Maine R. R. tracks, the City of Everett and railroad officials practically agreeing as to the location and form of construction, although a final report and recommendation has not been made by the Commission. Width of bridge 80 ft., length of span 80 ft.

Battle Creek, Mich.—See "Sewerage and Sewage Disposal."

Fairport, N. Y.—Town Clk. Chas. W. Butler writes that it was voted June 1 to issue $3,000 bonds for a stone arch bridge to cross Irondequoit Creek.

Luzerne, N. Y.—The Owego Bridge Co., Owego, N. Y., is reported to have received the contract for constructing a bridge across Hudson River, between Luzerne and Hadley, for $5,375.

Wheeling, W. Va.—See "Paving and Roadmaking."

Utica, N. Y.—Local press reports state that bids will probably soon be asked for constructing 2 bridges across Mohawk River. Appropriation, $65,000.

Brighton, Colo.—The American Bridge Co. is reported as having submitted the lowest bid for constructing a bridge at Brighton, for $9,500.

Clarksdale, Miss.—Bids are wanted Aug. 5 for constructing a 450 ft. steel bridge across Sunflower River. M. J. Bouldin, Clk. Bd. Co. Supervisors.

Quincy, Mass.—Bids have been asked for plans and specifications for a steel foot bridge to cross the tracks of the N. Y., N. H. & H. R. R. at Wollaston. Address, C. F. Knowlton, Commr. of Pub. Wks., Quincy.

New Brunswick, N. J.—Bids are wanted July 17 (extension of date) for constructing a steel bridge across Woodbridge Creek, at Perth Amboy, near Maurer Station. Asbury Fountain, Dir. Bd. Chosen Freeholders.

Hazleton, Pa.—Bids are wanted by the Keystone Improvement Co., at Hazleton, until July 15 for grading, culverts and bridge masonry, steel bridges, cross ties, track laying, fencing, etc., on Wilkesbarre & Hazleton Ry. A. E. Hess, Engr.

Flint, Mich.—A. W. Hall, City Engr., writes that the construction of a bridge across Flint River on Saginaw St. is contemplated, clear span 125 ft., width 99 ft.; the bridge will be either an arch concrete structure or heavy girders with pier in the center. Plans not yet completed.

Erie, Pa.—The Select Council has adopted a resolution directing the city engineer to draw specifications and estimate cost of constructing an overhead bridge on Buffalo road across the P. & E. tracks suitable for street cars and vehicles.

Canon City, Colo.—It is stated that bids will soon be asked for the construction of 2 bridges, one across Four Mile, the other across Beaver Creek.

Wellsville, O.—Press reports state that Watson C. Johnson of Chicago, has given options on the land to be used for approaches and piers for a bridge which Pittsburg capitalists expect to construct between Congo, W. Va., and Wellsville.

Richmond, Va.—Plans have been completed for Lombardy St. improvements. The improvement includes the grading and opening of Lombardy St., the construction of a $3,000 culvert across Shockee Creek and the construction of a steel viaduct connecting Lombardy St. with Virginia Union University grounds.

Victoria, B. C.—Local press reports state that the ratepayers have passed the loan by-laws to build 2 permanent bridges, pave Main St. with wooden blocks, and build a high school, the aggregate expenditure for which is $286,000. Press reports also state that the Street Railway Co. will spend $200,000 on bridges and in the improvement of its system.

Cincinnati, O.—Local press reports state that C. L. Stroble has secured the contract for the reconstruction and extension of the West Liberty St. viaduct, and Thomas Maloney, the contract for the substructure of the same at $22,920 and $5,332, respectively.

Topeka, Kan.—City Engineer McCabe estimates the cost of constructing a steel bridge 70 ft. long and 22 ft. wide, at Kansas Ave., at $3,500. Estimates may also be prepared for a Melan arch bridge.

Davenport, Ia.—Press reports state that the Davenport, Rock Island & Northwestern Ry. Co. will construct a viaduct at 12th St. C. H. Dearborn, Ch. Engr., Davenport.

Seattle, Wash.—The County Commissioners have passed resolutions in favor of a 90 ft. span for the drawbridge to be erected over the east branch of the Duwamish River, constituting part of the east canal waterway.

Asbury Park, N. J.—The American Bridge Co. is reported to have received the contract for constructing a steel and iron bridge across Sunset Lake for $17,500.

Tacoma, Wash.—Bids are wanted Aug. 1 for constructing a steel bridge across Puyallup River, at the Indian Reservation, near Tacoma. J. H. Davis, Co. Aud.

Topeka, Kan.—Separate bids are wanted July 23 for two 44-ft. and one 48-ft. low truss steel bridge in Tecumseh Township; for various bridge supplies including steel I beams, steel channel beams, etc., also for 3 steel bridges to cross Kansas River. Scott Kelsey, Chmn. Bd. Co. Commrs.; Jno. M. Wright, Co. Clk.

Helena, Mont.—Local press reports state that bids will be received by the County Commissioners until Aug. 2 for constructing 2 steel bridges, one across Flat Creek, the other across upper Du Bray Creek.

Bowling Green, O.—It is stated that J. N. Bick, of Toledo, has received the contract for constructing the substructure of a bridge to cross the Maumee River, for the Terminal R. R. Co. Probable cost, $60,000.

Miami, Fla.—The Converse Bridge Co., Chattanooga, Tenn., is reported to have secured the contract for constructing a bridge across Miami River at Ave. D for about $10,000.

Pakenham, Ont.—Bids are wanted July 26 for the iron superstructure and masonry work of a bridge, to be 232 ft. long, between abutments, across Mississippi River at Pakenham. James Connery, Township Clk.; Robt. Surtees, Engr., 110 Wellington St., Ottawa.

Boston, Mass.—Supt. of Streets Wheeler has awarded a contract to John Cashman, of Boston, at $14,990, for building abutments in extension of the existing abutments for the Bennington St. bridge, over the Boston, Revere Beach & Lynn R. R., East Boston. The work calls for an abutment 174 ft. long on one side and one 142 ft. on the other side; the height will be 23 ft. and the width at the base 9 ft.

Norristown, Pa.—Bids are wanted Aug. 7 for constructing a steel and concrete bridge across Tacony Creek, Cheltenham township, also bids for a stone arch bridge on Belmont Ave., Lower Merion township. John H. Dager, Engr.; John Hampton, Chmn. Co. Commrs.

Peoria, Ill.—Bids are wanted July 16 for constructing a steel, iron or stone arch across Wolfe Run, in Trivoli township; for a 50-ft. low truss steel bridge, with 10-ft. approaches, also a 50-ft. low truss bridge, on 17-ft. eye beams, across Big Run Creek. Marion Maple, Commr. of Highways.

Bay City, Tex.—The proposition to issue $40,000 bonds for the purpose of constructing a bridge across Colorado River near Bay City, carried at the recent election.

Terre Haute, Ind.—The working plans for the Wabash River bridge have been prepared and show that the bridge will have 5 spans of 120 ft. each and 2 of 90 ft. each. The roadway will be 30 ft. in the clear, with a brick pavement, and 2 sidewalks each 8 ft. in the clear. The Engineer's estimate of the total cost is $169,000.

Lansing, Mich.—The Grand Rapids, Grand Haven & Muskegon Electric R. R. Co. has filed plans with the Railroad Commissioner for overhead bridges to cross the Detroit, Grand Haven & Milwaukee, Ry. at Berlin and Spring Lake, and the Pere Marquette at Picand's Junction; also for a grade crossing with a Pere Marquette spur track at Fruitport.

Dyersburg, Tenn.—Bids are wanted July 27 for a steel bridge across Pond Creek, on Dyersburg and Friendship road, having one 60-ft. span, 2 30-ft. spans and 2 16-ft. approaches. W. R. Hayes, Chmn. Com.

PAVING AND ROADMAKING.

Everett, Mass.—Orders have been passed by the City Council for the following work to be done by city labor: 23,662 lin. ft. edgestone, to be laid at a cost of $17,000; 5,370 sq. yds. brick paving, cost $5,300, and 1,500 sq. yds. concrete, cost $1,200; $26,000 worth of macadamizing is also to be done.

Bay City, Mich.—City Comptroller T. W. Moore writes that contracts for about 20,000 sq. yds. of paving have been awarded as follows: To Hugh Campbell of Bay City the street paving, exclusive of street and alley crossings, vitrified brick to be used at a total of $25,200; to W. J. Meagher of Bay City, street and alley crossings and wings, with vitrified brick for $15,000.

Brooklyn, N. Y.—Bids are wanted July 23 for 25,906 sq. yds. granite block paving. James P. Keating, Commr. of Highways, N. Y. City.

Chester, Pa.—Bids are wanted July 15 for brick pavement on a portion of 24th St. and sheet asphaltum on a portion of Rose St. W. T. Cullis, Chmn. Street Com.

Spring Garden, Pa.—Bids are wanted July 18 for grading, paving and curbing Spring Garden Ave., in Borough of Spring Garden. Knopf & Milholland, Boro. Engrs., 413 4th Ave., Pittsburg.

Michigan City, Ind.—City Engr. H. M. Miles writes that bids will be received July 22 for paving Washington St., about 18,000 yds., with either asphalt or brick.

Sioux City, Ia.—Bids will be received about Aug. 1 for about 3,600 sq. yds. of asphalt paving on 6-in. natural cement foundation, also for 1,550 sq. yds. of brick paving on 4-in. Portland cement foundation. J. M. Lewis, City Engr.

Toledo, O.—Bids are wanted Aug. 5 for block pavement on a portion of Empire St. John E. Connell, City Clk.

Denver, Colo.—Bids are wanted July 18 for grading, curbing and macadamizing a portion of Grant Ave.; also for grading, curbing and paving several streets in "Broadway Paving Dist. No. 1." R. W. Speer, Pres. Bd. Pub. Wks.

Muskegon, Mich.—The Luten Engineering & Construction Co., of Grand Rapids, has received contracts for paving two streets at $1.23½ per sq. yd. using Metropolitan block; Peck St., 15,202 sq. yds., and 9,820 lin. ft. combination curbs and gutters; total, $22,692. Terrace St., 8,094.71 sq. yds., and 4,206 lin. ft. combination curbs and gutters, total, $11,599.

Westerly, R. I.—Bids are wanted July 15 for furnishing 4,000 tons of crushed stone, size ¼ to 2½ in. Sydney A. Chapman, Chmn. Highway Com.

Cleveland, O.—Bids are wanted by the County Commissioners until July 31 for grading, draining and paving a portion of Noble road. Julius C. Dorn, Clk.

Albany, N. Y.—The Board of Contract & Supply has awarded to Warner-Quinlan Co., of Syracuse, the contract for resurfacing Madison Ave. with asphalt, at $1.23½ per sq. yd.; total, $59,800.

Wellsville, O.—The Council has adopted plans, specifications and estimates for paving portions of the following streets: Commerce St., $7,738; 4th St., $5,825; Clark Ave., $16,423; 1st St., $2,641; Lisbon St., $7,869; East Liverpool St., $8,899.

Wheeling, W. Va.—City Engr. C. W. Lohse and Ass't. Engr. H. L. Arbenz have prepared plans for the relocation of the county road at the "Top Mill" at the north end of the city. The proposed relocation will necessitate an estimated expenditure of $45,031, of which $31,500 will be required for two overhead railroad crossings to consist of about 800 ft. of steel viaduct and two bridges, each having a 100-ft. span. The City Council has not yet acted on the proposed improvement.

New York, N. Y.—Bids are wanted July 23 for 28,340 sq. yds. asphalt block pavement on several streets and furnishing material and constructing a system of drains in a portion of 12th Ave., Boro. of Manhattan; also for 31,900 sq. yds. granite block and 6,625 sq. yds. asphalt block pavement, including sidewalks, etc., in Boro. of Bronx. James P. Keating, Commr. of Highways.

Cincinnati, O.—The Board of Public Service has approved ordinances, to pave with brick, on portions of Fenton Ave. and Pugh Alley.

Resolutions have been passed by the Board of Public Safety to improve portions of 6th and Hill Sts. with boulders at a cost of $16,313 and $15,114 respectively; also a portion of Wade St., with asphalt, cost $6,526.

Belair, Md.—Bids received for building Woolsey road, a distance of 5½ miles, have been rejected, the lowest bid received being $15,000.

Louisville, Ky.—It is stated that the Green River Asphalt Co. has received the contract to reconstruct a portion of Broadway between the street railway tracks at $1.44 per sq. yd. Appropriation, $19,800.

Milwaukee, Wis.—Contracts amounting to $30,000 have been awarded, according to local press reports, as follows: To Western Paving & Supply Co., portion of 3 streets, in all 12,965 sq. yds., at $2.21 and $2.23 per sq. yd; to Barber Asphalt Co., State St., 813 sq. yds., at $2.25 per sq. yd.

Willimantic, Conn.—The proposition to appropriate $9,000 for the improvement of highways in the town, during the next 2 years, carried at the recent election.

Newark, N. J.—Local press reports state that David Harper has secured the contract for granite block pavement on Kossuth St. (8,700 sq. yds.) at $16,686.

Utica, N. Y.—Engineers in the employ of the street railway companies estimate the cost of improvements to be made in Bleecker St. at a total of $125,000. Of this amount $40,000 will be for paving alone.

Pittsburg, Pa.—The County Commissioners have, it is reported, awarded contracts for improving 3 miles of Dairy Farm road, to Booth & Flinn at $42,034, and for improving 3 miles of Banksville road, to Keeling & Ridge, at $66,870.

Portsmouth, O.—The City Council on July 3 passed resolutions to pave three streets with brick: Market St., 4,906 sq. yds.; 5th St., 8,530 sq. yds., and N. Waller St., 13,667 sq. yds.

Buffalo, N. Y.—The Street Committee has voted to award contracts as follows: Repaving Seventh St. with asphalt to Warner-Quinlan Asphalt Co. for $7,595; repaving Ohio St. with asphalt to the Interstate Paving Co. for $14,000.

Washington, D. C.—The contract for paving with sheet asphalt (bids opened June 1) is stated to have been awarded to the Warner-Quinlan Asphalt Co., of Syracuse, N. Y., at $1.72 per sq. yd.

Des Moines, Ia.—G. A. Eberhart, of the Board of Public Works, writes that the contract for constructing 4,332 sq. yds. of brick pavement, with 6-in. concrete foundation, Portland cement top filler on W. 11th St. has been awarded to J. O. Likes, of Des Moines, Ia., at $1.68 per sq. yd.

Paterson, N. J.—Bids are wanted July 15 for grading and macadamizing portions of 5 streets. John Blauvelt, Chmn. Road Com., Co. Bd., Chosen Freeholders.

Wabash, Ind.—City Engineer Robt. P. Woods writes that bids will be received Aug. 12 for 1,200 yds. asphalt pavement and 6,000 lin. ft. cement curb and gutter.

St. Joseph, Mich.—It is stated that bids are wanted July 18 for 10,500 sq. yds. brick paving, 9,000 sq. yds. asphalt paving and 5,000 lin. ft. cement curb. W. J. Cleary, City Engr.

Beaumont, Tex.—See "Sewerage and Sewage Disposal."

Maryville, Mo.—Street paving bonds to the amount of $30,000 were voted July 9.

Rockport, Ind.—The contract for building 23 miles of rock road is stated to have been awarded to Henry W. Eigenmann, for $58,510.

Davenport, Ia.—Bids are wanted July 16 for furnishing macadam for repairing macadamized streets; also for furnishing stone for police station. Thos. Murray, City Engr.

Milwaukee, Wis.—Bids are wanted July 18 for brick pavement on streets in the 2, 4, 6 and 7 wards. Chas. J. Poetsch, Chmn. Bd. Pub. Wks.

Birmingham, Ala.—Bids are wanted Aug. 7 for 7,000 sq. yds. cement sidewalks, 73,000 ft. stone curbing; macadam 86,000 cu. yds., excavation, 29,000 cu. yds. slag and 26,000 cu. yds. chert. Julian Kendrick, City Engr.

Mt. Vernon, Ind.—City Clk. Frank Smith writes that all bids opened July 8 for asphalt paving in two streets have been rejected and new bids will be asked.

Boone, Ia.—City Engr. Chas. E. Russell writes that the contract for paving in Allen and 7th Sts. with brick on a 6 in. concrete foundation was let July 3 to Wm. Palmer, of Boone, at the following prices: approximately 3,500 sq. yds. of paving at $1.78; 1,000 lin. ft. 8-in. cement curb at 45c.; extra excavation, at 25c. per cu. yd.; 100 sq. yds. paving to be taken up and relaid, at 15c. per sq. yd.

St. Paul, Minn.—Local press reports state that the Barber Asphalt Paving Co. submitted the lowest bid July 1, for paving as follows: A portion of Minnesota St. with asphalt $5,647; Engineer's estimate, $7,000; with sandstone, $12,158; Engineer's estimate, $12,153; a portion of Jackson St., with asphalt, city's portion, $6,427; Street Ry's portion, $5,467; Engineer's estimate, $8,075 and $6,477 respectively; portions of Decatur and Beaumont Sts., with brick, total bid, $9,848; Engineer's estimate, $11,439.

St. Louis, Mo.—Waller Edwards, Secy. of the Board of Public Improvements, writes that contracts for reconstructing certain streets and alleys (bids opened June 28) have been awarded as follows: To Gottlieb Eyermann, of St. Louis, 712 sqs. Chouteau St. with brick pavement on 6-in. concrete base, granite curb, for $19,679. To John F. McMahon, St. Louis, 189 sqs. Franklin Ave., with limestone curb, and vitrified brick paving on 6-in. concrete for $4,130. To J. E. Perkinson, of St. Louis, several small contracts, amounting in all to $10,107.

Minneapolis, Minn.—The following bids were opened June 28 for furnishing and delivering vitrified paving brick to be used by the city during the season of 1901: The Barr Clay Co., Minneapolis, 14,000 yds. of No. 1 repressed brick, 57 to the yard at $17 per M.; 8-in. specials at $22 per M., and 4-in. specials at $18 per M. Flint Brick Co., Des Moines, Ia., 7,000 sq. yds. brick at 96c. per sq. yd., specials $1.25 per sq. yd. Purrington Paving Brick Co., Galesburg, Ill., No. 1 repressed paver at $17.25 per M.; 4-in. specials, $19 per M.; 8-in. specials, $22.65 per M. Higley, Keplinger & Co., Minneapolis, paving blocks, 41 to sq. yd., at $23 per M.

New York, N. Y.—The following bids were opened July 9 by Jas. P. Keating, Commr. of Highways, for repaving several streets with asphalt on the present pavement relaid as foundation: A, Broadway from 14th to Canal Sts.; B, West End Ave., from 79th to 91st Sts.; C, Seventh Ave., from Greenwich Ave., to 23rd St.; D, Madison Ave. from 116th St. to 125th St.

	Asph. pavt., sq. yds.	Stone pavt., relaid.	Concrete, cu. yds.	Curb, lin. ft. New.	Curb, lin. ft. Old.	Manhole and sewer covers.
A	30,900	25,900	730	4,150	950	119
B	16,400	16,480	.....	2,110	3,480	42
C	21,375	21,450	15	600	200	69
D	11,800	9,900	275	3,300	50	31
Barber Asphalt Paving Co.:						
A	$5.69	$.59	$6.75	$1.05	$.49	$24.00
B	2.73	.49	.....	1.05	.49	24.00
C	3.57	.52	6.75	1.05	.49	24.00
D	3.33	.52	7.00	1.05	.49	24.00
Warner-Quinlan Asphalt Co.:						
A	$6.23	$.80	$7.75	$1.15	$.47	$25.00
B	3.07	.65	.....	1.15	.47	25.00
C	3.49	.49	6.55	1.07	.47	25.00
Asphalt Construction Co.:						
D	$3.21	$.49	$6.80	$1.03	$.50	$24.00
Sicilian Asphalt Paving Co.:						
D	$3.03	$.51	$6.75	$1.06	$.60	$24.25

The high bids for the Broadway work are due to the expense of maintenance for 10 years on a street with double tracks and such an enormous traffic.

Decatur, Ind.—Bids are wanted July 27 for constructing macadam roads in East, West and South Jefferson Townships. Abe Boch, Co. Aud.

Wilkinsburg, Pa.—Boro. Engrs. Frease & Sperling write that the following bids were opened July 3 for about 17,788 sq. yds. of brick paving, and 14,989 ft. of curbing:

Bidders all of Pittsburg.	Grading, cu. yd.	Paving, cu. yd.	Curbing, lin. ft.	Stone under curb.	Total.
Ott Bros.	$.45	$1.48	$.55	$2.85	$44,663
Cronin & O'Herron........	.55	1.55	.60	2.00	45,577
Sweeney & Houston......	.55	1.55	.57	2.50	46,584

New Orleans, La.—The following bids were opened July 2 for paving a portion of Canal St. with asphalt:

Items and Quantities.	H. C. Spinks.	South'n Asp. Co.	Barber Asp. Co.	La. Imp. Co.
Asphalt, 116,000	$2.05	$1.36	$1.59	$1.44
Concrete:				
Artificial, 14,000	7.80	6.40	5.38	4.95
Natural, 14,000	7.00	6.00	4.45	4.88
Grading	1.00	1.00	.25	1.25
Curb, new, 5,500..........	.65	.45	.40	.45
Old	.50	.45	.40	.45
Granite corners	4.00	1.50	1.55	2.00
Com. curb and gutter, 15,900	1.80	1.20	.95	.85
Concrete gutter, 11,800..	.50	.20	.12	.20
Old curb relaid, 81,000...	.25	.15	.16	.10
Old wood curb relaid...	1.00	.15	.90	.90
Sub. lumber, 23,500.......	25.00	20.00	22.00	15.00
Piling (sheet)	40.00	35.00	35.00	39.00
Excavation, 10,250	1.50	1.00	.92	.73
Cinders	1.30	1.00	1.25	1.50
Gravel	2.60	2.25	2.07	2.50
Shells	2.50	1.40	2.00	2.50
Brick mas., 11,000........	.65	.55	.45	.35
Iron, 170,000	.06	.03½	.02½	.03
New wheel guards.....	10.00	9.00	8.00	10.00
Tile pipe, 3-in. agt., 28,000	.20	.20	.09	.065
Glazed pipe, 4-in., 3,000..	.60	.35	.12½	.15
Glazed pipe, 6-in.........	.80	.50	.20	.35
Glazed pipe, 8-in.........	1.00	.60	.24	.45
Glazed pipe, 10-in........	1.10	.70	.34	.60
Glazed pipe, 12-in., 10,000	1.40	.75	.40	.35
Glazed pipe, 15-in., 6,700.	2.00	1.00	.55	.50
Glazed pipe, 18-in., 5,500.	3.00	1.25	.66	.64
Glazed pipe, 21-in., 4,500.	4.00	1.35	.95	.83
Glazed pipe, 24-in., 850...	6.00	2.00	1.10	.99
Glazed pipe, 27-in., 850...	7.00	2.50	2.05	2.20
Glazed pipe, 30-in., 800...	8.00	3.00	2.35	2.68
Pavement relaid:				
Sheet asphalt	4.00	1.36	2.25	3.50
Rock asphalt, 140......	3.00	3.50	3.75	3.00
Vit. brick, 100..........	3.50	3.00	3.00	2.50
Belgian block	6.00	4.00	3.80	4.50
Square block	1.50	1.00	1.00	1.00
Cobble, 140	1.50	.70	1.00	.50
Gravel, 1,000	3.00	1.50	1.00	.50
Chert	3.80	3.00	3.45	3.50
Shell, 350	2.00	1.50	1.85	1.00
Shillinger	1.80	1.50	1.85	1.75
Flag	2.50	1.00	1.00	2.90
Brick	1.50	1.00	.95	1.40
Total	$532,608	$348,983	$336,243	$302,116

Albany, N. Y.—State Engineer Edward A. Bond writes that the following bids were opened July 2 for the improvement of public highways: a, Bid using local stone; b, using trap rock:

Name of Road.	Length.	Bidder.	Amount.
Troy and Brunswick.	3.05	Martin & Murray.	a $24,479
	3.05	Thos. H. Karr.	a 24,340 b 25,800
Southport Sec. 2.	3.40	Costello & Nagle.	b 34,187
	3.40	Chemung Co. Bd.	b 34,209
	3.40	Chambers & Casey.	b 37,264
	3.40	Swan & Murray.	b 33,108
Southport Sec. 3.	1.06	Chemung Co. Bd.	b 10,630
	1.06	Costello & Nagle.	b 10,634
	1.06	Swan & Murray.	b 10,013
South Broadway.	1.02	Chemung Co. Bd.	b 9,180
	1.02	Costello & Nagle.	b 9,167
	1.02	Swan & Murray.	b 8,466
White Plains.	3.21	Eldred & Johanknecht.	a 22,800
	3.21	Bellew & Merritt.	a 24,498
Waterford Sec. 1.	1.51	E. & J. E. Martin.	b 10,700
	1.51	Warner & Madigan.	b 13,140
	1.51	Parker & Flynn.	b 12,100
Cuyler.	.47	Town Board.	a 3,420
Chenango River.	1.76	Henry Richards.	a 14,800 b 17,800
	1.76	Chambers & Casey.	a 15,980 b 16,700
West Lake.	1.00	Chambers & Casey.	a 12,500 b 13,000
Fabius and Apulia.	2.00	Chambers & Casey.	a 21,000
Armonk-Mt. Kisco.	4.44	Eldred & Johanknecht.	a 34,200
	4.44	Bellew & Merritt.	a 36,253
Mt. Kisco-Bedford.	5.04	Bellew & Merritt.	a 40,815
Briar Cliff-Echo Lake.	2.65	Bellew & Merritt.	a 22,435
	2.65	McCabe & Duffy.	a 20,100
Hoags Corners.	3.15	Besch & Flynn.	b 10,700
	3.15	Thos. H. Karr.	b 9,450
Waterford Sec. 2.	5.03	Parker & Flynn.	b 41,100
	5.03	E. & J. E. Martin.	b 32,900
	5.03	Warner & Madigan.	b 44,100
Fairport.	3.03	Whitmore, Rauber & Vicinus.	b 34,900
	3.03	H. B. Hooker & Son.	b 28,000
	3.03	Chambers & Casey.	b 32,400
Pittsford.	1.30	Whitmore, Rauber & Vicinus.	b 13,200
	1.30	H. B. Hooker & Son.	b 11,000
	1.30	Chambers & Casey.	b 13,300

For bids received May 27 for this work see The Engineering Record of June 1.

POWER PLANTS, GAS AND ELECTRICITY.

Birmingham, Ala.—The Council has granted Caldwell Bradshaw and associates a franchise to construct and operate a gas plant in this city.

Salt Lake City, Utah.—The County Commissioners are stated to have granted the Utah Light & Power Co. a franchise to erect poles and wires for its southern extension.

Boulder, Mont.—The Missouri River Power Co. is stated to have received a franchise through Jefferson County.

Atlanta, Ga.—A press report states that a power plant is to be constructed on the Chattahoochee River, about eight miles from this city, at a cost of $1,000,000, which will supply power to Atlanta manufactories. F. W. Montgomery, President United Electric Company, New York, N. Y., and Capt. J. W. English, office Fourth National Bank, Atlanta, are reported interested.

Shakopee, Minn.—It is stated that bids will be received by the Electric Light Committee until July 19 for constructing an electric light plant.

Pottsville, Pa.—G. A. Berner, Town Clerk, writes that the contract for lighting the streets with electricity for a period of 5 years from February 15, 1902, has been awarded to The Edison Electric Illuminating Co., of Pottsville, at $55 per light per annum for open arc lights, and $18 per lamp per annum for incandescent lights.

Hastings, Mich.—The Thornapple Electric Co. of Hastings has been incorporated, with a capital of $100,000. It is reported that the new company expects to purchase water-power in Thornapple River.

Lompoc, Cal.—See "Water."

Chester, S. C.—J. Q. Davis, of Winnsboro, is reported to have purchased water-power on Catawba River, and will develop same and supply electric power to Chester, Lancaster and Rock Hill.

St. Paul, Minn.—The Imperial Mfg. Co. has been organized, and has petitioned the Council for a franchise for general lighting and heating. M. D. Flower, of the South St. Paul Stockyards Co., is president; M. P. Ryan, of the Butler-Ryan Co., vice-president.

El Paso, Tex.—See "Electric Railways."

Spray, N. C.—A charter is stated to have been granted to the Rockingham Co. of Spray, with a capital of $100,000, to develop water-power and operate mills and electric plants.

Faribault, Minn.—The Polar Star Electric Light Co. is reported to have petitioned the Council for a franchise for a heating system.

Ellisville, Miss.—This city has awarded to Newman-Sprauley Co. of New Orleans the contract for an electric light plant at $12,800.

Tullahoma, Tenn.—See "Water."

Albuquerque, N. M.—C. F. Resseguie, of Topeka, Kan., Gen. Supt. Santa Fe Route, is reported to have recommended the construction of a $30,000 electric light plant at this place, to light shops, depot, etc.

Greensburg, Pa.—C. S. Knight, of Ft. Wayne, Ind., representing the Allegheny & Westmoreland Heat, Light & Power Co., is stated to have petitioned the Council for a franchise. This company proposes to supply heat, light and power to all the towns within a radius of 25 miles of here.

Glace Bay, Canada.—Bids are wanted July 20 for the installation of an electric light plant, to supply 50 arc lamps of 1,200 c. p. and 2,000 incandescent lamps of 16 c. p., together with engines and complete steam plants necessary to operate the same. Michael McIntosh, Town Clk.

York Haven, Pa.—It is stated that the York Haven Water & Power Co., Maj. Geo. B. Burbank, Ch. Engr., 15 Wall St., N. Y. City, will receive bids about Aug. 15 for hydraulic and electric equipments.

Hawkesbury, Ont.—See "Water."

Ottumwa, Ia.—The City Clk. writes that on July 8 it was voted to grant a 25-year franchise to the Ottumwa Electric & Steam Heating Co.

ELECTRIC RAILWAYS.

Indianapolis, Ind.—The Indianapolis, Danville & Western Traction Co. has been incorporated with a capital of $10,000 to construct a line from this city to Danville. Directors: Leister and Walter T. Williams of Cincinnati, O.; George W. Gribbon of Dayton, Ky., and others.

Delaware, O.—The Marysville, Delaware, Sunbury & Mt. Vernon Ry. Co. has been incorporated, capital of $10,000 to construct an electric railway from Delaware to Mt. Vernon. Incorporators: L. McElroy, Mt. Vernon, O.; Jas. W. Holcomb, Cleveland, and others.

Attica, Ind.—The Fountain-Warren Traction Co. has been incorporated with a capital of $300,000 to construct and operate an electric railway in Attica, Covington and Veedersburg in Fountain County and Williamsport in Warren County. Directors: Chas. M. McCabe, Henry C. Martin and others.

Parkersburg, W. Va.—The Wood County Commissioners are stated to have granted the Parkersburg Industrial Co. a franchise to construct an electric railway on the south side of Little Kanawha River.

New Orleans, La.—A correspondent writes that a project is on foot for the formation of a company to secure franchise for electric railway in Algiers.

Ambler, Pa.—The Council is stated to have granted a franchise to the Lehigh Valley Traction Co. A. Markie, Mgr., Hazleton.

Dubuque, Ia.—The Dubuque, Vinton & Southwestern Ry. Co. has been incorporated to construct and operate railway and telegraph lines in Dubuque; capital $100,000. Incorporators: J. H. Shields, H. G. Torbert and others, all of Dubuque.

Gainesville, Ga.—The City Council is stated to have granted a franchise to the Gainesville & Dahlonega R. R. Co. to construct an electric railway in Gainesville.

Ballston Spa, N. Y.—The State Board of R. R. Commissioners is stated to have granted permission to the Ballston Terminal Co. to increase its capital to construct 20 miles of new road. A. B. Pine, Ch. Engr., Ballston Spa.

El Paso, Tex.—T. M. Barnsdill and C. R. Burchatt of Pittsburg, Pa., are stated to have purchased the mule car lines and the electric light plants of El Paso and Juarez, Mexico. It is stated that the motive power of the railways will be changed to electricity.

Atlanta, Ga.—The Council is stated to have granted the Atlanta Rapid Transit Co. a franchise on the Boulevard. F. M. Zimmermann, Supt., Atlanta.

Lexington, Ill.—Surveys are being made for an interurban electric railway to run from Lexington via Bloomington and Clinton, to Decatur. Chas. B. Griffin and H. W. Knight of Toledo are at the head of the project.

Hagerstown, Md.—The City Council is stated to have granted the Hagerstown Electric Ry. Co. a franchise for an extension of its line to Boonsboro. W. C. Hepperle, Supt., Hagerstown.

Freeport, (L. I.), N. Y.—The Village Trustees are stated to have granted a franchise to the Mineola, Hempstead & Freeport Traction Co.

Chambersburg, Pa.—The Council is stated to have granted franchises to the Baltimore, Westminister & Gettysburg Ry. Co., and the Chambersburg & Gettysburg Ry. Co.

Saugerties, N. Y.—The Saugerties & Palenvill R. R. Co. has been incorporated with a capital of $250,000, to operate an electric road 16 miles long from Saugerties to the station of the Otis Elevating R. R. Co., north of Palenville in the town of Catskill, with a branch running from Glasco to Saugerties. Principal office to be in Saugerties. Directors: R. N. Jackson, Middletown, Conn.; D. J. Gale, Jr., Saugerties; T. V. R. Brown, Kingston, and others.

Lexington, Ky.—The County Commissioners are stated to have granted a franchise to the Bluegrass Traction Co. to construct an electric railway between this city, Georgetown and Paris. Y. Alexander of Brooksville, is one of the directors.

Fond du Lac, Wis.—C. D. Smith secured the right of way for an interurban electric line from Fond du Lac to Oshkosh, a distance of 20 miles.

Windsor, Ont.—The Council is stated to have granted a franchise to the South Essex St. Ry. Co. to enter the city on Chatham and Arthur Sts.

Worcester, Mass.—The Directors of the Worcester Consolidated St. Ry. Co. are stated to have voted to expend $65,000 in improving the system. W. W. McKee, Ch. Engr., Worcester.

Norristown, Pa.—The Schuylkill Valley Traction Co. has awarded to A. G. Focht of Reading the contract to build its power house at Collegeville, total estimated cost, $75,000. Car-barn to be built on the outskirts of Norristown, at an estimated cost of $35,000, not yet contracted for. G. Holger, Gen. Mgr., Norristown.

Lafayette, Ind.—J. M. Monker and Fredk. Helfenberger of Indianapolis are stated to have petitioned the Tippecanoe County Commissioners for a franchise for an electric railway which they propose constructing from Lafayette to Frankfort.

Delaware, O.—The Columbus, Delaware & Northern Co., of which Jas. Loren is President, is stated to have purchased the Delaware Electric Ry. It is reported that it will be immediately extended to Greenwood Lake and the southern limits of the city.

North Amherst, O.—The Commissioners of Lorain County at Elyria are stated to have granted A. Baker a franchise to construct an electric railway from North Amherst to South Amherst.

Clinton, N. Y.—Mr. McCabe of Clinton, Mr. Harrison of Clark Mills and others are reported interested in the construction of an electric railway between Clinton and Westmoreland.

Valparaiso, Ind.—The Portage County Commissioners are stated to have granted a franchise to Wm. Freeman.

Pittsford, N. Y.—The Monroe County Electric Belt Line Co. is stated to have received a franchise.

Lowell, Wash.—C. K. Greene is stated to have received a franchise to construct an electric railway from Lowell to Snohomish.

Binghamton, N. Y.—C. F. Gales and Jas. Hickok, of Binghamton, are reported interested in the construction of an electric railroad from this city, or Port Dickinson, to Chenango Bridge, Lily Lake and Chenango Forks.

Wabash, Ind.—Articles of incorporation have been filed for the construction of an electric railway from Wabash to Lafayette, along the towpath of the abandoned Wabash & Erie canal. E. H. Shirk, of Peru, Ind., Pres.

The Wabash & Rochester Ry. Co. has been incorporated with a capital of $50,000 to construct an electric railway 33 miles long between Wabash and Rochester. Incorporators: John B. Litchem, Aaron Simons and others.

Concord, N. H.—The Concord St. Ry. has been sold to the Boston & Maine R. R. B. A. Kimball, Concord, and C. E. Morrison, Boston, Mass., are on the new board of directors.

Wilmington, Del.—The People's Ry. Co. is stated to have decided to double the capacity of its power plant. Richard W. Crook, Gen. Mgr.

Columbus, O.—Bids are wanted July 24 for grading, culvert and bridge masonry, piling, concrete, etc., for the grade of the Scioto Valley Traction Co., a distance of 21 miles. A. W. Jones, Ch. Engr., Rm. 42, Bd. of Trade Bldg.

Muncie, Ind.—The Muncie, Middletown & Greenfield Traction Co. has been incorporated with a capital of $100,000 to construct an electric railway from Greenfield to Muncie. Incorporators: Wm. H. Wood, Chas. B. Fudge and others.

The Council is stated to have granted a franchise to A. L. Johnson, of Muncie, representing the Muncie, Hartford City & Ft. Wayne Electric Ry. Co.

RAILROADS

Des Moines, Ia.—The Continental R'y Co. has been incorporated, with a capital of $100,000, to construct an air line 1,500 miles long from the Lake of the Woods to the Gulf of Mexico, through the States of Minnesota, Iowa, Missouri, Kansas, Indian Territory and Texas. Wm. T. Smith of Des Moines is a promoter of the line.

Tecumseh, Okla. T.—It is stated that the Choctaw, Oklahoma & Gulf R. R. Co. will construct a line from Tecumseh south, a distance of about 22 miles. F. A. Molitor, Ch. Engr., Little Rock, Ark.

Mankato, Minn.—The Chicago, Milwaukee & St. Paul Ry. Co., W. R. Williams, Gen. Mgr., Chicago, Ill., has been granted right of way across streets to connect with the tracks of the Chicago, Great Western Ry., Saml. C. Stickney, Gen. Mgr., St. Paul. The two companies will build a Union Depot and the C., M. & St. P. Ry. will build an extension to Farmington, Minn., for which surveys have been completed.

Pawnee, Okla. Ter.—The Atchison, Topeka & Santa Fe Ry. Co. is stated to have secured the right of way for an extension of the Eastern Oklahoma Ry. from Pawnee to Ralston. The line will be still further extended across the Osage Reservation. W. B. Storey, Jr., Ch. Engr., Topeka, Kan.

Denver, Colo.—A new short railway line, one that will decrease the distance between Denver and Salt Lake City, is projected by the incorporators of the Denver & Salt Lake Ry., Tunnel & Mining Co., which filed papers with the Secretary of State July 2d; capital, $5,000,000. Incorporators: J. E. Ratchford of Syracuse, N. Y., D. W. Hamnum and others of Denver. It is reported that the company also intends to complete and use the Atlantic & Pacific tunnel.

Tallulah Falls, Ga.—It is stated that the Tallulah Falls R. R. Co. is to extend its line from this place to Franklin, N. C., a distance of about 45 miles. Saml. C. Dunlap, Gen. Mgr., Clarkesville, Ga.

Toledo, O.—The Toledo Southeastern R. R. Co. of Toledo is reported incorporated, with a capital of $10,000 to construct a railroad from a point on the Michigan-Ohio boundary line in Lucas County to a point on the bank of the Ohio River in Lawrence County. Incorporators: Lewis W. Morgan, Chas. Hartman and others.

Newport, Ark.—A charter has been granted to the Southern Missouri & Arkansas R. R. Co. of Arkansas to construct a railway from Newport in a northerly direction through Jackson, Independence, Lawrence, Randolph and Clay counties, a distance of 80 miles.

Norfolk, Va.—The Council has granted the Bay Shore Terminal R. R. Co. a franchise to construct and operate a railroad over certain streets of the city.

Galena, Mo.—A charter has been granted to the Arkansas, Missouri & Kansas R. R. Co. with a capital of $2,000,000 to construct a line about 100 miles long from the south State line, in Stone county, to the west State line of Missouri, in Jasper County. Incorporators: Aravester L. Fuller, Foxboro, Mass.; Henry Oleer, Grangevill, Mo.; G. G. Farwell of Joplin, Mo., and others.

Vernon, Tex.—A charter is stated to have been granted to the Blackwell, Enid & Texas Ry. Co., with a capital of $20,000, to construct a railroad about 14 miles long from Vernon to the east line of Wilbarger County, Tex. Incorporators: C. T. Herring, Vernon; W. C. Robinson, Winfield, Kan., and others.

Leroy, Kan.—The Missouri Pacific R. R. Co. is reported to be considering the construction of a short line from Leroy to Waverly, a distance of 20 miles. H. Rohwer, Ch. Engr., St. Louis. Mo.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Prescott, Ariz.—Bids are wanted July 20 for erecting a library. Hugo Richards, Clerk.

Carnduff, N. W. Ter.—Bids are wanted July 27 for erecting a court house at Carnduff. Fred. Gelinas, Sec'y. Dept. Pub. Wks., Ottawa, Ont.

Central Islip, N. Y.—Bids are wanted July 19 for erecting and electric wiring a bakery at the Manhattan State Hospital, Central Islip. Henry E. Howland, Pres. Bd. Mgrs., 1 Madison Ave., N. Y. City.

Olivia, Minn.—The plans of Fremont D. Orff Lumber Exchange, Minneapolis, have been accepted for a court house to be erected here, at a cost of about $75,000 and contracts will be let during July by the County Commissioners at Beaverfalls, Minn., for constructing the basement story.

Topeka, Kan.—Contracts for the State House heating plant are stated to have been awarded as follows: For the building and stack, to Michael Heery, of Topeka, at $10,524; 4 boilers to Joseph Bromich, of Topeka, at $6,237; trenches and steam mains, to the Erie City Iron Works, for $4,560; the Overton Mfg. Co. of Topeka is stated to have received the contract for the electrical work, including the remodeling of elevator, for $12,500.

Pittsburg, Pa.—It is stated that plans are being prepared by Sidney T. Heckert, 341 6th Ave., for a 5-story fireproof addition to Mercy Hospital and for a wing to be added to the present building; total cost of improvements estimated at $300,000.

Norristown, Pa.—All Saints' P. E. Church is stated to have been destroyed by fire July 4th.

San Francisco, Cal.—Andrew Carnegie is stated to have offered this city $750,000 for a public library.

Medical Lake, Wash.—The State of Washington has let the contract for an addition to the Medical Lake Asylum for Insane, to P. Hughes, of Spokane, Wash., for $34,000.

Norfolk, Va.—The contract for equipping the new jail with steel cells is stated to have been awarded to the Stewart Iron Works of Cincinnati, O., for $30,450.

Little Rock, Ark.—Architects Mann & Gibb., 112 Louisiana St., have been awarded the supervision of the construction of the Deaf Mute Asylum to be erected here at an estimated cost of $80,000. It is stated that bids for construction will be received about the first of September.

Rolling Fork, Miss.—Hull Bros., of Jackson, are stated to have received the contract for erecting the Sharkey county court house for $25,000.

New York, N. Y.—The following bids were opened July 8 by the Board of Estimate and Apportionment for furnishing materials and performing work for the finishing and equipment of the erection of the Hall of Records Building: John Peirce, 277 Broadway, $1,959,000 (awarded); P. J. Carlin & Co., $2,473,000; Louis Wechsler, $2,230,000.

St. Paul. Minn.—Contract for steps and terraces for Minnesota Capitol has been awarded to the Butler-Ryan Co. of St. Paul, amount of contract $190,101, being one of their modified figures for granite; $48,731 was deducted from granite bid for work omitted; $16,285 was also omitted for the substitution of granolithic floors in place of granite in certain platforms. Original granite bid $255,116.

Ortonville, Minn.—County Auditor H. L. Zwiener writes that it has voted July 2 to construct a $30,000 court house.

Rutland, Mass.—The contract for erecting 3 buildings for the state in connection with the sanatorium for consumptives at Rutland is stated to have been awarded to H. W. & O. H. Welch of Clinton for $75,000.

New Orleans, La.—The following bids are stated to have been opened by the City Comptroller July 1 for the erection of a police jail: F. A. Noullet, $112,800; W. T. Carey & Bro., 630 Camp St., $107,197; Glover & Sicard, $127,445; and W. U. Mills & Co., $117,770.

Covington, Ky.—Andrew Carnegie is stated to have offered this city $20,0000 for an auditorium.

Meridian, Miss.—The Lauderdale County Supervisors are stated to have voted to erect a $35,000 jail.

New York, N. Y.—Plans have been filed at the Building Department for an 8-story brick hospital to be erected at 55th St. and Lexington Ave., to be occupied by the Babies' Hospital; cost, $50,000; architects, York & Sawyer, 56 5th Ave.

Great Falls, Mont.—The County Commissioners are stated to have opened the following bids July 1st for erecting the Cascade County court house: Lease & Richards, $183,985; the Great Falls Iron Works, $197,000, and Wm. Roberts, $196,870. Bidders all of Great Falls.

Olympia, Wash.—The following bids are stated to have been opened July 1 for constructing an addition to the recently purchased Thurston County court house to be used as a capitol: F. H. Goss, Washington Bldg., Tacoma, $134,987 (awarded); Hastie & Dugan, Tacoma, $142,900; J C. Bonnell, Tacoma, $159,882; W. R. Nichols, Tacoma, $171,700; A. Behrens, Seattle, $154,741.

Battle Creek, Mich.—L. B. Valk, of Los Angeles, Cal., is stated to have prepared plans for a $35,000 Methodist Church to be erected here.

San Antonio, Tex.—P. T. Shields, 1788 North Olive St., is stated to have received the contract for erecting the Carnegie Library, for $45,000. Architects, J. Rieley Gordon Co., Dallas.

Carrollton, Mo.—The County Commissioners are stated to have rejected all bids opened July 8 for erecting a court house, to cost about $60,000.

Richmond, Va.—Working drawings prepared by J. K. Peebles, of Norfolk, for the Methodist Orphanage of Va., to be erected in this city, have been approved by the Building Committee, C. W. Hardwicke and John P. Branch, of this city, are prominently connected with the enterprise. About $50,000 will be expended at this time.

Philadelphia, Pa.—Bids are wanted July 18 for erecting 3 buildings on 34th and Pine Sts. John V. Shoemaker, Pres. Dept. Charities & Corrections, Bureau of Charities.

Vincennes. Ind.—The Knox County Commissioners have adopted the plans of John W. Gaddis, of Vincennes, for a sheriff's residence and jail, to cost $30,000.

Uxbridge, Ont.—Bids are wanted July 18 for erecting a town hall. J. W. Gould, Town Clk.

Waco, Tex.—Bids are wanted July 19 for erecting a Methodist church at Austin Ave. & 12th St. A. P. Duncan, Chmn. Bldg. Com.

Nashua, N. H.—The plans of Cram, Goodhue & Ferguson, 53 State St., Boston, are stated to have been selected for the Hunt Memorial Library, to cost about $50,000.

National Military Home, Kan.—Bids are wanted July 22 for extending the boiler house and plant at Western Branch, N. H. D. V. S. Address W. B. Shockley, Treas.

Gloversville, N. Y.—F. L. Comstock, 37 W. Fulton St., has prepared plans for a 4-story fireproof hotel to be built by a stock company on South Main St. Cost, $80,000.

St. Cloud, Minn.—Bids are wanted Aug. 1 for erecting the St. Cloud Public Library.

Cleveland, O.—Bids are wanted July 24 for erecting a bath house in Gordon Park. Chas. P. Salen, Dir. Pub. Wks.

Baltimore, Md.—Bids are wanted July 24 for additions and alterations to the hospital at the Baltimore City Jail. James T. Doyle, Warden; Thos. G. Hayes, Pres. Bd. Awards.

Ft. Smith, Ark.—The R. Catholic Sisters have let the contract for the foundations for a monastery and bids are asked for the main building, to cost about $30,000.

Norwalk, O.—It is stated that bids are wanted July 27 for repairs to the court house. J. H. Beattie, Co. Aud.

Alameda, Cal.—Andrew Carnegie is stated to have offered this city $30,000 for a public library.

Vicksburg. Miss.—Press reports state that bids will be received Aug. 15 for erecting a city hall, to cost about $40,000. Architect, J. Riely Gordon, Dallas, Tex.

Abilene, Tex.—It is stated that bids are wanted Aug. 8 for erecting buildings for an epileptic colony near Abilene. John D. Sayers, Governor, Austin; J. L. O'Connor, Archt., Austin.

New Orleans, La.—Bids are wanted July 22 (readvertisement) for a passenger elevator in the City Hall. V. Tujague, City Compt.

Riverside, Cal.—It is stated that bids are wanted by the Board of Supervisors until July 26 for erecting a jail.

New York, N. Y.—The following bids are stated to have been opened July 11 by the Park Board for a lion house in Bronx Park: Thos. Cockerill & Son, 220 4th Ave., $134,500 (awarded); John D. Sheehan & Co., $149,500, and Louis Wechsler, $155,000.

Jersey City, N. J.—Bids are wanted July 17 for erecting a police station. C. P. Robinson, Clk., Police Commrs.

Birmingham, Ala.—Bids are wanted July 25 for remodeling and enlarging the city hall; also for additional cell work. D. A. Helmich, Archt., 306½ 19th St.

Syracuse, N. Y.—Contracts for erecting the Carnegie Library are stated to have been awarded as follows: For the building, to David Murphy, of Syracuse, for $133,897; structural steel and fire proofing to the Expanded Metal Fire Proofing Co., of Pittsburg, Pa., for $26,000; ventilating, heating and plumbing to W. N. Tobin, 109 W. 42d St., for $12,342, and electric wiring to the Syracuse Electric Equipment Co. for $2,460.

BUSINESS BUILDINGS.

Jacksonville, Fla.—G. L. Norrman, Equitable Bldg., Atlanta, Ga., is stated to be preparing plans for a $60,000 office building to be erected on Bay and Main Sts. for West Bros., of Westlake, Fla.

Sioux City, Ia.—Frost & Granger, 806 "The Temple," Chicago, Ill., are stated to be preparing plans for a $100,000 depot to be erected here by the Northwestern R. R.

Baltimore, Md.—A 6-story brick and iron building on North and Lexington Sts., occupied by A. Hoen & Co., lithographers, was burned July 4th.

Medford, Mass.—Warren & Torrens contemplate the construction of a 3-story business block upon Salem St.

Birmingham, Ala.—It is reported that W. H. Woodward has purchased a site at 1st Ave. and 20th St. for the erection of a $200,000 building.

Youngstown, O.—E. R. Thompson, Diamond block, is stated to have been selected to prepare plans for a 3-story temple for the Odd Fellows' Association.

Boston, Mass.—It is stated that a 9-story warehouse will be erected on Atlantic Ave. and Beach St. to be occupied by the U. S. Leather Co.

The plant of the Metropolitan Coal Co. was destroyed by fire July 2d.

Ft. Smith, Ark.—The St. Louis & San Francisco R. R. Co. has purchased a new site and will build thereon a $35,000 depot. B. F. Yoakum, Gen. Mgr., St. Louis, Mo.

DWELLINGS.

Nashua, N. H.—Bids are being received for the construction of a $15,000 residence for Geo. E. Anderson, to be located at Concord St. and Columbia Ave.

Cambridge, Mass.—C. Herbert McClare has prepared plans for a frame and brick apartment house (hot water heating), to be erected on Mifflin Place for J. M. Hilton; cost $11,500.

SCHOOLS.

Villisca, Ia.—Bids are wanted July 20 for erecting a school in Sub-Dist. No. 2, Jackson Township. G. S. Burnham, Pres. Bd. School Dir.

Giard, Ia.—Bids are wanted July 20 for erecting a school in Dist. No. 7, Giard Township. H. J. Klotzbach, Sec'y.

Cleveland, O.—Bids are wanted July 22 for erecting Milford school, also separate bids until July 29 for erecting an addition to Orchard school, including ventilating, heating and plumbing. Thos. H. Bell, School Dir. Bd. Educ.

Moscow, Idaho.—Bids are wanted July 22 for plumbing and heating in the girls' dormitory and the science hall at the University of Idaho. Geo. C. Parkinson, Sec'y Bd. Regents.

Lynchburg. Va.—A correspondent writes that the trustees of the "Sweet-brier" Institute near Lynchburg have been negotiating with architects relative to plans, etc., for a building which will cost about $75,000. W. M. Poindexter, of Washington, D. C., it is thought, will be the architect selected.

Columbus, O.—Bids are wanted July 23 for erecting Livingston Ave. school, also separate bids, with plans and specifications, for heating same by a hot air gravity system. David Riebel, Archt., 328½ S. High St.

Cincinnati, O.—Bids are wanted July 31 for installing a system of steam heating at the University Building, Brent Woods Park. Jas. M. Robinson, Chmn. Com. on Bldgs., Bd. Dir. of University of Cincinnati.

Champaign, Ill.—N. S. Spencer, I. O. O. F. Bldg., is stated to have prepared plans for a chemistry building for the University, to cost about $100,000.

Pittsburg, Kan.—The citizens are stated to have voted to issue $35,000 bonds for the erection of a school.

Stockton, Cal.—High school bonds amounting to $150,000 have been sold.

Philadelphia, Pa.—Henry Dagit, 435 Chestnut St., is stated to be preparing plans for a parochial school to be erected on 23d St. and Montgomery Ave. for St. Elizabeth's R. C. Church, cost to be about $65,000.

Geo. W. Pierson, Lippincott Bldg., is stated to have received the contract for erecting an 8-room school on Benner and Dittman Sts., for $43,366 and W. J. Smith, 622 Mifflin St., has received the contract for erecting two wings to the Matthias W. Baldwin school, for $33,628.

Toledo, O.—Morgan Sheehy, 321 Chamber of Commerce Bldg., is stated to have received the contract for erecting the Glenwood school for $25,471.

Charlotte, N. C.—A school to be known as St. Peter's Parochial School and Hall is about to be built at a cost of $15,000. Address Rev. Francis Meyer, Charlotte, N. C.

Victoria, B. C.—See "Bridges."

Conneaut, O.—The plans of H. O. Wurmser, of Lorain, are stated to have been accepted for the $26,000 school.

Reedsburg, Wis.—It is reported that it has been voted to erect a $30,000 school. J. H. Hasler, Clerk School Bd.

Bloomer, Wis.—It is stated that it has been voted to erect a school here, at a cost of about $15,000.

O'Fallon, Ill.—R. Z. Gill, of Urbana, Ill., is stated to have received the contract for erecting an 8-room school for $14,675.

Butte, Mont.—The Board of School Trustees of School District No 1, Silver Bow County, Mont., will soon let contracts for the construction of an $18,000 addition to the Monroe school in Butte; F. L. Kern, architect. A 4-room school to cost about $10,000 is also to be built for the G. A. Cobban addition; N. A. O'Brien, architect.

Worcester, Mass.—Barker & Nourse, Box 13, have prepared plans for two 6-room brick schools, each to cost $20,000.

Berlin, Wis.—Architect Van Ryn, 211 Grand Ave., Milwaukee, is stated to have been selected to prepare plans for a $30,000 high school.

Washington, D. C.—Bids are wanted Aug. 3 for erecting an 8-room school. Lansing H. Beach, Commr. D. C.

Des Moines, Ia.—Bids are wanted July 17 for an addition to the high school. R. M. J. Coleman, Secy. Bd.; W. R. Parson & Son Co., Archts., 317 E. 5th St.

Huntsville, Tex.—Bids are wanted July 29 for erecting a library at the Sam Houston Normal Institute at Huntsville. A. T. McKinney, Chmn. Local Bd. Directors.

Mars, Pa.—Bids are wanted July 16 for a hot air or steam heating system in a 2-story 8-room school. E. Brown, Secy. School Bd.

New York, N. Y.—Bids are wanted July 22 (extension of date) for sanitary work in Wadleigh high school, Boro. of Manhattan; for erecting school No. 80, Boro. of Queens; for erecting Richmond Borough High School No. 1, Boro. of Richmond, and for installing electric light wiring, fixtures and electric gong system in school No. 18, Boro. of Richmond. Richd. H. Adams. Chmn. Com. on Bldgs., Bd. Educ.

New York, N. Y.—Bids are wanted July 22 for installing, ventilating and heating system and electric wiring, in addition to school No. 133, Boro. of Bronx, for installing electric light wiring, fixtures, electric bell system, etc.; also a ventilating and heating apparatus in Wadleigh High School, Boro. of Manhattan.

New York, N. Y.—The following bids were opened July 8 by the Committee on Buildings, Bd. of Education, for erecting additions to and alterations in public school 164, Boro. of Bronx: Thos. Cockerill & Son, $52,500; Pat. Sullivan, 389 Broome St., $48,800 (awarded); Hartman & Horgan, $56,263; Tolmie & Kerr, $51,000; Alfred Nugent & Son, $50,000; Chas. H. Peckworth, $49,900; Chas. Wille, $59,990.

Fulton, Mo.—It is stated that bids will be received Aug. 1 for erecting a 3-story brick dorimtory for the Missouri School for the Deaf at Fulton. N. B. McKee, Supt.

Grand Forks, N. D.—Contracts for erecting the Science Hall at the State University are stated to have been awarded as follows: Building, Bailies & Perkins, $30,697; heating and plumbing, Spriggs Bros., $5,200; water main from city, J. B. Mooney & Co., $5,750. Contractors all of Grand Forks.

Lawrence, Kan.—Bids are wanted Aug. 6 for erecting, heating and plumbing the Natural History Museum building at the University of Kansas. W. C. Spangler, Vice-Pres. Bd. Regents.

Massillon, O.—Bids are wanted July 22 for erecting an 8-room school on Walnut St. Wm. B. Humberger, Secy. Bd. Educ., Massillon Union School Dist.

Brooklyn, N. Y.—The following bids were opened July 8 by the Committee on Buildings, Bd. of Educ., New York City, for erecting school 129, Boro. of Brooklyn: Peter Cleary, $129,000; John Thatcher & Son, $135,600; Luke A. Burke, 401 W. 59 St., N. Y. City, $124,700 (awarded); John H. Goetschius, $154,900; K. A. Murphy, $139,500; P. J. Walsh, $153,000; George Hildebrand, $137,407; William P. McGarry, $134,387; Alfred Nugent & Son, $129,900; Christopher J. Kenny, $132,055; Rutan & Henningham, $131,567; Thos. Cockerill & Son, $124,900; William & Thomas Lamb, $126,525.

The following bids were opened at the same time for erecting school No. 140, Boro. of Brooklyn: John Thatcher & Son, $119,700; P. J. Walsh, $139,000; Thos. Cockerill & Son, $113,900; Peter Cleary, 195 Bainbridge St., Brooklyn, $111,500 (awarded); Luke A. Burke, $114,000; K. A. Murphy, $124,900; Wm. & Thos. Lamb, $116,300.

STREET CLEANING AND GARBAGE DISPOSAL.

Meadville, Pa.—City Engr. W. A. Doane writes that bids are wanted for a double furnace crematory, having a capacity of 1 ton per hour of garbage.

Alliance, O.—The matter of garbage disposal is said to be under consideration.

Watervliet, N. Y.—Bids recently received for garbage collection have been rejected and new bids will be asked.

Yonkers, N. Y.—It is stated that bids are wanted July 16 for removing and disposing of dead animals for one year. Jas. J. Hanrahan, Secy. Bd. of Health.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted July 15 for constructing a conduit between the old Post Office and Patent Office buildings, Washington. E. A. Hitchcock, Secy. Dept. of the Interior.

San Juan, Porto Rico.—Bids are wanted July 27 for furnishing and erecting one 100 H. P. boiler with steel chimney at the Naval Station, San Juan. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Washington, D. C.—The Navy Department has awarded a contract for steel work and fire proofing at the Washington Navy Yard to the Penn Bridge Co., of Beaver Falls, for $7,630.

Genoa, Neb.—Bids are wanted July 29 for erecting a brick school and frame hospital, including heating and electric lighting system, at the Genoa Indian School. W. H. Winslow, Supt. Indian School; W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior.

Phoenix, Ariz.—Bids are wanted Aug. 6 for erecting an auditorium and a hospital building at the Phoenix School, Ariz. S. M. McCowan, Supt. Indian School, Phoenix.

Pago-Pago Harbor, Samoa.—The Secretary of the Navy has allotted $15,000 for building a Governor's house at Pago-Pago Harbor. It is stated that in addition to this there will be $200,000 expended for coaling piers, warehouses and general improvements at the station.

Washington, D. C.—Bids are wanted July 27 for furnishing and erecting structural steel work for a building about 32 x 87 ft., at the Navy Yard, Washington. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept.

Ft. Lincoln, Neb.—Bids are wanted July 30 for a double officers' quarters, a double non-commissioned officers' quarters, a Q.-M. and subsistence storehouse, a Q.-M. stable and a coal shed at Ft. Lincoln. Geo. E. Pond, Ch. Q.-M., St. Paul, Minn.

Ft. Crook, Neb.—Bids are wanted Aug. 5 for one brick set of non-commissioned officers' quarters at Ft. Crook, and for plumbing and gas-piping same. Jno. W. Pullman, Ch. Q.-M., Omaha, Neb.

Norfolk, Pa.—Bids are wanted Aug. 17 for furnishing a 120-ton floating derrick for the Navy Yard, Norfolk. Appropriation, $8,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Boston, Mass.—Bids are wanted Aug. 3 for installing a central heating system at the Navy Yard, Boston. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Portsmouth, N. H.—Bids are wanted Aug. 24 for erecting a coal storage and handling plant at Navy Yard, Portsmouth. Appropriation, $100,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Galveston, Tex.—The contract for repairing the north jetty at Aransas Pass has been awarded to Chas. Clarke & Co., of Galveston, at their bid of $3.30 per ton for rip rap and $3.95 per ton for large blocks. Appropriation, $75,000.

Boston, Mass.—Bids are wanted July 27 for constructing a concrete or granite and concrete quay wall; also until Aug. 3 for furnishing and erecting a ship-fitters' and metal-workers' shops at the Navy Yard, Boston. Estimated cost of each building, $160,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Washington, D. C.—Bids for supplying dynamos and engines to be placed in the annex building of the Department of the Interior have been received as follows: Westinghouse Electric & Mfg. Co., $14,715; Bullock Electric Mfg. Co., $17,420; Carr Electric Co., $20,136; Edward Heaton & Co., $18,173; Thresher Electric Co., $17,330; Crook, Horner & Co., $19,505; Western Electric Co., $17,273; McKey Engineering Co., $16,655; McCay Engineering Co., $14,970; Ridgway Dynamo & Engine Co., $14,950 (awarded); National Electric Supply Co., $17,898.

MISCELLANEOUS.

New York, N. Y.—Bids are wanted July 19 for preparing for and extending and repairing the pier, with appurtenances, at W. 30th Sts., North River; bids are also wanted until July 22 for constructing a wooden pier at Wall St. to be known as pier No. 12 East River. J. Sergeant Cram, Commr. of Docks, Dept. Docks & Ferries.

Cleveland, O.—Plans have been approved by the Grade Crossing Commissioners for eliminating grade crossings on the Lake Shore R. R. at Detroit St. and at Gordon Park Ave., near the entrance to Gordon Park. The plans provide for an underground driveway and the elevation of the railroad tracks.

Cleveland, O.—Bids are wanted July 17 for constructing 2 stone jetties at Edgewater Park. Chas. P. Salen, Dir. Pub. Wks.

Port Colborne, Ont.—Bids are wanted July 19 for deepening certain portions of the level between Thorold and Port Colborne. L. K. Jones, Secy. Dept. Rys. & Canals, Ottawa.

Springfield, Mo.—Hedges & Gosney Construction Co. is stated to have the contract for constructing a 120-ft. subway at Washington Ave. and a subway 50 ft. long at Lyon St. for $26,800.

Sheboygan, Wis.—The Sheboygan Gaslight Co. is stated to have agreed to build an 80-ft. channel in the river and a 400-ft. dock opposite their proposed gas plant.

NEW INDUSTRIAL PLANTS.

T. Harlan & Co., Trenton, Tenn., will rebuild their stave mill, recently burned. The size of the building will be about 150 x 200 ft., and an engine of about 75 H.-P. and a boiler of about 90 H.-P. will be used.

The Leatherbury Shoe Co., Clarksburg, W. Va., will erect a 4-story and basement, 40 x 100-ft. factory. P. H. Koblegard is interested.

The Wild Cotton Mfg. Co., Valatie, N. Y., will erect a new mill.

The Pacific Coast Co., Seattle, Wash., will build a new machine shop and roundhouse this fall, but plans have not yet been prepared. D. O'Leary, Master Mechanic.

The Wisconsin Graphite Co., Stevens Point, Wis., will erect a 100 x 160-ft. factory, to be equipped with a 50-ton Cummer dryer, five grinding mills, and engines and boilers with a capacity of 400 H.-P. A conveyor system will be adopted, and arrangements made for a daily capacity of 50 tons. The company is working double turn and is behind on its orders.

The Seaman, Sleeth Company, Pittsburg, Pa., will add 90 ft. to its No. 2 foundry, making it 240 x 60 ft. and install two 60-ton electric cranes and add two 30-ton reverberatory furnaces, making a total of seven.

The American Cigar Co., Madison, Wis., is erecting a 68 x 309-ft. brick storehouse at Madison, and will erect a storehouse of the same size, a factory about 170 x 349 ft., a 21 x 40-ft. boiler house, all of brick, and a frame lumber house 80 ft. square, at Sparta, Wis. A 100-H.-P. boiler and an electric lighting plant will be installed.

Frank Heierman, Austin, Tex., expects to erect a yarn mill the coming winter.

The National Pump Co., Mound City, Ill., will rebuild its plant for making wood pumps, recently burned.

J. M. Russell, Woodbury, Conn., will erect an 80 x 24-ft. building, with an engine and boiler room 20 ft. square, and install a 30-H.-P. boiler and a 25-H.-P. engine.

Barnett & Record, Minneapolis, Minn., will construct an elevator for the Kansas City, Fort Scott & Memphis Railroad Co. at Rosedale, Kan., to have a capacity of 160,000 bush., with two storage tanks of 100,000 bush. capacity each. Steam will be used as power, and a 150-H.-P. engine installed. They will also overhaul the railroad's present elevator at Rosedale, increasing its capacity from 100,000 to 360,000 bush.

The New Bethlehem, Pa., Window Glass Co. is building a 30-pot window glass factory. The power plant will have a capacity of about 25 H.-P.

The Universal Winding Co., Providence, R. I., will erect a new factory to employ not less than 1,000 hands. Plans and location have not yet been decided on.

Lane, Tillman & Co., Valdosta, Ga., will erect a 50 x 200-ft. factory, with a separate engine and boiler room. The power plant will have a capacity of about 50 H.-P.

The Union Carbide Co., 157 Michigan Ave., Chicago, Ill., will erect a calcium carbide plant at Sault Ste. Marie, Mich., using 20,000 H.-P. furnished by the Lake Superior Power Co.

BUSINESS NOTES.

The Heating, Ventilating & Foundry Co., Pittsburg, Pa., has just completed a foundry and machine shop at Lazearville, W. Va. The main building is about 65 x 145 ft. A private siding runs the full length of the building. The raw material is unloaded from cars on platforms and into sheds surrounding the cupola, which has a melting capacity of 5 tons per hour. Directly in front of the cupola, and about 25 ft. distant, is a 2-ton jib crane for handling large ladles of iron and heavy castings. After the castings are made they pass into the tumbler and emery room, adjoining the moulding room, and if they require machine works, they then pass into the machine shop, adjacent to this room, and then into the store or wareroom, adjoining the machine shop and cleaning room. In case no machine work is necessary, the castings pass directly into the storage room from the tumbler and emery room, from which they are loaded into cars, ready to ship. There is no rehandling of either the raw material or the manufactured goods. The power is furnished by two 25-H.-P. gas engines. The whole plant will be heated by large horizontal furnaces made by the company and there will be blowers for circulating the air in both winter and summer.

The Stilwell-Bierce & Smith-Vaile Co., Dayton, O., has recently shipped one of its feed-water heaters and two Smith-Vaile duplex steam pumps to the Iroquois Portland Cement Co., Caledonia, N. Y., and received orders from the Alsen's American Cement Works, West Camp, N. Y., for a feed-water heater and purifiers; Village of Buchanan, Mich., for a feed-water heater and purifier, and J. M. Keifer, Lexington, O., for a 15-in. upright cylinder gate Victor turbine.

The New England Structural Co., of Boston, will furnish the steel framework and ornamental ironwork for the new ten-story Walker Building, in that city.

The Atlas Tack Co., Fairhaven, Mass., has placed a contract for a Green economizer with H. G. Brinckerhoff, 53 State St., Boston, Mass., the New England representative of the Green Fuel Economizer Co.

Wm. B. Scaife & Sons, Pittsburg, Pa., have been awarded a contract for the manufacture and erection of a steel-frame boiler house, for the L. Glesenkamp & Sons' Carriage Works, Pittsburg.

The Minneapolis, Minn., General Electric Co. has placed an order with the Ball Engine Co., Erie, Pa., for a 700-H.-P. vertical cross-compound Corliss valve engine, and a 450-H.-P. vertical cross-compound single valve engine, and the Pennsylvania Railroad Co. has ordered two 500-H.-P. tandem compound engines, direct-connected to General Electric alternators.

The United States Power Co. has been incorporated in New Jersey with a capital of $250,000, to build steam engines and other machinery, by J. Wesley Allison, Kenneth McLaren and William M. Malloy.

At the annual meeting of the Structural Iron & Steel Co., Baltimore, W. T. Stilwell, J. W. Leroux, John Mackenzie, E. A. Frink, Layton F. Smith, Jacob Ochse and L. B. Kemp were elected directors. Mr. Stilwell was re-elected president, Mr. Leroux vice-president and general manager, Mr. Frink chief engineer, Mr. Smith secretary, and Mr. Ochse treasurer. A 6 per cent. annual dividend was declared.

At a recent stockholders' meeting of the Cambria Steel Co. a resolution was passed authorizing the sale of the company's property to the Conemaugh Steel Company.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
July 16.	Linton, Ind Adv., Eng. Record, June 29.	June 29
July 16.	Jersey City, N. J	July 13
July 18.	Columbus, Ind	July 6
July 19.	Salt Lake City, Utah Adv., Eng. Record, June 29 to July 13.	June 29
July 19.	Binghamton, N. Y	July 6
July 19.	Bonaparte, Ia	July 6
July 19.	Pittsburg, Pa	July 13
July 22.	Pipe, Atlantic City, N. J Adv., Eng. Record, July 6, 13	July 6
July 22.	Paris, Mo	June 29
July 22.	Baker City, Ore	July 13
July 23.	Sanford, N. C Adv., Eng. Record, July 6, 13.	July 6
July 25.	Boston, Mass Adv., Eng. Record, June 29 to July 13.	June 29
July 25.	Pumps for sale, Lancaster, Pa Adv., Eng. Record, July 6, 12.	July 6
July 25.	New London, Conn Adv., Eng. Record, July 13.	July 13
July 26.	Kansas City, Mo	July 13
Aug. 1.	Rimonski, Que	May 25
Aug. 6.	Filter plant, Reading, Pa Adv., Eng. Record, June 15 to 29.	June 15
Aug. 6.	Dam, Centralia, Ill	July 13
Aug. —.	Reservoir, Dauphin, Pa	May 4
Sept. 2.	Barrackpore, Calcutta, India	July 13
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29.	June 29
	SEWERAGE AND SEWAGE DISPOSAL.	
July 15.	Coraopolis, Pa	July 13
July 15.	Gloversville, N. Y	July 13
July 16.	Oshkosh, Wis	June 29
July 16.	Cleveland, O Adv., Eng. Record, June 29, July 6.	June 29
July 16.	Dunkirk, N. Y	July 13
July 18.	Spring Garden, Pa	July 13
July 18.	Milwaukee, Wis	July 13
July 18.	Cleveland, O	June 29
July 18.	Dubuque, Iowa	July 13
July 20.	Mt Vernon, O	July 13
July 24.	New Orleans, La Adv., Eng. Record, May 11 to June 29.	May 11
July 24.	New York, N. Y	July 13
July 27.	Washington, D. C Adv., Eng. Record, June 29.	June 29
July 27.	East Cleveland O	July 6
July 29.	Oshkosh, Wis	July 6
Aug. 2.	Shreveport, La Adv, Eng. Record, July 13.	July 13
Aug. 3.	Galion, O Adv., Eng. Record, July 6, 13.	July 6
Aug. 5.	Akron, O	July 13
Aug. 5.	Concordia, Kan	July 13
Aug. 5.	Sewage purification, La Grange, Ill	July 13
Aug. 6.	Laramie, Wyo	July 13
Aug. 7.	Birmingham, Ala	July 13
Aug. 10.	Visalia, Cal	June 22
Aug. 12.	Wabash, Ind	July 13
Sept. 25.	Havana, Cuba Adv., Eng. Record, June 29 to July 13.	June 29
——	McMinnville, Ore	July 13
	BRIDGES.	
July 15.	Hazleton, Pa	July 13
July 16.	Peoria, Ill	July 13
July 17.	New Brunswick, N. J	July 13
July 18.	Oil City, Pa	June 15
July 19.	Battleford, N. W. Ter	July 6
July 23.	Oglethorpe, Ga	June 15
July 23.	Topeka, Kan	July 13
July 24.	Chicago, Ill	May 25
July 26.	Pakenham, Ont	July 13
July 27.	Dyersburg, Tenn	July 13
July 30.	Dublin, Ga	June 29
Aug. 1.	Tacoma, Wash	July 13
Aug. 2.	Helena, Mont	July 13
Aug. 5.	McRae, Ga	July 6
Aug. 5.	Clarksdale, Miss	July 13
Aug. 7.	Norristown, Pa	July 13
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
——	Plans, etc., Quincy, Mass	July 13
	PAVING AND ROADMAKING.	
July 15.	Westerly, R. I	July 13
July 15.	Paterson, N. J	July 13
July 15.	Chester, Pa	July 13
July 16.	New York, N. Y	July 6
July 16.	Davenport, Ia	July 13
July 16.	Des Moines, Ia	June 29
July 17.	Scottdale, Pa	June 22
July 18.	Denver, Colo	July 13
July 18.	Spring Garden, Pa	July 13
July 18.	St. Joseph, Mich	July 13
July 18.	Milwaukee, Wis	July 13
July 22.	Michigan City, Ind	July 13
July 23.	Brooklyn, N. Y	July 13
July 23.	New York, N. Y	July 13
July 23.	South Bend, Ind	June 29
July 27.	Bellefontaine, O	July 6
July 27.	Washington, D. C Adv., Eng. Record, July 13.	July 13
July 27.	Decatur, Ind	July 13
July 29.	Springfield, O	July 6
July 31.	Cleveland, O	July 13
Aug. 1.	Sioux City, Ia	July 13
Aug. 2.	Salt Lake City, Utah Adv., Eng Record, July 13.	July 13
Aug. 5.	Toledo, O	July 13
Aug. 7.	Birmingham, Ala	July 13
Aug. 12.	Wabash, Ind	July 13
Aug. —.	Houston, Tex	June 22
Sept. 25.	Havana, Cuba Adv., Eng. Record, June 29 to July 13.	June 29
——	Fowler, Ind Adv., Eng. Record, July 6.	July 6
——	Windber, Pa	July 6
	POWER, GAS AND ELECTRICITY.	
July 19.	Cincinnati, O	June 22
July 19.	Shakopee, Minn	July 13
July 20.	Glace Bay, Canada	July 13
July 22.	Paris, Mo	June 29
July 23.	Winton Place, O	July 6
July 25.	Oil burning apparatus, Alexandria, La Adv. Eng. Record, July 13.	July 13
July 27.	Ft. Washington, Md	June 29
July —.	Doylestown, O	June 15
Aug. 1.	Rimouski, Que	May 25
Aug. 1.	Burlington, Ia Adv., Eng. Record, June 29.	June 29
Aug. 2.	Cambridge, N. Y	June 1
Aug. 9.	Tampa, Fla	July 6
Aug. 9.	Ft. Hunt, Va Adv., Eng. Record, July 13.	July 13
Aug. 15.	York Haven Pa	July 13
	GOVERNMENT WORK.	
July 15.	Washington, D. C	July 13
July 16.	Beacons Mobile, Ala Adv., Eng. Record, June 22, 29.	June 22
July 17.	Albany, N. Y	June 29
July 19.	Elevator, New Orleans, La	June 22
July 20.	Ft. Hancock N. J	June 29
July 22.	Ft. Mason, Cal	June 29
July 22.	Norfolk, Va Adv., Eng. Record, June 29, July 6.	June 29
July 23.	Newport, R. I Adv., Eng. Record, June 29, July 6.	June 29
July 23.	Amagansett, L. I, N. Y Adv., Eng. Record, July 13.	July 13
July 24.	Norfolk, Va Adv., Eng. Record, June 29, July 13.	June 29
July 25.	Waldoboro Me	July 6
July 26.	Pier repairs, Grand Rapids, Mich Adv., Eng. Record, June 29 to July 13.	June 29
July 27	Washington, D. C	July 13
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July 20.	School, Villisca, Ia	July 13
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Data for Water Supply Computations.

Although many observations have been made in this and other countries relating to the amount of water for any given purpose which may be expected from the rainfall on a watershed of known area, yet if an engineer is called upon to make computations of this character he needs to pass but little outside of the narrowest limits to realize that the subject is conspicuous chiefly from its unknown quantities rather than from its well-defined features. This is particularly true in reference to a certain class of investigations connected with such a water supply as that for a canal. To go no further than the State of New York, let it be supposed that it is desired to determine whether the available portion of the rainfalls on the watersheds tributary to the Erie Canal is sufficient for the needs of the large canal which has been proposed to connect Lake Erie with the Hudson River.

In the first place, he will find that while the rainfall varies somewhat from one watershed to another, he may make a reasonable estimate for ordinary years for each basin. If he attempts, however, to ascertain that rainfall which may be considered a minimum for a long series of years his troubles will begin, although they are among the least that will beset him before he closes his labors. He will find about the same amount of uncertainty if his investigations require the determination of the maximum monthly or annual rainfall in connection with regulation works where the greatest elevation of water surface must not exceed a fixed limit. What is needed in both cases is a continuous series of rainfall observations. The greater the period over which they extend the greater will be their value, the points of observation and the appliances used being judiciously selected so that the results may represent with reasonable accuracy the precipitation for each entire basin. If a watershed is small, one or two points well located may be representative of its entire area, but if it is no larger even than those of some of our inland lakes, not including the Great Lakes, a number of points so distributed as to justify generalizations for the entire watershed are needed, and nothing less is sufficient for safe conclusions.

While in many instances these necessary conditions are fulfilled, in many others they are not. Although many of our river and lake basins have been subjected to hydrographic observations, including those of rainfall, the recorded results prove to be highly unsatisfactory when an engineer attempts to make use of them for deductions relating to the entire basin in question. This is particularly true of investigations made in regions not yet much frequented, and it is also a characteristic of some of the hydrographic work of the federal government. It is evident that isolated observations made at points located without much regard to the general principles set forth above have some value, and much value even in some cases; but the trouble with them is that no engineer can accept conclusions based on them as final. They can be taken as provisional only, and always leave the main question still open, to be closed when additional observations, which ought to have been made in the first instance, supply the lacking data.

Again, even if the precipitation data are complete and exhibit results secured at properly located points, there are other elements in which there is far greater uncertainty than that already noted. When the surface of a considerable body of water, like that of a large lake, is involved, the matter of evaporation must be treated. In some instances the amount of water lost by evaporation is relatively of the greatest importance and yet it is almost an unknown quantity in the United States. Observations have been made in some places, which aggregate probably a large number. If, however, it were desired to use either the monthly or annual evaporation from the surface of one of the lakes in the central portion of the State of New York, it is doubtful whether anything nearer than the loosest approximation would be available, although it is quite supposable that it might be one of the most important elements of the problem. The force of such an observation may be more easily appreciated when it is borne in mind that the report of the Nicaragua Canal Commission shows that the annual evaporation from the surface of Lake Nicaragua is equal to a depth of water of 5 feet, whereas the annual amount of water needful for canal purposes would not exceed one-twelfth of that amount.

In estimating the amount of runoff from a given watershed on which the annual rainfall is known, it is customary to use a certain percentage of the entire rainfall, which may, perhaps, be fifty. Yet every well-informed civil engineer is well aware that it should be expressed as a percentage of the excess above a certain minimum part of the total precipitation, which is held by the ground or is evaporated from its surface, and so can produce no runoff at all. As a matter of fact, there is yet practically nothing known as to the amount of this evaporation from the soil or of the retained percentage. It is desirable that these voids in our empirical hydrographic knowledge should be filled, for no complete treatment of hydrographic problems, many of them of great practical importance, can be given until our data are much more complete than at present. This is a matter which could well receive attention in connection with the hydrographic work now being done by the Government.

A New Ruling Concerning Underground Water Rights.

On December 1, 1900, there was printed in this journal a review of the decision of the court of final jurisdiction of the State of New York in the highly important Forbell case. Briefly summarized, the ruling was to the effect that the pumping of underground water from the land of another by means of wells, or otherwise, was a trespass. The plaintiff received $6,000 as damages, the costs of the suit, and a permanent injunction restraining the city of New York from operating its pumping plant. The great importance of such a decision from an engineering point of view was shown in the review mentioned, and a suggestion was made concerning a reasonable interpretation of the law, which has been adopted recently by one of the lower courts in similar suits. That suggestion read as follows: "If it can be proved that the natural ground-water level is 7 feet below the surface of a given tract of land and that celery and water-cress cannot utilize water in the soil more than 3 feet below the surface, it is immediately demonstrated that the failure of crops was due to deficient rainfall, the exhaustion of the soil or some other surface condition, and that the operation of the driven-well stations was no more the cause of poor crops than it was of the movements of the planets."

The local importance of the Forbell case was very great. The surface water supply of the borough of Brooklyn has been inadequate to the demands for some years, and as other surface supplies on Long Island are forbidden to the city by peculiar State laws, a number of driven-well plants have been constructed to furnish the necessary additional supply from underground sources. To shut down these well plants means a serious loss of water to the million people of Brooklyn. On the other side of the question are ranged the market gardeners of Long Island, of whom there are very many, for the island is a leading source of the vegetables sold in New York. They saw in the Forbell decision an excellent opportunity to secure large sums from the municipal till without the hard labor attending the raising of potatoes and green truck, and they made haste to utilize the gift of the courts. Unfortunately for their bright anticipations of unearned wealth, they have won a Pyrrhic victory which conforms to the law but destroys their expectations of receiving large sums for damages that never occurred. This result has been attained mainly by the efforts of R. Percy Chittenden, Esq., assistant corporation counsel, and Mr. Rudolph Hering as engineering witness.

Four market gardeners were the first to seek relief by the Forbell method from the alleged oppression of the city, and by consent of all parties their cases were considered together. No. 1 owns 5½ acres of which 5 acres are marsh on which lettuce, celery and other crops are raised. Prior to 1894, when pumping began from the city wells, he testified to receiving about $4,000 a year, half of it net profit, from his produce, while now the yearly product is only worth about $850, although prices are as high as formerly. On this basis his lawyer figured out a loss of $21,082 for the seven years, which is surely a tidy sum for 5½ acres. "This testimony passes all credence," according to Judge Gaynor, before whom the case was argued. "If the court believed it, respect for the administration of justice and the discernment of courts would be lost. In the administration of justice things are not so easily taken for granted. Truth and falsehood are known at sight. . . . Inasmuch, however, as the Court of Appeals has decided that the act of the city in pumping from adjoining lands is a trespass, I am required to give the plaintiff judgment for some amount to satisfy the law." The amount was $350.

Gardener No. 2 hired 6½ acres of which 6 acres are marsh. He swore that before pumping began his annual net profit was $1,000, but that during recent years he had not even paid expenses and had lost over $3,000. He said he originally had $3,000 in a drawer in the house and after spending it in paying these losses he gave up the farm. "Of course I cannot and do not believe a word of it," says the judge. "If courts were to believe everything like this that comes along they would be laughed at. I allow this plaintiff $100 for the reasons stated in the preceding case." Gardener No. 3 leased 6½ acres of which 4 acres are marsh. He testified that his net profit of $1,075 in 1893 disappeared after pumping began at the city wells, and that his losses since then were $500 to $800 a year. "This is all incredible," the judge reported, but he granted damages to the amount of $100 for the reason already stated. The case of gardener No. 4 was the same and was similarly settled. Concerning all four, Judge Gaynor stated: "The testimony of these plaintiffs and of their witnesses on the question of losses is interested, grossly exaggerated and not credible. The city and its taxpayers are entitled to be protected against such claims."

The reasons which led to such emphatic language were those outlined by Mr. Hering in his testimony and supported by facts stated by others. The pumping is from a depth of 36 to 157 feet below the surface and the plaintiffs claimed that this caused the water table to fall about 8 feet, thus exhausting the moisture from the surface soil. The judge rules that this is physically impossible except where the water table is at or very near the surface; in other words, it would only occur in the case of marsh land. Where the water table is so far below the surface that the surface is not moistened from it by close contact or by capillary attraction, a lowering of the water table would not affect the moisture in the surface soil. It is a common thing to have to go down 25 to 100 feet to reach water in localities having moist and good land. Such moisture, it is held, does not depend at all on the depth of the water table below the surface but on the rainfall. In addition to these scientific facts testimony was given by witnesses concerning the lowering of the water table under their land by the city's pumps, which showed that such lowering did not dry up the surface soil. The marsh land of the plaintiffs was used to raise crops like lettuce, celery and the like, which were greatly depreciated, they claimed, by the drying of the surface. Nevertheless, they went on year after year raising these same crops, although, according to their testimony, they knew they would be ruined by the effect of the city's pumps. This being so, it was manifest that the measure of damage could not be the value of the crops lost. If the land was really made unfit for these crops, it is strange they were planted year after year. Hence the law was interpreted in the light of reason, and the city has been saved very large payments and much inconvenience.

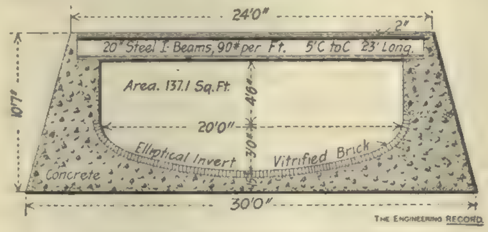
The Importance of Forestry was sufficiently recognized recently by the Department of Agriculture and Congress to cause the division of forestry to be advanced to the honors of a full-fledged bureau. The appropriation for the current fiscal year is but $185,000, but it is safe to say that Mr. Gifford Pinchot and his staff will secure the maximum possible return from each dollar at their disposal. The work they have accomplished in the past on far more slender resources has been noteworthy.

The Sewerage System of Havana.

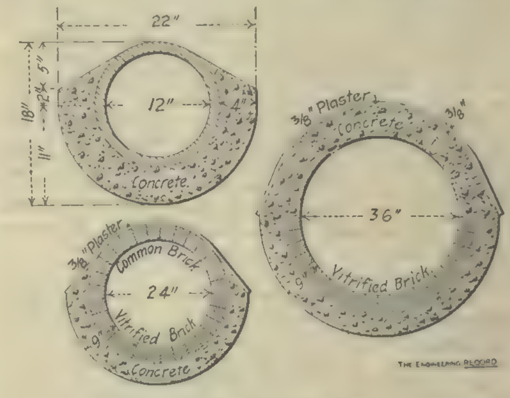
A few weeks ago there was published in The Engineering Record an outline of the proposed sewerage system of Havana. Since it appeared Lieut. W. J. Barden, Corps of Engineers, U. S. A., chief engineer of the city of Havana, has furnished some interesting information concerning the important modifications in the plans originally prepared by Mr. Gray.

The first of these changes was the substitution of centrifugal for plunger pumps in the pumping stations. This alteration was made largely as a result of the satisfactory working of the centrifugal pumps at Boston, some of which are of almost similar size to those required in Havana and are working under much the same conditions, save that the lift there is even less than in Boston. The efficiency of the centrifugal type, although not so great as that of the plunger type, is still quite high, and it is believed that the difference in first cost and the greater convenience in operation more than offset the slight difference in economy. Mr. William M. Brown, Jr., of the Metropolitan sewerage works, gave a flattering account of the operation of the pumps under his charge.

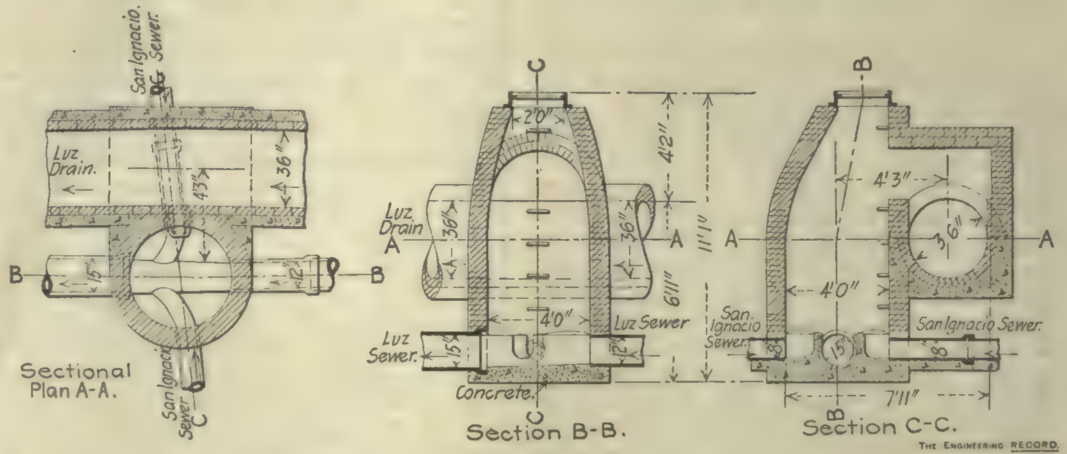
The syphon across the entrance to the harbor was originally planned to be similar to that built by the Metropolitan Sewerage Commission and described in The Engineering Record of May 11, 1895. It was to be a brick-lined steel conduit built in sections which could be floated into place, sunk, and connected by divers. It was finally decided to substitute two 5-foot flanged cast-iron pipes with flexible joints capable of deflecting 10 degrees. It is believed that these pipes will be cheaper and more easily laid, and also be as satisfactory in every respect.



Typical Section, Matadero Drain.



Typical Sewer Sections.



Combined Manhole for Sewers and Drain, Havana, Cuba.

The third change was the addition of an emergency pumping station at La Punta, the Havana end of the syphon. This is to be fitted with a centrifugal pump driven by an electric motor and will be used in case of accident to the syphon or the main pumping station across the harbor at El Morro. Before the completion of the syphon, the Morro station and the outfall sewers, the contractor is required to dispose of all sewage at this point, either by the use of the permanent pump or such temporary plant as he may install, pumping the sewage through a wood-stave outfall sewer into 25 feet of water, as described in the previous article. Afterward, in cases of emergency when this pumping station must be used, the sewage will have to pass directly into the entrance to the harbor at this point, although, of course, so long as the wooden stave sewer remained in good condition it could be used.

The fourth change was the general use of concrete around the pipe sewers in wet ground in order to avoid leakage and the consequent increased cost of pumping. The method of construction in the case of three typical sections is shown in one of the accompanying cuts. The specifications for the sewer construction were unusually rigid. In the case of pipe sewers and drains the excavation "shall be 1 foot wider at the bottom than the outside diameter of the pipe, and for brick or concrete sewers or drains, as wide as the greatest external horizontal width of the structure to be placed therein, without any undercutting of the banks. The trench at the top shall not extend laterally more than ½ meter beyond the outside of the sewer, unless by written permission of the chief engineer. Whenever the material is of such a nature as to allow it, the bottom of the excavation up to the greatest horizontal diameter of the proposed construction shall be made with a template, so as to conform to the exact shape of the proposed construction. If the character of the ground met with is such that the external form of the construction cannot be preserved, the excavation will be made to conform as nearly as possible to the external form of construction, and the space for a width equal to the greatest diameter of the construction between the bottom of the construction and the excavation must be filled with concrete in the case of a sewer and with well-rammed sand or loam in the case of a drain unless otherwise ordered by the chief engineer, and without extra compensation." The contractor is not allowed to obstruct adjacent blocks in parallel streets nor to occupy more than 100 meters of a street in which work is in progress, without written permission.

The disinfection of the trenches is also specified in the following clause: "All materials taken up and all earth uncovered shall be thoroughly soaked with disinfectants to the satisfaction of the chief engineer. The disinfectant used shall be a solution of chloride of lime in the proportion of one pound of chloride of lime to ten gallons of water, or electrozone furnished by the city at its works, of a strength not less than 125 grains available chlorine per gallon. All hauling and application of the electrozone to be done by the contractor. Quicklime will also be used when so directed."

The materials for the work on the sewers and drains are required to be of the best class. The concrete about the sewers is mixed in the proportion of 1 part Portland cement, 2 parts of sand and 3 of broken stone. The concrete bed is first laid and rammed to the grade of the sewer, and holes are left or excavated to receive the bell of the pipe. After the pipe has been laid and jointed, concrete of the same composition is then rammed on the sides and haunches to the outlines indicated in the cuts. In the case of drain pipes, the same method of laying is followed except that sand is used for bedding instead of concrete. Loose fine earth, free from stones, must be used in the backfilling for a depth of 2 feet above the sewer. The remainder of the trench must not contain more than one-third broken rock and no stone must weigh more than 50 pounds. The material must be laid in 6-inch courses and the ramming must be done with two tampers for each shoveler.

The fifth change was the adoption of combination manholes to serve both sewers and drains, in place of separate manholes for each. Their design is shown in the accompanying cut. Sewers and drains are ordinarily laid in the same trench, and by shifting one or the other a little throughout the length of the block, one manhole can be used for both. There are 776 of these combination manholes on the entire system, 871 single manholes for sewers and 32 for drains.

The sixth important change was the substitution of a flat-topped channel, like that employed in New Orleans, for the large circular drain originally proposed for the Matadero drainage district. This section, of which an illustration is given, has a heavy steel I-beam and concrete roof, and can be built at a greatly decreased cost and with its top at a much lower elevation than the circular section. The latter advantage is very important, as the drain has to pass under several streets which it is impracticable to raise. The illustration shows the largest cross-section; others of a smaller size have the same form.

So much has been said concerning the prices submitted in the only tender received under the recent call for bids, that it seems desirable to add a few words on the subject. The specifications were made to conform to Spanish precedents in a number of respects over which the engineer officer in charge had no control. All bidders were required to deposit with the city treasurer at least twenty-four hours before the time set for opening proposals, bonds to the amount of $500,000. This deposit was a guarantee of the good faith of the bidder. Within ten days after the approval of the contract the contractor was required to deposit $250,000 in United States currency with the treasurer of the Island of Cuba as reimbursement to the Island for its expenses in connection with the contract. The contractor was further required to furnish security in the amount of $1,000,000 for the faithful performance of the contract and the maintenance of the works, for the contractor was required to keep all the work in repair for a term of five years from the date of its acceptance, except the pumping machinery, for which the term was reduced to one year. Payments for the work were to be made monthly, but 10 per cent. was to be retained as an additional security and guaranty fund for keeping the works in repair. At least three-fourths of the unskilled laborers and employees had to be inhabitants of Cuba. In case of a general strike the contractor and mayor were to appoint arbitrators to settle it, but in case of failure to adjust matters within twenty-four hours, the contractor was allowed "to employ any labor available within the Island." The contractor was also required to insure the lives of the workmen against all accidents which might be caused by the works. The new requirements under which bids will be opened on September 25 have been somewhat modified from the draft first used.

A study of the full schedule of the engineer's estimate of the cost of the sewers and of the contractor's bid shows that the former, at least, was drawn up with careful attention to the details in each section of the city. When the schedules were first prepared, Lieut. Barden assumed that an addition to the estimated actual cost of 10 per cent. for contingencies and 15 per cent. for profit would be entirely sufficient. On further consideration, in view of the very many contingencies which are liable to occur in the prosecution of a work of such magnitude in a tropical country where the political conditions are liable to considerable change, it seemed that a larger percentage might be allowed. Accordingly, 20 per cent. was added for profit and 30 per cent. for contingencies. These large percentages were taken rather for the purpose of comparison with the figures actually received than as an intimation that they were the proper allowances to be made. In his report advising the rejection of the bid, Lieut. Barden did not mean, by giving these figures, to commit himself to the recommendation of acceptance of a bid with such large percentages for profit and contingencies. The total cost plus these additions was estimated at $5,275,338, whereas the only bid received was $6,573,353. There was a similar excess in the bid for paving so the tender was recommended for rejection.

Summary of Itemized Estimate of Cost plus 50 Per Cent. and of Bid. on the Smaller Sewers and Drains. Figures give price per foot.

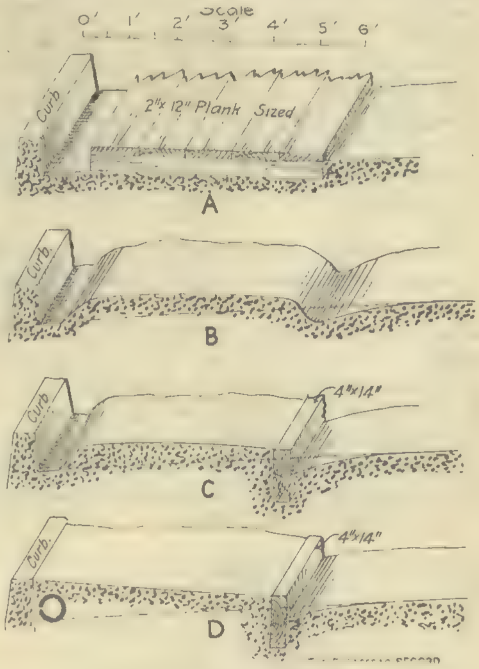
Diameter, Inches.	Length, Feet.	Lowest Figure, Estimate.	Lowest Figure, Bid.	Highest Figure, Estimate.	Highest Figure, Bid.
Sewers:					
8	465,061	$1.17	$2.18	$3.68	$3.21
10	57,013	1.54	2.48	3.44	2.50
12	24,652	1.88	2.70	4.83	2.70
15	26,037	2.25	3.31	4.18	3.31
18	14,596	2.61	4.01	7.13	5.03
20	8,897	3.20	4.53	6.32	5.53
26	7,446	5.56	8.23	9.21	10.19
28	6,872	6.15	8.54	11.21	16.46
32	4,887	6.47	9.24	9.76	9.24
36	3,756	8.23	12.03	12.79	17.37
Drains:					
12	13,924	0.68	0.91	0.68	0.91
15	18,375	0.99	1.34	0.99	1.34
18	24,820	1.23	1.87	1.23	1.87
20	21,008	1.50	2.32	1.50	2.33
24	24,820	2.56	2.56	2.56	2.56
26	10,457	2.85	2.85	2.85	2.85
28	8,735	3.17	3.14	3.17	3.16
30	9,289	3.37	3.36	3.36	3.37
32	7,662	4.30	4.30	5.22	4.30
34	5,674	4.72	4.72	5.11	4.72
36	5,258	4.96	4.96	4.96	4.96
38	5,815	5.46	5.23	6.35	5.23
40	3,109	5.60	5.77	6.68	5.77
42	5,314	6.00	6.04	7.13	6.04
44	3,155	6.77	6.32	8.05	6.32
50	2,749	7.36	7.36	10.12	7.36
58	2,181	9.87	9.25	11.30	9.26

It is interesting to examine some of the items where there was the greatest difference between the bid and the estimated cost plus 50 per cent. One of the items was 428,000 feet of 6-inch vitrified pipe house connections, where the maximum estimate was $328,860 and the bid $411,075. The South Side, Vedado and El Morro pumping stations were estimated to cost $415,650, while the bid was $683,972. The estimate for the syphon across the harbor was $163,425 and the bid was $285,000. In one section of the South-Side high-level district, the sewers and drains were estimated to cost $142,162, and the bid was $306,637. The tunnel for the 70-inch sewer in the North-Side marginal district (see the map in the previous article) was estimated to cost $46,368 and the bid was $112,000. The range of prices on some of the smaller sewers and drains is shown in the accompanying table, but it should be added that in almost every case except large drains the estimate of actual cost plus 50 per cent. is lower than the tender.

Bicycle Paths in Portland, Ore.

A number of bicycle paths have been put under construction in Portland, Ore., at the instance of the county government, although under the charge of City Engineer William B. Chase. They will not be constructed on every street, but only on general lines leading from certain districts to the four bridges which span the Willamette River. The streets are generally 60 feet wide and have a roadway 36 feet wide. Portland is a city with easy grades and widely separated houses, which lead to the use of a great number of wheels.

Four plans have been prepared for the paths. Plan A is built wholly of timber, with 4 x 6-inch mud sills placed at right angles to the path and 4 feet apart. Where the side slope of the street is flat the sills are laid broad side down, otherwise on edge. The top is made of five 2 x 12-inch plank laid close together and breaking joints at least 4 feet. Each plank is spiked to each mud sill with a 6-inch spike in each edge of the plank and three at each end. In general, the plank path is placed about a foot from the curb of the sidewalk and a small ditch is excavated along its outer edge.



TYPES OF BICYCLE PATHS.

Plan B is carried out by digging a small ditch with its center 6 feet from the sidewalk curb. The material is thrown on the path and enough earth, gravel or crushed rock added to make an embankment 5 feet wide and 8 inches above the surface of the street. The top is crowned slightly and the side slopes rammed until they are hard and smooth, a ditch at least 6 inches wide at the bottom being left between the curb and the path. The surface is a layer of cement gravel or screenings 1 inch thick.

Plan C is constructed by first setting a 4 x 14-inch timber curb 5½ feet from the sidewalk curb and with its top 2 inches lower. On the outside of this curb a ditch approximately 6 inches deep is excavated and the materials thrown on the path. After the plank is securely set and tamped in, the space back of it is filled with earth, gravel or crushed rock to a depth of approximately 8 inches above the normal surface of the street at the center of the path. The material is rolled or rammed, and then covered with a wearing surface of cement gravel or screenings, rolled or rammed until hard.

Plan D is 5 feet wide and is also formed with a 4 x 14-inch timber curb, which in this case has its top 1½ inches below the top of the sidewalk. The space between the two curbs is then filled to within 1 inch of the top with well-rammed or rolled earth, sand, gravel or broken stones. The wearing surface is a layer of fine cement gravel screenings 1 inch thick at the edges and slightly more at the center. Whenever necessary, a tile drain is placed, as shown in the cut.

The Construction and Dimensions of Chimneys for Boiler Plants.—I.

A few years ago the Prussian Minister of Commerce and Industry requested the boiler insurance companies and allied organizations to investigate the principles underlying the construction and dimensions of chimneys, considered structurally. These companies, the Society of German Engineers, the International Union of Boiler Insurance Societies and a number of specialists were represented on a commission which was appointed to undertake the work. After careful investigation a report was adopted, of which a full review appeared in The Engineering Record of August 13, 1900. It was decided to allow the use of any method of computing the stability of chimneys in which no reliance is placed on the tensile strength of the masonry. Two such methods of computation are employed extensively in Germany, and as there is no thorough explanation of the subject in English, it is proposed to explain one of these systems in the following article, translated and abridged from a paper by Prof. G. Lang in the "Zeitschrift" of the Society of German Engineers.

The following discussion applies to chimneys of round, octagonal and square cross-section:

Determination of the diameter and height.—The abbreviations employed in the paper are as follows:

d_o = inner diameter at top, in feet.
d_u = inner diameter at bottom, in feet.
F_o = area of opening at top, square feet.
F_u = area of opening at bottom, square feet.
F = area of opening of smoke flue and passages, square feet.

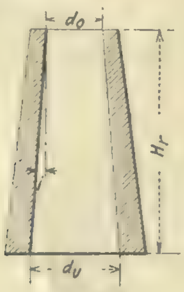


FIGURE 1.

G = weight of gas in pounds from combustion of 1 pound of coal.
B = coal burned per hour, pounds.
H_r = height of chimney in feet above grate-bars.
v_n = required velocity of escaping gases in feet per second.
l = length of smoke flue and passages.
t = temperature of outside air in degrees Fahr. (Most unfavorable case, 81 degrees Fahr.)
t_o = temperature of gases at top of stack, degrees Fahr.
t_u = temperature of gases at bottom of stack, degrees Fahr.
t_m = $(t_o + t_u) \div 2$, average temperature of gases in stack, degrees Fahr.
a = $1 \div 492$, coefficient of expansion of gas for 1 degree Fahr.
g = weight of 1 cubic foot of average dry air at 32 degrees Fahr, at average barometrical pressure.
d = density of escaping gases in respect to air at 32 degrees Fahr.
n = a constant dependent upon the length and form of the smoke flue.
u = factor representing the cross-section of smoke flue.
$\tan. i = (d_u - d_o) \div 2H$ = the average batter of the inner stack wall, H being the height of stack above flue opening. H may usually be taken as H_r.

For G: Let L represent the air required for theoretical combustion, then $G = \zeta L + b$, where b depends upon the fuel and ζ upon the method of burning. L varies from 0.8 to 10.7 pounds for fuels from producer gas to anthracite. For a solid fuel ζ varies from 2 for the older plants to 1.8 or 1.3 for more modern ones. A fair average is 1.7, but this will be reduced in time by improvements in practice. For gaseous fuel, $\zeta = 1.0$. For good anthracite coal, $b = 0.96$, $L = 10.6$: therefore $G = 1.7 \times 10.6 + 0.96 = 19$ pounds on an average.

For g: In moderate altitudes, 0.080; in higher altitudes it is less.

For d: the value is usually taken as 1. The actual value varies between 0.94 and 1.09.

For v_n: Usually taken at 13 feet per second; in sheltered locations 10 feet, but where the prevailing winds are deflected by hills so that they blow down into the chimney opening v_n should be 6 or 7 feet. Values as low as 1½ or 2 may be used when effectual wind-hoods are used, but these, on account of their exposed position, are but seldom to be recommended. If a number of boilers obtain draft from the same chimney, the value of v_n must be increased for full operation, so that for partial operation there shall be a sufficient speed of discharge. Instead of the average value, $v_n = 13$, let v_n for three boilers = 16.4, for 7 = 20, for 12 = 23, and in general, for 12 + x boilers, $v_n = 23 + (x \div 20)$ feet per second.

For t_o: The value is most easily obtained by estimation. It depends upon the boiler setting, the materials and thickness of the walls, and the tightness of the masonry, and varies from 300 to 520 degrees Fahr. The value of $1 + at_o$ is readily determined by the slide rule.

For t_m and t_u: Since t_u is much easier to measure than t_m and t_o, its value has more often been determined in practice, therefore it is easier to assume a value for it than for t_o in designing a new chimney. For careful firing t_u lies between 320 and 570 degrees, but it may vary considerably. Its relation to t_o depends not only on the height of the chimney, but also on its materials, wall-thickness and workmanship. In general it may be assumed that $t_o \div t_u$ = 1 to 0.96 for thick-walled brick chimneys, lined or unlined; 0.92 to 0.86 for thin-walled unlined brick chimneys and for plate stacks with fire-brick lining; 0.76 to 0.70 for cast-iron or plate stacks without lining. It may here be noted that the accepted rule allowing 1 degree Cent. of loss for each meter in height (1 degree Fahr. for 22 inches) is applicable only to thin-walled brick chimneys of moderate height. The smaller ratios apply to very tall, thin-walled chimneys, the larger ones to shorter, thick-walled chimneys which are free from cracks.

For n: In accordance with the length of the smoke passages, the value of n varies between 0.03 and 0.15. For well-designed chimneys in large plants, having ample flues and smoke passages, free from sharp angles, and with proper firing it may be taken as 0.04 or in particularly favorable cases, as 0.03. The smaller the internal batter, tan. i, the more the gases are hindered by narrow smoke passages and angles and the more unskilful the firing, the larger n will be, approaching 0.15 for locomotive boilers and 0.11 for water-tube boilers. If tan. i = o, causing a corresponding contraction of the smoke flue opening, nevertheless in an otherwise well-constructed plant n may be taken as 0.066 or 0.07. Intermediate values can easily be interpolated.

For u: The value is 3.1416 for a circular cross-section, 3.3137 for an octagonal cross-section and 4.0 for a square cross-section. These factors are used later in the calculation of the stability.

For tan. i: The value varies from 0 to 0.015. The American practice of building the inner flue with practically parallel sides is not to be generally recommended, since with increased value of tan. i height and weight can be saved. The value is usually taken between 0.006 and 0.011, or, more nearly between 0.008 and 0.010. This holds for lined and for unlined chimneys, including the base, but if the lining reaches only a short distance up the shaft, the above figures apply to the shaft alone. For the total draft height the average internal batter would be between 0.004 and 0.008.

The equation for the area of the top opening, as derived elsewhere by the author, is

$$F_0 = BG\,(1 + at_0) \div gd\,37{,}400\,v_n.$$

which being simplified by the substitution of v_n = 13 feet per second, t_o = 455 degrees, $1 + at_0 = 1.927$, $d = 1$, and $g = 0.080$, we have $F_0 = BG \times 0.00049$. For anthracite coal and good firing $G = 19$, hence $F_0 = 0.00936$ B. From which the size of opening can easily be obtained. For small plants it is best not to go below 2 feet in diameter for brick chimneys, but to obtain the necessary velocity of discharge by contracting the opening of the stack in accordance with the formula.

The height, H_r, of the stack opening above the grate-bars is influenced by so many considerations that a convenient and exact determination is impossible. It is best, therefore, to follow the example of Herm. Fischer and Rietschel and determine the value of H_r by a convenient approximate formula and from this the velocity of discharge corresponding to it. According to whether this quantity is greater or less than v_n, the required velocity of discharge, the value of H_r can be diminished or increased until v_o and v_n are equal. The closer the approximate formula for H_r approaches the local conditions, the easier will be the calculation; indeed, the approximation given below is often sufficient. H_r depends, first, upon the volume of the waste gases, therefore upon d_0; second, upon the velocity of discharge, v_n; third, upon the form and smoothness of surface of the passage walls, their length and somewhat upon the thickness of the fire, all of which is included in the term nl; fourth, upon the internal batter, tan. i, of the stack-walls and on the smoothness of their surface (the latter influence may be considered practically constant for all stacks); fifth, upon the average temperature t_m of the escaping gases and the temperature t of the outer air; for the last assume 81 degrees Fahr. as the most unfavorable case. These conditions are satisfied in the following approximate formula, which has been amply confirmed in practice:

$$H_r = (15\,d_0 + 2.5\,v_n + nl - 525\,\tan.\,i) \times (1292 - t_m) \div (328 + t_m).$$

For average conditions assume v = 13 feet per minute, l = 80 feet, n = 0.04, tan. i = 0.006, t_m = 482 degrees Fahr., and substituting, we have

$$H_r = 15\,d_o + 32.5,$$

in which the value of H_r may be taken as the next highest even foot. If the required capacity is very large, and according to the formula the stack should be of unusual height, it is preferable to resort to mechanical draft for the additional capacity required.

Construction.—Since chimneys if insecure are a constant menace to life and property, it is important that the materials of which they are built shall be uninfluenced by the weather and heat to which they are exposed. In the case of chimneys through which acid vapors pass, adequate protection should be provided, especially for the mortar joints.

Well-burned brick of high specific gravity are the best building material, and for round stacks those shaped to conform to the circle, the so-called radial brick are to be recommended. They are usually perforated vertically, as an aid in burning. Porous brick are undesirable unless they absorb little water and are weather-proof. Brick should not crush under a pressure ten times that which they are to support.

The strength of the mortar should be determined with reference to the time required for building, and under the prevailing conditions of rapid construction. Lime mortar strengthened with cement should be used. Mortar made with lime alone becomes equally strong in time, and resists the heat better, but does not harden so quickly, and therefore exposes a newly erected stack to danger of distortion or collapse should a storm occur before the mortar is fully set. Lime mortar, therefore, is only used for stacks that are to be constructed slowly, and when a strong outside scaffolding is used. The harder and better burned the brick are, the more needed is the cement, as lime mortar does not cling to them strongly.

The materials and the conditions under which they are to be employed vary very much, but it may safely be said that a mortar suited to chimney construction, made of a good quality of sand, lime and Portland cement, should show a strength of 441 pounds per square inch in compression and 73 in tension after 7 days in moist air, 735 and 103 pounds per square inch after 28 days and 1,029 and 132 pounds per square inch after 90 days, the compression test being made on briquettes having 7¾ square inches area, and the tension test on those of the usual German form. For materials of good quality this strength will be attained by a mixture of cement, lime and sand in the proportions 1 : 2 : 6 by volume for the upper part of the shaft, and 1 : 2½ : 8 for the lower part, careful mixing being of course understood. If the lime is hydraulic in its nature, the cement may be decreased; of the sand is very sharp, it may be increased. For the cap the proportions should be 1 : 1 : 4. Mortar of cement and sand alone is not to be generally recommended, as it does not resist the heat well and is attacked by the carbonic acid contained in the escaping gases, particularly when there is moisture present. This may be avoided by painting with a protective coating, but the cement mortar hardens so quickly that the structure does not set uniformly throughout.

Mortar made with lime alone may be used on the base, provided the strength is ample. For the foundation it is entirely out of place, and the proportion of cement should be increased if the ground is damp. Cement mortar is better in this portion, in the proportions of 1 : 4 or 1 : 5 if the load is not excessive, the heat being kept from it by a fire-brick lining so built as to allow for expansion. If the brick are specially hard and smooth, from ½ to 1 part of hydraulic lime may be added to increase the adhesion of the mortar.

The thickness of the shell at the top, for stacks built with inside scaffolding, should be at least 7 inches if of radial brick, and 9 inches if of square brick, since a thinner wall will not support of scaffolding. In square stacks a thickness of ½ brick in the upper section is only to be allowed when the scaffold is built outside and independently. Such scanty dimensions are not really economical, however, since the height of the upper section is thereby limited, the temperature of the exit gases diminished by radiation through a thin wall, making a higher stack necessary, and the above-mentioned difficulty in construction encountered in order to save a relatively insignificant amount of masonry. The lower the temperature and higher the moisture of the escaping gases, the greater the advantage of the thicker wall. The old rule giving one-tenth of the top opening as the thickness of the wall gives too small a value for narrow stacks and one too large for wide stacks. A better rule is to assume

$$S = 0.328 + 0.05\ d_0 + 0.0005\ H.$$

where S, d_0 and H are the thickness, inner diameter and height in feet.

In order to find the height, h, of the sections between the offsets in the thickness of the wall, assume the following terms, with reference to Figure 2:

φ = factor for the height of the section dependent upon cross-section of the shaft.

H_0 = the height of the shaft in feet.

r_0 = the half diameter of top opening in feet, the inscribed circle for polygonal sections.

r_n = the half diameter of shaft at base of the nth section in feet.

tan. i = the tangent of the angle of internal batter.

S_1 = the thickness of the wall of the top section in feet.

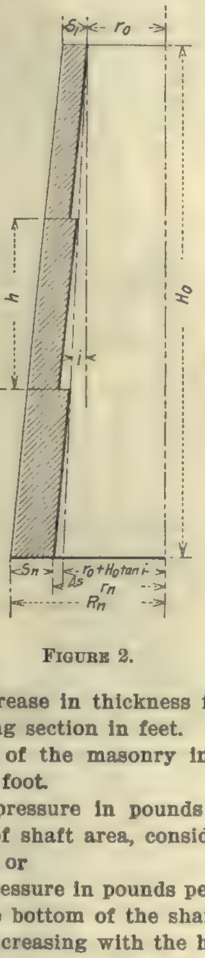


FIGURE 2.

$\varDelta s$ = the increase in thickness for each succeeding section in feet.

γ = weight of the masonry in pounds per cubic foot.

ω = Wind pressure in pounds per square foot of shaft area, considered as constant, or

ω_u = wind pressure in pounds per square foot at the bottom of the shaft, the pressure increasing with the height.

For plain brick stacks in which the temperature of the escaping gases t_m does not exceed 480 to 570 degrees Fahr., the following formula is a very close approximation, the wind pressure increasing with the height:

$$h = (20\ S_1 + 60\ \varDelta s + 0.1056\ \gamma + 2.5\ r_0 + 656\ \tan.\ i - 0.01\ H_0 - 0.453\ \omega_u - 18.7)\ \varphi.$$

Considering the wind pressure as constant, the formula would be,

$$h = \varphi\ (20\ S_1 + 60\ \varDelta s + 0.1056\ \gamma + 2.5\ r_0 + 656\ \tan.\ i - 0.007\ H_0 - 0.453\ \omega_u - 18.7).$$

The values of φ, which are 1 for circular, 0.97 for octagonal and 0.83 for square sections, show the advantage of the circular form.

Proper values for tan. i have already been given in the discussion of the effective height, H_r. If r_n is given in place of tan. i, the latter may be found from the equation, referring to Figure 2,

$$\tan.\ i = (r_n - \varDelta s - r_0) \div H_0.$$

The preceding formulas for the spacing of the offsets are derived from the measurements of a large number of chimneys of improved construction, and their use facilitates the rapid design of the most economical chimney for a given set of conditions. If a value for h be obtained that is not contained an even number of times in H_0, the total height, it may be slightly increased or diminished, and the equation worked out again for the differing valve of tan. i. Practical examples of this method are given by Professor Lang in his work entitled "Der Schornsteinbau."

The preceding equations hold good for all materials and for every condition of batter, wind-pressure, diameter and wall thickness. The only proviso necessary is that in the case of stacks having a shaft height exceeding 100 feet, the critical point is no longer at the base of the shaft, but at the bottom of one of the lower sections, therefore it would be well in using the preceding equations to substitute, say, 100 for H_0 instead of the real height, using also a corresponding value for ω_u, and then add enough sections of a height, h, so found to make the needed height.

If the gases are more than 510 degrees Fahr. in temperature, an inner lining of fire-brick is to be recommended, from 4 to 9 inches in thickness, according to the height of the temperature. In the two preceding equations for h, an extra term $+ 10\ s_1$ may be added, this being the proper allowance for the benefit of the lining. If the temperature is not above 480 degrees a fire-brick lining reaching only to the top of the base is sufficient.

The base itself requires no special treatment, except for architectural reasons. It is usually a simple prolongation of the main shaft down to the ground level. The inner opening remains the same, while the form of the outside may be varied at will to accommodate the entrance of the smoke flue. It is only necessary that the masonry shall be at least as heavy as if the shaft itself were continued to the point in question.

The foundation is enlarged at the bottom to distribute the weight so that the ground shall not receive more per square foot than it can properly carry, at the same time avoiding variations in pressure due to the wind. The latter requirement usually prevents the use of very deep foundations. The footing slope should have a general angle of at least 60 degrees with the horizontal. According to Hotop, it is sufficient if the foundation be carried below ground level one-eighth of the height of stack above ground, its breadth being one-eighth of the total height. For unusually wide chimneys these values are to be increased. By adhering to this rule foundation pressures exceeding 530 pounds per square foot will seldom be encountered. For sand and gravel bottoms this is by no means an excessive load, and it may safely be imposed upon clay bottoms as well if the footing is properly proportioned. Concrete rammed in place is the material best adapted for the foundation, as it forms a single monolithic mass. Its depth should exceed 1.6 + 0.01 H, expressed in feet. The concrete may be composed of cement, hydraulic lime, sand and stone in the proportions of 1 : 0 : 4 : 7 to 1 : 1 : 4 : 7, according to the amount of water encountered. Hotop's rule may be disregarded in the following cases:

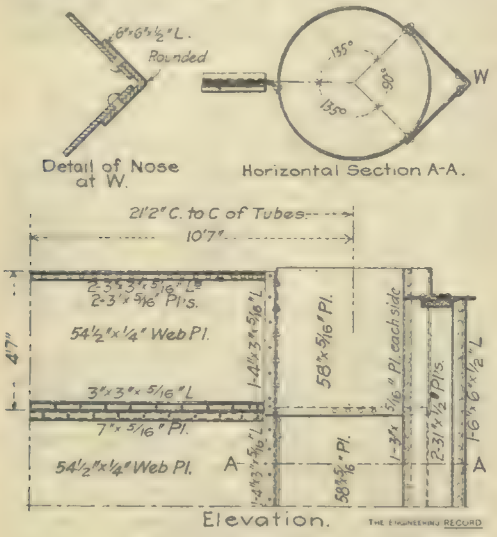
If the foundation is solid rock, a much higher load than 530 pounds per square foot may be used. If the bottom proves untrustworthy after it has been excavated some distance, dry material may be rammed in to form a bottom, as done by Dulac (see The Engineering Record of September 4, 1897), or if water is present piles may be driven, cut off just below low-water mark and then capped with concrete.

If the water level is very near the surface, the foundation should be carried but little below ground level. The bottom of the shaft opening must be at least 3 feet above the water, and protected from rising moisture by waterproofing. The footing projections will be at an angle less than 60 degrees, and usually it will be necessary to lay I-beams or old rails in the concrete in two layers at right angles to each other. If space is limited by adjoining buildings, the foundation may be extended in the direction where possible, and old rails built in.

(To be Continued.)

The Dunsbach Ferry Bridge.

The Mohawk River ferry about four miles above Cohoes, N. Y., was replaced in 1898 by a light highway bridge 20 feet wide in the clear and 206 feet long, with three equal steel truss spans supported on two abutments and two steel cylinder piers. It has a 16-foot roadway and a 4-foot sidewalk, is proportioned for dead and live loads of 1,000 and 1,200 pounds per lineal foot respectively.

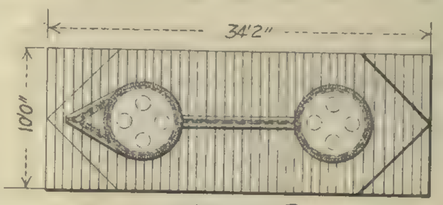


Details of Top of Pier.

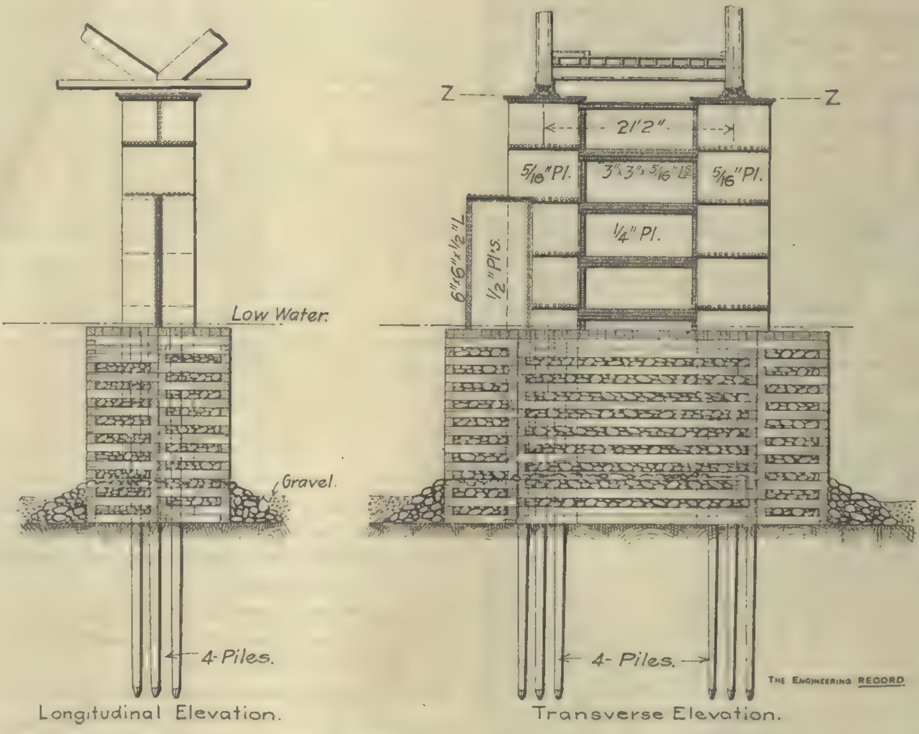
The through Pratt trusses are 204 feet long and 30 feet deep, center to center of pins, and are divided into 34-foot main panels. Sub-verticals in the middle of every panel suspend the intermediate floorbeams and support the centers of the top-chord sections, their connections at the centers of the main ties being braced by short counter diagonals to the tops of the main posts. The end posts and top chords are made of pairs of 10-inch channels and 14-inch cover plates, the vertical posts are made with pairs of channels and the bottom chords and diagonals are made of pairs of 3, 4 and 5-inch eye-bars. There are deep knee-braced portals and overhead sway-brace frames of riveted angles. The top and bottom laterals are pin-connected rods, which have bent loop eyes engaging the ends of the lower-chord pins. The I-beams carrying the floor are bolted to the vertical posts and have brackets on their lower flanges to receive the thrust of the bottom-chord pins which take bearing on them with jam nuts. The centers of the lower lateral rods are supported from the intermediate floorbeams by adjustable suspenders.

The tallest pier is about 44½ feet high and is seated on the hardpan just below the bottom of the river in about 28 feet of water. It is made with two vertical steel cylinders, 5 feet in diameter, one under the center of each truss, and connected by a vertical transverse diaphragm plate with stiffened horizontal splices, which extends from the top to one foot below the low-water line. A V-shaped cutwater was riveted to the upstream side of the upstream cylinder. The other pier is 39 feet high and is in about 19 feet of water. The fill between the wing walls of the approaches was made from stone wall fences purchased in the vicinity for six cents a cubic yard and was piled up with the large stones laid in courses at the bottom.

The pile trestle bents of falsework were framed on shore, floated to position and raised by the booms of an overhead traveler. The two 8-inch piles in each bent were then driven, butts down, by a wooden ram operated by a tackle on the traveler boom, and guided by a long vertical rod controlled by a man seated on the boom. An extra heavy bent was set each side of the pier and a longitudinal gallows-frame was seated on the caps of the two bents in the plane of each truss. The lower section of one cylinder was floated under the gallows-frames and lifted by two tackles suspended from one frame and one tackle suspended from the other frame. The boat was removed, and the double tackle hoisted and the single one slacked until it could be removed and the cylinder lowered vertically to rest on bottom. The upper section of the cylinder was similarly handled and bolted to the top of the lower section, above the water line. A wooden frame was put in the cylinder and it was centered, plumbed and seated on the bottom of the river, the other cylinder similarly erected, the transverse diaphragm plate bolted to them, and the field rivets driven. The bottom was nearly level, but when one cylinder was found a little higher than the other the falls were attached to the low one and it was lifted clear of the bottom and moved back and forth laterally while the bottom inside the other cylinder was broken up with a long churn drill to facilitate its penetration. After the cylinders were thus levelled the tackles were removed and they stood for two weeks without any support except the resistance of the soil under the edge of the metal 5/16-inch thick, which amounted to 265 pounds per square inch and caused no settlement which could be detected by daily level readings.



Plan Z-Z.



Longitudinal Elevation. Transverse Elevation.

Steel Cylinder Pier with Anchor Piles and Protection Crib.

A guide frame was put in each cylinder and four 46-foot piles were simultaneously set in it, and successively driven about 13 feet by a 1,400-pound hammer which, falling 20 feet caused a final penetration of 1 inch. The guide frames were removed, the tops of the piles cut off, and the cylinders filled to the water line with 1 : 2 : 4 concrete deposited through a chute; above water the proportion of stone was increased to 4½. After the concreting was finished protecting cribs of 12-inch hemlock were built outside the cylinders. They are 30 x 10 feet in plan and 14½ and 22 feet high, reaching from hardpan nearly to the low-water level. Each crib had four sets of cross timbers and was sunk by filling the floored end pockets with stone. The loose surface of the river bottom was dredged down to hardpan for the crib foundations, and the excavation outside the cribs was filled with riprap for some distance above the original surface of the bottom.

The stability of the piers was demonstrated by the exposure of one of them after its completion to the pressure of a 2½-acre field of 20-inch ice in a current of two miles an hour, without perceptible displacement or injury. The bridge is owned by the Dunsbach Ferry Bridge Company, Cohoes, N. Y., Mr. W. H. Adey, engineer, and was designed and built by the Wrought Iron Bridge Company, of Canton, Ohio.

An Unusual Instance of the Deterioration of Wrought Iron Pipe.

In a recent volume of the "Proceedings" of the Institution of Civil Engineers, Mr. William Wark describes an unusual experience with wrought iron pipe buried in light sandy soil at Hay, N. S. W. In the year 1885 the gas-works were built, and the usual course was adopted of laying the consumers' services of ordinary black wrought-iron pipe. The conditions of climate appeared to warrant the expectation that precautions such as are usual in the humid climate of the United Kingdom would not require the same consideration in New South Wales. It was assumed that the dryness of the climate would constitute a factor in the preservation of all ironwork, and this has proved to be so, but only in the case of iron not in contact with the soil.

After the lapse of 11 years, attention was drawn to a steady increase in the amount of gas unaccounted for, and examination led to the discovery that the pipes had completely perished, and exposure to the air had caused them in some instances to crumble to pieces, while in others the granulated appearance of the external surface suggested galvanic action between the metallic base of the soil and the wrought iron. The suggestion that the action of coal-gas was in any measure accountable for the corrosion, was not upheld by any facts elicited during the investigation. The interior of the pipes may, through the action of impurities in the gas, scale and become filled with rust; but the evidence in this case strongly supported the assumption that the injury was due principally to external causes, and this theory is partially borne out by the fact that wrought-iron water-service pipes, in the town, have a life of only 7 years.

The influence of soil in contact with the metal has been held responsible for the structural alteration of its character, but it has not been proved that the deterioration is due to the constituents of the soil, to dampness, or to the alternations of moisture and dryness; and it is probable that, owing to the light character of the soil, the great variations of temperature throughout the seasons exercised some influence. Analysis of the soil disclosed the presence of large quantities of common salt and magnesium chloride, in addition to iron, alumina, silica, lime and phosphates. Owing to the dryness, heat and length of the summer season, it is customary to water the streets frequently, and, as they are uniformly level and without any system of drainage, the subsoil is continuously damp. It is conjectured that, as the result of this periodical and frequent street watering, the combination of carbonic acid with the moisture so readily absorbed by the porous earth, formed the basis of chemical action, and the alternate moisture and dryness no doubt greatly facilitated the process of deterioration. To all appearance, the trouble is confined to wrought iron, the cast-iron mains not showing any signs of unusual injury. Experience in other parts of the colony is quite at variance with that at Hay. In Bathurst, where the soil is of a rotten granite nature, services are still in use, and apparently quite sound, after a life of 27 years.

In relaying the Hay services the preservative measures adopted consisted in applying heat to the pipe and then coating it with boiling coal-tar, with a little lime added to neutralize the carbonic acid before application, and in embedding the pipe in a layer of asphalt. Raw tar is not well suited for coating iron. Instances have been known of damage resulting from its use, the injurious action arising from the presence of carbonic acid. Exception has been taken to the inference that lime exerts a protective influence over wrought iron, since from its hygroscopic character it must act as the vehicle for conveying the very element which it should be the aim to exclude. Where clay is obtainable, puddle is recommended for the envelopment of pipes, as a preventive against injury by corrosion.

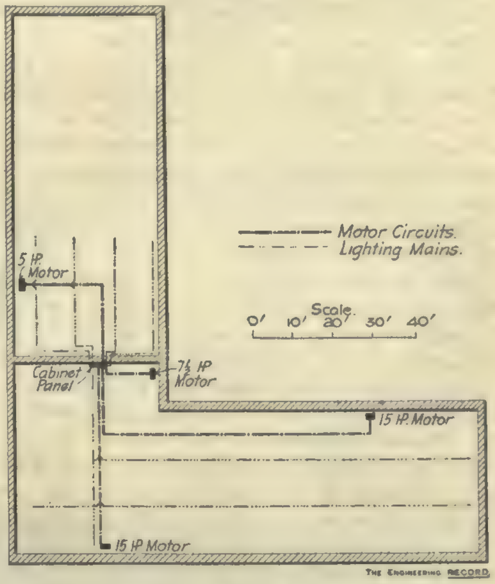
Concrete Foundations for columns have recently been built with expanded metal in their lower part as a substitute for a steel grillage. A considerable saving in cost is reported.

The New Power Plant of the Joseph Dixon Crucible Company.

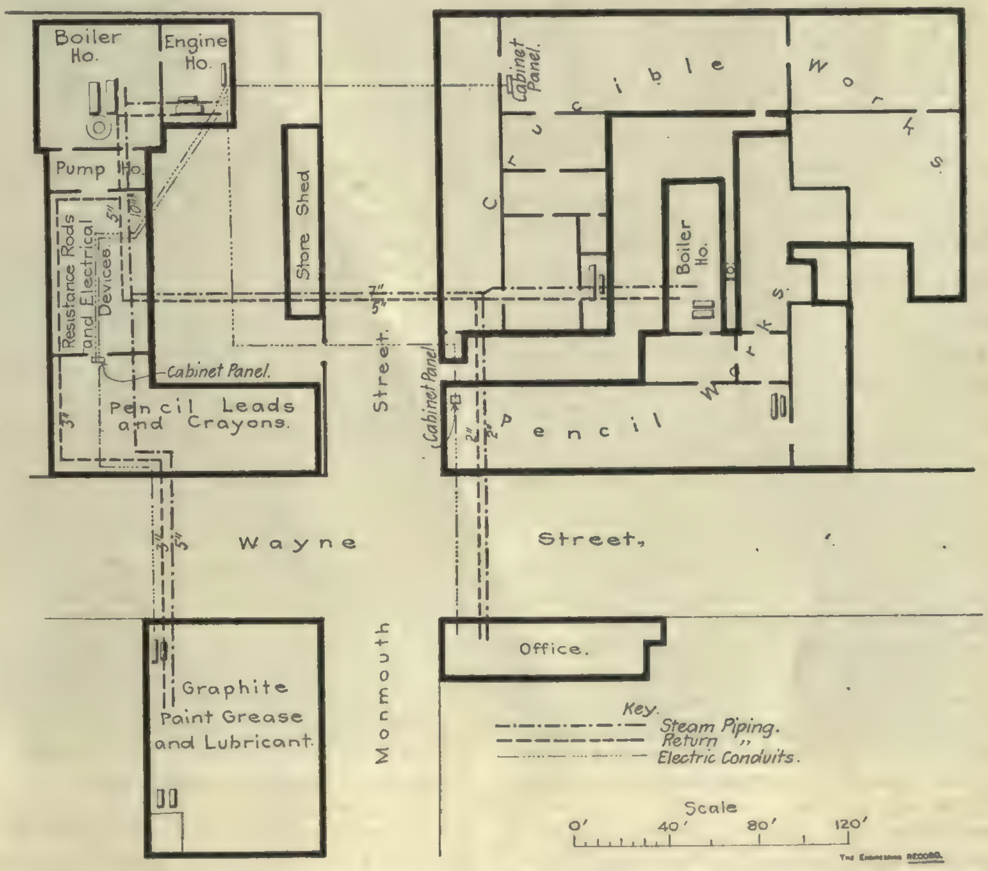
The works of the Joseph Dixon Crucible Company in Jersey City were formerly operated by four separate steam plants located respectively in the lead and crayon, grease and lubricant, pencil and crucible works shown in the accompanying plan of the establishment. The plants were respectively of 50, 80, 80 and 250 horse-power. It was decided to build a central steam plant and distribute electricity to the various buildings and use motors. The new plant is directly on the tracks of the Pennsylvania Railroad, and as the boiler room floor is below the elevation of the track, coal is dumped from cars directly on the boiler-room floor in front of the boilers.

The new plant, which is constructed of brick, contains a 60 x 45-foot boiler room, a 45 x 30-foot engine room and a pump room, 20 feet square. The stack, which was erected by the Alphons Custodis Chimney Construction Company, is built of brick, and is 5 feet in inside diameter and 150 feet high. It is located immediately behind the boilers, thus avoiding a long breeching.

There are installed at present two Babcock & Wilcox boilers of 264 horse-power each, with 126 4-inch tubes 18 feet long, laid fourteen wide and nine high. The boilers each have two 36-inch drums, 20 feet 4 inches long. The steam pressure carried is 90 pounds. The boilers are equipped with Korting injectors in addition to the feed pumps. Double blow-off valves are used and the blow-off is connected with a tank 6 feet long and 4 feet in diameter, opening to the atmosphere. All the drips from the exhaust piping system also lead to this tank, which is connected with a sewer. The Parsons hot-blast injector is used on the boilers to regulate the steam pressure. The fuel used is buckwheat anthracite coal. Space is provided in the boiler room for an additional unit of the same size.



Typical Wiring Diagram.



General Arrangement of Joseph Dixon Crucible Co.'s Works.

The feed water is obtained from artesian wells, thus avoiding the expense of using city water. All the condensation from the steam and heating mains is returned to a drip tank by Kieley & Mueller traps. The shortage in water thus returned is made up by pumping a supply from two cisterns under the floor of the pump house next to the boiler room. The feed water pumped, both from the drip tank and cisterns, passes through an auxiliary heater and is heated to 190 degrees, thence through the pumps to a 500-horse-power Berryman heater where the temperature is raised to 212 degrees. The feed pump is of the Blake duplex pattern with cylinders 7½ and 5 inches by 6 inches. A Kieley & Mueller governor is used on the pump.

In addition to furnishing steam for the new engine the boilers, at present, are furnishing steam to operate the engines in the crucible and grease works. The steam mains leading to these works are laid underground on the outside of the buildings, as shown in the plan. The steam piping is connected to a 14-inch steam drum placed on top of boilers; the size of mains are shown in the drawing.

Steam is also used for dry rooms with the pressure reduced to from 10 to 40 pounds and for other purposes. Return mains are laid with the steam mains, as the condensation in the dry rooms is very heavy and these mains are connected with the drip tank before mentioned.

The exhaust from the feed water pumps is carried to the auxiliary heater and thence to the atmosphere, and from the main engine through a Kieley & Mueller oil separator to the Berryman 500-horse-power heater. A Kieley & Mueller back pressure valve is placed in the piping above the heater, and the steam after passing through the heater is used for heating the buildings in the winter and escapes to the atmosphere in the summer. The back pressure valve is set at 1 pound in the winter.

There is installed in the new plant one 150-horse-power Fischer simple, high-speed engine direct-connected to a 100-kilowatt, 230-volt, direct-current, compound-wound Crocker-Wheeler generator running at 250 revolutions per minute. The engine is equipped with a Wright spring governor and a Kieley & Mueller separator. A gravity oiling system is used.

There is space in the engine room for three more units of the same size, it being intended to install these so soon as the grease, crucible and pencil works are equipped electrically.

A ten-ton traveling crane has been placed in the engine room, made from plans prepared by the company's engineer.

The switchboard, built by the Walker Electric Company of Philadelphia, contractors for the electrical work in the plant, is made of marble and consists of one generator and one feeder panel. The generator panel is equipped with voltmeter, ammeter, starting switch and circuit breaker; the feeder panel with a recording ammeter and six switches, four controlling main circuits to the lead and crayon, grease, crucible and pencil departments and two in anticipation of the erection of new buildings.

The mains are carried out of the station in iron armored conduit, laid underground outside of the buildings, to a main distributing cabinet panel in each building, located on the lowest floor. From this main panel, vertical mains are carried to the other floors and also mains to the various motors on the same floor and the lighting mains. On each floor other cabinet panels are placed, which distribute the lighting mains and mains to the motors on the respective floors. A plan of the wiring on the first floor of the lead and crayon department is shown in one of the accompanying cuts.

Two hundred and thirty volt lamps are used, so that only one voltage is required in the entire station.

The lead and crayon department is the only part of the works now being operated electrically, and there are installed fourteen Crocker-Wheeler motors from 5 to 15 horse-power each. These motors are belted to small lines of shafting which drive in turn several groups of machines. The pencil factory is now being equipped with ten motors from 1 to 10 horse-power each. For the present, the crucible and grease works will be run by steam taken from the central steam plant. It is proposed, however, to run the entire plant by electricity eventually.

The company has two artesian wells respectively 1,200 and 400 feet deep. An air lift is used to raise the water from the wells to the cisterns in the pump house. From the cisterns it is pumped by a direct-acting steam pump for distribution through the various buildings. The air compressor, which is also used for operating the pumps on the hydraulic filters used in the process of preparing the graphite and for an air lift used to raise ashes from the boiler-room floor, is of the Ingersoll-Sergeant single acting, fly-wheel type with cylinders 7 and 9 inches by 9 inches. The compressor is equipped with a receiver 3 feet in diameter and 6 feet high. The air is compressed to 90 pounds. The cisterns are constructed of tank steel and are respectively 6 feet square by 6 feet deep and 12 x 9 feet by 9 feet deep. The steam pump is of the single-acting Blake pattern with cylinders 7 and 6 inches by 8 inches. The exhaust steam from the air compressor and pump passes through a small heater in the pump room and thence to the atmosphere. This heater is used to heat water for manufacturing and toilet purposes and is distributed over the several buildings.

Mr. Fred Engelbrecht, superintendent of the color and lead department, designed the new plant and supervised its construction.

A Factory Suspension Bridge.

Large quantities of light goods have to be transferred between the upper stories of two factory buildings about 250 feet apart in the Johnson & Johnson plant, New Brunswick, N. J. It was proposed to connect the buildings with a truss bridge span or by a trestle viaduct, but it was considered that these structures would be too expensive, or would cause too much obstruction on the grounds, and it was almost decided to transfer the goods on a surface railway and hoist and lower them by elevators in both buildings, when a light suspension bridge and tramway was adopted. This has recently been completed and is now operated satisfactorily. Considerable ingenuity was exercised in making the main walls of the building serve for the bridge towers, and the walls, roof and floor serve for the anchorages without subjecting them to injurious strains or involving any material expense above their necessary cost, and without obstructing the interior of the buildings.

The bridge floor has a reverse camber of 2½ feet in the middle, and has a grade of about 10 feet down from the fifth floor of one building to the fourth floor of the other. Its center line is perpendicular to the face wall of one building, and makes a skew of about 15 degrees with the face wall of the other building. The bridge is proportioned for a concentrated load of 4,000 pounds, and has four ⅞-inch steel cables with a breaking strength of 28½ tons each. The upper cables have a versed sine of 22 feet, are 11 feet apart at their highest points, and are cradled to give a clear width of 4 feet 2 inches to the bridge platform.

The bridge floor is made of narrow transverse planks bolted on top of the lower cables, and having 6 x 4-inch longitudinal stiffening timbers bolted across both ends of the planks. These timbers supply all the stiffness of the bridge, except what is derived from the cables themselves, and are carefully lap-spliced so as to be continuous from end to end. The 2 x 4-inch floor boards are spaced 2 inches apart in the clear so as to diminish the resistance to the wind as much as possible, and on them is laid a narrow-gauge track with very light rails for the transfer car, which is hauled up the grade by a wire rope on a friction drum belted to a shaft in one of the buildings. The whole bridge weight, inclusive of track rails and two lines of hand-rail rope on each side, is 62 pounds per lineal foot.

The main cables are arranged on the principle illustrated in the description of the Nuttallburg bridge in The Engineering Record of February 3, 1900. One end of each main cable is anchored, and the rope passes over the two towers, around an anchored sheave at about the roadway level, and returns parallel to the roadway, which it directly supports, and is anchored separately near the anchorage of the first end. In this case the bridge connects the upper stories of both buildings, and the outer brick walls are carried up a few feet above the regular cornice lines to form the bridge towers. In the oblique wall one cable enters it about 18 inches higher than the other. The eight bearings of all the cables on the walls are made with flanged saddle castings built into the brickwork, which completely encloses them.

At one end of the bridge the upper cables are attached to steel straps, which are bolted to the flat roof deck, crossing several main girders, through the first one of which there are a pair of vertical rods anchoring them down to the floorbeams in the story below. These rods constitute the only obstructions in the buildings which are made by the bridge, and as they are near the regular columns they are not troublesome. The end of the lower cable is carried under the fifth floor of the building, and passing through a floorbeam is anchored by nut and washer bearings on its vertical side. Additional security is gained by tying this beam to the next by two rods parallel to the cable. At the opposite end of the bridge both upper and lower cables pass across the 50-foot building, and their bight engages two sheaves anchored to the rear wall, one near the ceiling, of the fourth story, and the other near the ceiling of the third story. The two sheaves in the plane of each pair of cables, or of the two parts of each continuous rope, are attached to a vertical strut which is bolted to the wall and braced at the bottom by the ends of the adjacent floorbeams and at the top by angle-iron knee braces to the ceiling beams. Both main cables and hand-rail ropes have long screw adjustments, and the bridge is so rigid that very little deflection or vibration is observed walking over it or from the passage of the loaded car. This bridge was designed and built under the direction of Mr. S. A. Cooney, engineer for the John A. Roebling's Sons Company.

The same builders have recently shipped a highway suspension bridge to San Cristobal, Tachira, Venezuela, which was designed for transportation on mule back 40 miles from the seacoast to the site, a condition which limited the separate pieces to a weight of 300 pounds and a length of 8 feet. The bridge has a span of 190 feet, and a roadway which is 8 feet wide in the clear, and was required to be capable of supporting a load of cattle closely packed from end to end of the bridge. It was therefore proportioned for a load of 640 pounds per lineal foot, which is carried by two main cables, each composed of seven 1-inch galvanized steel suspension bridge ropes with a breaking strength of 41½ tons each.

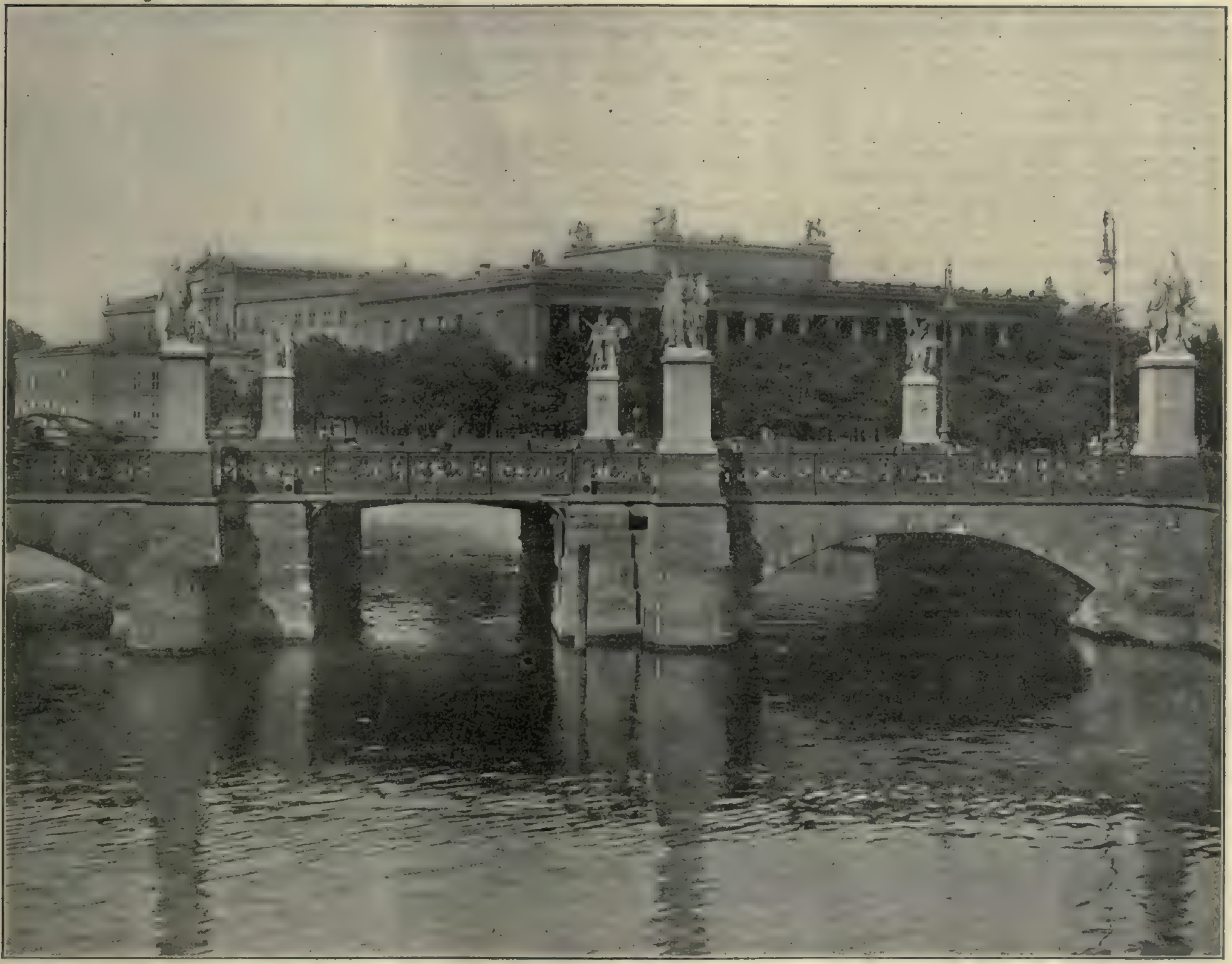
At one end the cable strands are connected to oblique U-bolts cemented in vertical holes drilled in the solid rock, and at the other end they engage pins in a 6 x 3-foot anchor shoe, made of pairs of 6-inch and 7-inch channels riveted together and bedded in a solid block of masonry. The strands are united to form cables 3 inches in diameter, passing over the tops of towers 19 feet high, which will be made of brick manufactured at the site with horse-power machinery. The cables deflect 16 feet, are cradled 2½ feet each, and are stiffened with wooden Howe trusses 5 feet deep, which have double lower chords. The longitudinal floor planks are covered with concrete and the dead weight of the structure will be 500 pounds per lineal foot.

A Fire Test of a Concrete Building was afforded by the recent serious fire at Mr. Thomas M. Morgan's Crescent cement works at Longue Point, P. Q., Canada. The works destroyed were built two years ago with concrete walls and the rest of the structures of wood. These walls were almost intact after the fire, although brick or stone masonry would have been seriously injured, Mr. Morgan writes.

Requirements of Electricity in Manufacturing Work.

A paper by Prof. Wm. S. Aldrich, read before the American Society of Mechanical Engineers at the Milwaukee Convention.

This paper briefly considers some essential features of electric power transmission in manufacturing work. Earlier treatment of the subject has been varied and somewhat scattered, but not necessarily inadequate as far as the science had been developed at the time of its presentation. The statements and principles here set forth are founded upon what has been done, upon actual experience.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXV, BERLIN, THE SCHLOSS BRIDGE.
A larger detail of the structure shown in the last issue.

Examples illustrating one or more of the principles involved might here be cited in detail, but complete descriptions of installations and valuable results of experience are now accessible on every hand. In fact, the whole development of this field of application of electricity is quite open and above board. It is founded upon common sense and engineering practice. It has therefore at once an advantage over many earlier and some modern or wished-for developments of electricity. The demand for increased production is extending to all lines of manufacturing industry. It is created by the keen competition of trade and the necessity of filling orders promptly. The exigencies of business, therefore, are bringing directly to the front the question of this new motive power in manufacturing.

Factories are not built in a day, but the ready extension of existing electrical supply service has increased the output from 30 to 40 per cent. per square foot of floor space. New machines and tools cannot always be obtained on telegraph order, but a resort to electric driving has increased the output of existing machines from 20 to 60 per cent. Workmen may not be had for the asking, but giving them electric-driven machines has increased the output per man from 10 to 30 per cent. All of this has been developed without any strikes or other than satisfactory regulation of wages by recognized premium and price-rate systems.

It is an axiom that the old-established concerns get the business. To-day they must guarantee delivery on time and at lower prices to keep their factories and mills in operation. Electric driving accelerates and intensifies production for the first requirement. It reduces the cost of production from 25 to 45 per cent. for the second requirement. Of two manufacturers, each using the same size and style of latest machines, with equally skilled workmen, the one adhering to belt transmission, with its limited capacity and speeds, will probably fall behind in orders. With many manufacturers it is still a question whether the electric drive costs more to install and to maintain than the belting system. This can only be determined for each particular case as it arises. If it should cost more, it will still prove a profitable investment when it increases the output per day, per man, per machine, per square foot of floor space, increasing the quantity and enhancing the quality of the product while decreasing the cost.

It is no longer a question of the efficiency of electricity vs. shafting for power transmission. Nor is it a mere question of saving at the coal pile when only 2 or 3 per cent. of the total cost of production is to be charged to the fuel account. In many cases electricity has effected a saving during the first year that has more than paid for the change to the new system. Whether it is more or less economical than mechanical transmission depends upon circumstances. When properly installed and operated, electricity should have inherently all of the considerations in its favor.

The resulting economy of production and the ability to fill orders promptly are all in favor of the electric system. It may be compared to skilled labor—high-priced, but very desirable from the standpoint of the economics of production. Few manufacturers still hesitate to employ high-priced skilled labor. Many more cling to antiquated methods of driving modern machinery operated by most skilful workmen. To-day, therefore, this question assumes very different proportions. The discussion has been shifted to the field of manufacturing economics, involving considerations of maximum output with given equipment, floor space and working force. It is a question of accepting and filling orders or of losing the business to those manufacturers who can take them.

The disciplinary value of electric driving cannot be ignored. The old easy-going belt system used to allow many a glance at the morning news, many a familiar chat during long and deep cuts. With the electric drive the operator finds it very convenient to be near his machine. The customary warning signals of slipping belts are no longer heard.

Satisfactory illumination should also be provided. No one will work by a smoky torch when he can have an arc or an incandescent lamp. Electric light must be supplied in these times in all shops where they make a practice of doing a day's work the year round. Only a little wiring is required, and a small amount of extra power is necessary at the generating plant to drive machines and tools by electricity. In many instances electric lighting has paved the way for electric driving.

We have all had experience in getting men to "speed up" their machines. Tradition and custom are both against the operator who does much belt shifting. In the eyes of almost all journeymen and of some piece workers it is next to treasonable to change the rate of working. Even though paid extra, to do more than a day's work in many shops is still a crime against the union or other combination interested. The workman who attempts it soon finds a job elsewhere or is promoted. The electric drive changes all of this. A press of the button, a turn of the lever, and each piece of work can be executed at maximum speeds allowed by the temper of the tool steel. It forcibly illustrates Maxim's statement that American workmen find it pays to do as much as they can.

The ever-widening applications of electricity in manufacturing work show that it has fully proven its claim to a consideration. It is thoroughly reliable. It has come to stay. It fills the exacting requirements in this new field more economically and satisfactorily than any other system of power transmission. In the common forward movement of industry electricity is still in the van. It stands ready for any emergency within its province and so far has been equal to each new demand made upon it.

Aside, however, from all purely technical considerations of the application of electricity to manufacturing stands pre-eminently the question: does it pay? Many manufacturers have conclusively shown that the economies of production have been enhanced by their adoption of electricity, that its inherent advantages in this relation far outweigh all previously debatable questions of economy and efficiency of the electric drive compared with belting transmission and that even if there were no saving at the coal pile it would still not pay to return to the old method and lose orders.

General Considerations.

Electric transmission in manufacturing work is a means to an end.—Centralized power generation for light and manufacturing purposes; subdivision of the transmission system and the motive power equipment; execution of all classes of work, irrespective of its location; maximum efficiency of workmen, machines and labor involved; intensified production at best speeds and at the power limit of machines with improved quality, maximum output and reduced cost.

Sanitary considerations.—It is healthful, clean and free from dirt, dust and dripping oil; it affords accommodations and facilities for proper lighting and ventilation; it removes dangers from overhead machinery shafting and belts; it reduces the sick list to a minimum; it insures quietness from absence of much unnecessary noise with older systems, and develops cheerfulness in workmen.

Disciplinary value.—It improves the morale and the personnel of workmen; it conduces to shop order and discipline, with the most economic use of the workman's time, quick handling of material and maximum efficiency of labor.

Flexibility of the system.—Accessibility of all parts, adaptability to various uses, and portability of tools are inherent advantages.

Reliability of service.—It is free from any general breakdown, localizing casualties and stopping least machinery for repairs; no accident can affect the whole plant in any case of a modern electrical installation properly designed, equipped and operated; it is more to be depended upon than any other system.

Economics of Electricity in Manufacturing.

Electric power generation.—This system admits of centralized or concentrated power generation which is required for maximum economy. Distributed power generation in small and scattered units is very wasteful. The electric power plant may be located to best advantage for fuel and water supplies, conveying and transportation facilities. It may be isolated from other structures, so reducing fire risks and insurance rates, especially where the boiler house is in a separate building.

The electric generating sets may be subdivided into similar and independent units. These may be operated at all times under the most economic condition of normal loads. This permits manufacturing work in any branch or section of the establishment as economically under part load as under full load, on overtime and night shifts as during the day's work. Electric light may be supplied from the power mains or from separate generators, as conditions require. In not a few cases of the introduction of electric driving the additional saving has been more than enough to pay for all of the lighting service. The cost of generating electric power can only be a deciding factor when the total cost of power required is large compared to the running expense. The saving in fuel depends upon the cost of fuel, the average load, the amount of shafting and belting displaced.

Electric power transmission.—The distances are short in factory service, the electric distribution being within one building or a group of buildings. The so-called line losses are therefore usually negligible in well-designed installations. Low voltages are employed in factory transmission. From 110 to 550 volts are the accepted limits at the present time in this country, either for direct or alternating-current working at constant potential or pressure. The economics of the various systems can be only satisfactorily discussed with reference to any given project or installation.

The following are recognized methods of distribution, for electric light or power, or both, in manufacturing work: Two-wire and three-wire systems, for direct or alternating currents. Multi-circuit system for direct-current multi-voltage service. Single-phase, two-wire alternating current; two-phase, three or four-wire alternating current; three-phase, three or four-wire alternating current; composite system, direct current and singlephase or two-phase alternating current on the same wires.

The first cost of electrical installation.—This will usually be higher for an electrical than for a mechanical transmission. The interest on first cost will rarely be a determining factor. It will be more than offset by the manufacturing economies elsewhere effected and by the reduced cost of shop buildings incident to the use of the electric drive.

Maintenance of electric system.—The cost of maintenance is a minimum. The depreciation is less than in any other system.

The saving effected is much more than sufficient to pay for all of the incidental repairs and renewals to the electrical machinery or the wiring system. Attendance and supervision are largely centralized and reduced to a minimum compatible with efficient service, owing to the reliability of the system. Electric generators and motors are the simplest types of motive-power machinery that can be used in the development of power transmision for manufacturing work. They have the fewest parts requiring any renewals. They require practically no repairs.

Electric machines will either work or not work. They soon make their wants known. They cannot be maintained in wasteful operation, as is the case with every other kind of motive-power machinery. Standardization of this class of electrical machinery has facilitated repairs. They are quickly and easily made, at minimum cost and with least interference with the routine work of the establishment. Small electric motors in general require more frequent attention and renewals than larger machines. Belt tightening or lacing in the old system stops work on that section, and stop all work if it chances to be the main driving belt. Any similar casualty in the electric system is remedied at once, by throwing into service another line, or a jumper, or a relay bus-bar.

Influence of Electric Transmission upon Factory Buildings.

The design, plan and arrangement of manufacturing establishments are not always now dictated or controlled by the new electric transmission, as always has been the case with the old mechanical system. Factory and mill construction is undergoing radical changes incident to the electric transmission of power. There is now a superior adaptation of the building to manufacturing work and sanitary requirements, with higher ceilings for light, ventilation and overhead transportation. The cost of buildings is reduced to a minimum. The electric drive does not require the heavy construction of walls, overhead work and roof trusses demanded by shafting transmission.

The site for buildings may be chosen independent of power considerations and located on most suitable ground. There is no necessity for buildings being placed around or adjacent to the power house, as required for mechanical connections to engines or turbines. Grouped shops may be arranged in best manner to facilitate economic production and the handling, conveying and transportation of material and work. Detached buildings, a tendency of certain lines of modern manufacturing development, are feasible and the work therein facilitated by electric transmission. The isolation of various shops, departments and work rooms for manufacturing or insurance reasons may be carried to any extent with the electric system without impairing its efficiency or economy. The output per square foot of floor space is a maximum with electric transmission.

Influence of Electric Transmission upon Workshop Expansion.

Future areas of work may be planned and arranged for with the utmost freedom and entirely irrespective of power considerations. They can be located as desired, on separate floors, in various departments or in detached buildings. Original provision for prospective development is not necessary in the electric system, but is required by shafting transmission. There is no expense for contemplated additions till they are actually installed as required. Permanent additions to the electric generating plant and the distributing system are made with a gradual and pro rata outlay of capital, instead of in disproportionate blocks of new equipment, as required by mechanical transmission.

Extensions of electric transmission and new centers of power distribution may be established at any time and of reasonable capacity, anywhere and at any distance, at minimum cost for labor and material. There is no crowding, overloading or interference with existing conditions, or with the daily progress of routine work. Temporary extensions, to meet sudden demands for power at any point, are quickly made by running to the desired location electric wires or cables. These are easily removed when no longer required and as readily used elsewhere for similar purposes. The shifts are made with the least expense of time and labor in handling, and with no accompanying waste of material to suit different conditions. Auxiliary power is always at hand for emergencies and to almost any reasonable extent, on account of the reserve nature of the electric supply.

Influence of Electric Drive upon Arrangement of Machinery.

The floor space required per machine or tool is reduced to a minimum. The alignment of overhead shafting is no longer necessary. Clear overhead room is provided for handling all classes of heavy work. The crowding and complications arising from overhead shafts and belts are avoided. Location of machines and tools may be made to suit the requirements of the work and the available floor space. The product may then be finished with least time and labor, with least handling and transportation, and in the most efficient and economic manner. All the conditions of work and of labor may be arranged to handle tools and material to the best advantage with freedom of workman's movements and facility in executing manufacturing operations.

Changing from the Old to the New System of Driving.

When alterations or additions in power transmission are required, it is the invariable practice in many modern shops to extend in the line of electric driving. This is notably the rule where electric supply is already at hand for either lighting or power service. In the rehabilitation of an old establishment some of the shafting transmission may usually be combined with the electric drive, as in the so-called group system. Much can be done to improve the power transmission if existing lines of shafting are divided into the most economic sectional lengths, determined by the speed, character of load, and kind of work. Electric motors will prove valuable adjuncts if installed to drive these sections independently. The electric drive is an economic and flexible auxiliary, supplementing the earlier and rigid mechanical power transmission. Such partial introduction of the new system, especially if an electric lighting plant is already in service, will early develop its advantages. It will defray the cost of installation and maintenance by greater economic production.

Scrapping the old to make room for the new involves the same economic questions in the case of power transmission as in that of manufacturing machinery. Productive machinery should not in general be scrapped while there is retained the old system of belt driving, with its inherent power and speed limitations. The increased output of the old machine, electrically driven, will frequently equal that of a new machine, belt driven and turning out the same kind of product.

Application of the Electric Drive.

Individual driving without intermediate gearing.—The armature of the motor is mounted on the main spindle of the machine. The power is most directly applied, with ideal adaptation of tool to work. It requires more or less special adaptation of motor to machine, with rarely any marked changes in the structural design of the latter.

Individual driving with intermediate gearing.—The motor is conveniently mounted on the frame of the machine and drives it through the intervention of the ordinary gearing. It requires no special adaptation of motor to machine. Any suitable motor may be used on any machine.

Advantages of the individual drive.—The workman has the most perfect control of all factors entering into the economics of production. There is maximum economy in the application of power. The speed control and the output are independent of any other machine. They are no longer limited by the speed of the line shafting. Machines and tools may now be worked to the limits of their respective capacities. The productive efficiency of the machine is increased. It may be operated at all times up to the power limit, reducing time and cost of labor for any given product. The choice of the individual drive depends upon the power required, the size of the machine, the time it is in service, and the value of the product.

The individual motor drive is usually adopted where the machine is in use only part of the time, and in sizes as small as two or three horse-power, and requiring wide variations in speed and power for maximum output quite independent of the first cost. For large machines this method reduces the power losses to a minimum. It is particularly advantageous for shears, punches, and a class of repair shop tools requiring power only at intervals. The constructive details and design of direct-driven machines are not usually altered to any extent; secondary speed changes are obtained by the usual change-gear and mechanism; in special cases of large tools, a range of speeds is sometimes best provided by a special variable-speed motor.

Group driving.—A few large electric motors are employed independently driving sections of shafting of most economical length. This method is thus adapted for driving a number of small machines, with no particular requirements in speed or in power; or for most economical manufacturing along special lines; or for driving any section on overtime or night shifts; or for independent driving of separate floors, departments or detached buildings.

The maximum economy with the group system can only be secured when all of the machines so driven are in constant use, at best speeds for maximum output. This dictates grouping machines as far as practicable of the same size, style, functions, speed and power requirements, having due regard to the work to be executed. Sectionalizing the power transmission by substituting electric motors for either the main or section belts secures partial advantages of the new system side by side with the old, and is frequently resorted to in old establishments adopting new methods.

Individual and group driving.—The most general requirements of factory transmission can all be met by an intelligent combination of these two methods of electric driving. The first cost of installing the individual drive will generally be from 2 to 5 per cent. higher than for the best group system, when all other considerations are the same. The individual drive is more economical in the use of power than the group system, especially if in the latter only a limited number of grouped machines are in use at any one time, at average loads.

Portable tools and appliances.—The extreme flexibility of the electric system invites the widest use of portable tools and appliances. A flexible heavily-armored cable gives any desirable radius of action, with no expense to maintain as a part of the transmission system, with no danger or difficulty in handling, and requiring least time and labor for any immediate shifting of tool or work. Least used tools need not occupy floor space when not in operation. Most favorable economic relations may, therefore, be secured in many lines of manufacturing work, especially of the heavier grades. Almost all required tools may be taken to and operated at the work in hand. Time is saved in not having to shift and adjust the work to the machine or tool. Several operations may be carried on at one time by bringing different tools to the work, each independently driven and operated.

Electric transportation and conveying.—Electric hauling by surface or overhead systems of distribution, electric conveying and telpher systems, electric cranes, hoists, lifts and elevators are all well-developed fields and present no unusual nor insurmountable difficulties when installed as a part of the regular electric system of a manufacturing establishment. Tools are taken to the work, or machines and tools are quickly served with material and work, reducing the cost of all handling to the lowest terms in a field of non-productive labor that has formerly been very expensive.

Electric-driven auxiliaries.—With an established electric supply service for all manufacturing work it is an economic step to drive by electricity all auxiliaries, as pumps, fans, blowers, air compressors, etc.

Selection of Equipment.

Factors determining choice of the electric system.—Each manufacturing industry has its own inherent requirements. No general rules can be given, but every case must of necessity be studied and developed by itself with a thorough preliminary survey of all conditions and requirements. One successful system cannot furnish precedent for another. In general, the following lines of inquiry should be freely investigated before choosing any system for power transmission in manufacturing work: the size of the establishment; the area to be served; the arrangement and grouping of shops, departments or buildings; the arrangement, types, and sizes of machines or tools to be driven; the variety of speeds required; the character of the loads involved; the kind of work to be executed; the economics of fuel and water supplies.

The above items should have been predetermined from the standpoint of most economic production. They should in no wise be influenced by questions of power transmission. How to drive the machinery in a new and modern manufacturing plant should be a second and not a first consideration. It should be determined by, rather than itself determine, the conditions for economic production.

Interchangeability throughout the electric system.—It should be possible to drive similar apparatus and motors from any point of attachment to the wiring system. Greater flexibility is thereby secured, added facilities provided for use of portable tools, and readiest extension made of plant and distributing system at any time. Preferably have one, and only one, electric system if it can be secured by intelligent consideration of all present and the most probable future requirements. This does not necessarily imply that it is best to have one single circuit for all kinds of service required in a manufacturing establishment, as light and power; but it should not be required to use different circuits for the same service, as portable tools.

Uniformity of electrical equipment—Generating sets and motor equipments should be standardized as far as possible in the case of any given establishment. These machines, as well as all their parts, should be readily obtained in duplicate at any time. This is particularly important in making additions and extensions in the group system, where it may be required to change from a smaller to a larger motor at any time to accommodate more machines on a given section. It cannot be advantageous to experiment with different styles and types. Electrical machinery to-day is so far standardized, and its performance predetermined, that there can be no excuse for not selecting that style and type best adapted to any given factory.

Power required as a basis for size of electric motor.—The load diagram for any machine will furnish the best data for determining the proper size of motor. It may be readily obtained under the working conditions of the machine by using a test motor. In almost all metal-working industries the power required is subject to extreme fluctuations, and may be very heavy, at times, while the bulk of it will be quite light. It is not necessary to install an electric motor to carry, for any length of time, such sudden and heavy loads as will be shown by the peaks of the load diagrams for the several machines, or the sudden initial throw of the ammeter needle. The limit of overload is fixed by the allowable rise of temperature, and can readily be predetermined for any given electric motor. In general, the surface temperature of the motor field coils, as measured by a thermometer, should not exceed from 35 to 45 degrees C., with a maximum limit of 50 degrees C., after an overload run of from six to eighteen hours, as may be specified by the builders.

Starting load currents are of course high, and may be from two to three times the normal current, as in the case of overloads, for brief periods. Individual drives require proportionately larger motors to enable them to carry alone the heavy overloads. Group drives require only normal load motors, as it will rarely ever occur that the several grouped machines are all carrying overloads at the same instant. Motors for this service may often be much smaller than would be dictated by the combined load diagram of the machines forming the given group or section. In no case will they require to approach the maximum, or the sum of the maximum, loads of the various machines. Group system load curves will be smoothed out considerably. In all electric motor installations there should be ample power provided, rather than a narrow margin only to work upon. Increasing loads are almost sure to arise in time. A motor of ample size gives that reserve power so characteristic of the electric system, if properly installed.

Character of loads in manufacturing work.—Load curves and diagrams of individual machines, groups, sections, and the entire plant, only can be relied upon in estimating the character of loads being carried or likely to be carried under similar conditions. The load factor, the ratio of the maximum to the average load, for any given time on any part of the system, should be as high as possible for best working efficiency and economy. It may be largely influenced by the way the operator handles his motor. Whatever the kind of load, uniform or variable, light or heavy, continuous or intermittent, suddenly fluctuating or periodically variable, it must be carefully investigated before installing electric motive power. In certain instances flywheels may be useful and for the same mechanical reasons as elsewhere employed in machinery.

Speeds of manufacturing machinery.—The speeds should be predetermined by the conditions for most economic maximum output, and so fix the range required for the electric motors. In no instance should the reverse be the case. In many cases of individual drives it may be best to secure the speed reductions mechanically, as by the ordinary change-gear. It is not necessary nor advisable in all cases to secure the same by mounting the motor armature directly on the spindle of the machine. Provide motors with speeds consistent with the range of change gear, and gear down rather than up.

Electric generators required in manufacturing plants.—The style and type should be largely determined by the kind of service to be supplied, the size by the normal and overload conditions as shown by the plant load diagrams, with due considerations given to special conditions and variable loads. The actual normal capacity of the generator will be chiefly determined by the length of time the various motors are in use, rather than by their normal or aggregate capacity. It may happen, owing to the intermittent use of machines and motors, that the generating plant may be reduced to 50 per cent., or even to 20 per cent. of the aggregate normal capacity of the motors out in the establishment. An increase of the electrical system can only be intelligently made from a careful study of the load curves of the existing installation, and using it as a basis for comparison with the probable load curve under the proposed conditions. There should be judicious subdivision of the generating plant into units, preferably of the same size and style, that they may be readily interchanged and duplicated at any time, with one or two relay units for emergencies and extra rush seasons of work. All generating units used in manufacturing installations will necessarily be of such size as to warrant their being driven by direct connection to engines or turbines. If generators required are too small to warrant direct connection, the establishment is too small to warrant an introduction of the electric drive.

The electric wiring and distributing system.—All wiring should be done in accordance with the "National Electric Code," being the rules and requirements of the National Board of Fire Underwriters. Separate service circuits, from the same or separate bus-bars, may be provided to advantage, for lighting and various power uses. Sub-stations, or sub-station switchboards, should be provided for separate shops, floors, departments, or buildings, making it unnecessary to run a separate set of wires back to main switchboard for each service.

Indirect electric distribution.—Indirect distribution, through the use of accumulators, converters, or transformers may be found expedient under certain conditions. For the three-wire systems, some type of accumulator or motor-generator balancing set is almost essential for efficient regulation. The accumulator may render as invaluable service in certain kinds of factory installations, as in iron and steel mills, as it is now rendering in traction work, where the character of the load variations of the former is somewhat analogous to that of the latter. The loss in the battery is very small and entirely negligible compared to the advantages to be derived from its use in manufacturing plants of the type mentioned.

Losses in Factory Transmission.

The inherent losses common to all systems of factory transmission are due to the intermittent and irregular use of the machines driven. These are reduced to a minimum with the electric drive. There is no consumption of power when the motor and machine are not in operation. There are no power losses when the motor is not in use, no so-called dead load losses, due to mechanical friction of the shafting system, no transmission losses in the line when the electric current is not required.

Electric generators and motors, when in operation at uniform speeds, have, generally speaking, but two kinds of losses: the first is a constant quantity depending upon the size and type of machine; the second is a variable loss proportional to the square of the current in the armature circuit. The electric line and other wiring has a loss proportional to the square of the current carried. The cost of waste power in the mechanical system becomes excessive at light and frictional loads. It is saved in the electric system, in which the constant losses are minimized and the variable losses are throughout proportional to the amount of work being done.

Efficiency of Electric Transmission.

The efficiency of the electric system under normal conditions shows high maintained values, from about 25 to 35 per cent. underload to the same amount of overload, for the individual generators and motors, as well as for the aggregate efficiency of the installation. In mechanical transmission there is a constant falling off in efficiency at various underloads in every part of the system, owing to the inherent losses due to mechanical friction, which losses are constant at all loads and constant speeds. It is not a question so much of the individual efficiencies, in either case, as of the aggregate or combined efficiency, from engine or turbine shaft to machine or tool. The performance should be considered and compared at proportional parts of the full load as well as at normal loads. The mechanical efficiency of all manufacturing machines is almost invariably low. It is possible materially to effect it by efficient motors properly selected, installed and operated. The all-day efficiency may be made higher with the electric drive than with any other system, as the amount of time is minimized during which machines and tools are necessarily idle.

Operation and Testing of Factory Installations.

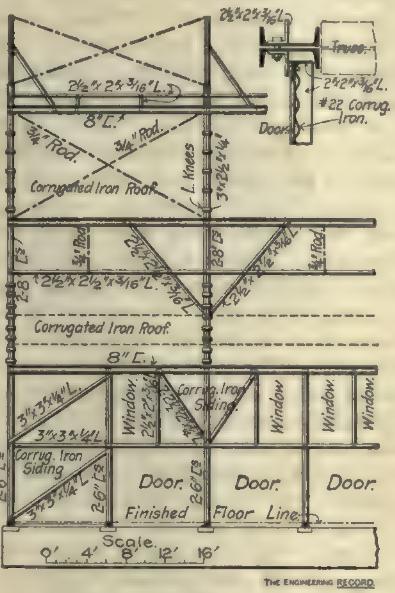
The generating plant.—As far as practicable, each unit should be operated at its normal capacity—additional units to be switched in as may be required by the manufacturing conditions.

The motors.—Rarely the case that any machine or tool is started from rest with full load upon it. Motors may be started best under the usual friction, or light loads on the machines, as in the belt systems. When the machine is brought up to proper speed, work may be thrown on to it. In this respect the practical operation of an individual electric drive follows closely that of the belt system. It is always possible to tell exactly what is going on in an electric drive, both in kind and amount of useful work, as well as in matter of wastes and losses. Power measurements are made at any point by ammeter and voltmeter, or by a wattmeter alone. A special test motor of known performance lends itself admirably to comparative tests of the performance of machines and tools under various conditions. Workmen may know at any moment whether they are driving tools or machine to best advantage for maximum output at best speeds.

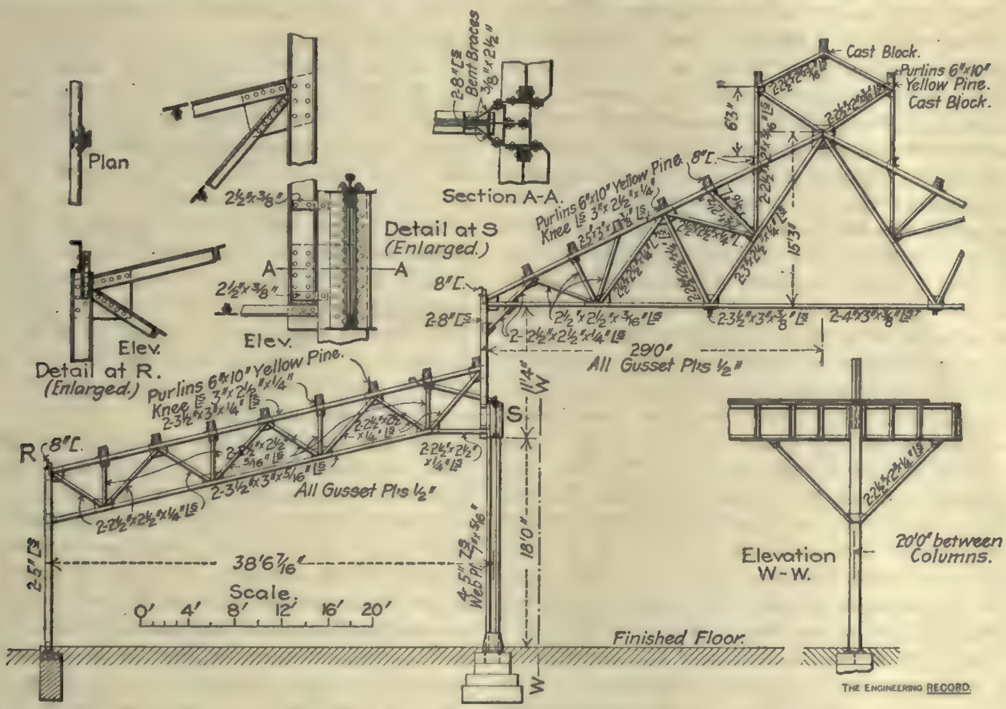
The definite power required for definite work may be determined and charged to each machine, tool, or piece of work, and so make up the shop cost of production more exactly than by any other system. The power lost in friction of individual machines when running empty may be obtained with equal facility and compared with that required in doing useful work. It will be found that the latter increases almost directly as the resistance being overcome by the machine in its operation under working conditions. The power required by the work is a small per cent. of the total power delivered to the machine.

A Steel Rolling Mill Building.

The new steel building for the American Rolling Mill Company at Middletown, O., is 340 x 133½ feet in plan, and 42 feet high, and has a steel framework with sixteen bents 20 feet apart. Each bent has four columns supporting a 56½-foot center roof span and two 38½-foot side spans. The center span is of the usual type of Fink truss, made of single and double angles with riveted connections, but is slightly modified by having the web members nearest the center made vertical so as to form an apparent continuation of the louvre posts which are seated on the top chords above them.



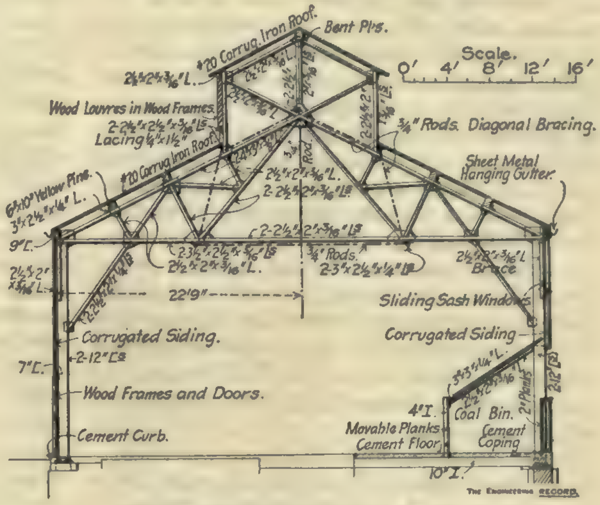
Part Side Elevation.



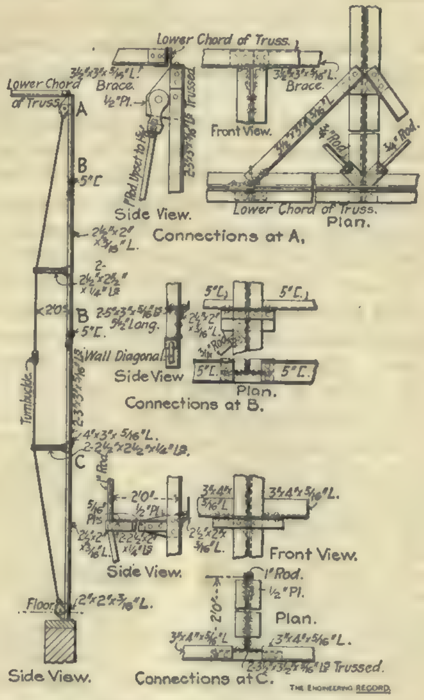
General Cross-Section of Rolling Mill.

The side trusses are simple lattice girders with parallel inclined chords made of pairs of 3 x 3½ x 5/16-inch angles and web members made of single and double 2½ x 2½ x ¼-inch angles. The ends of the bottom chords are continued from the last vertical posts to the wall columns to take the place of knee braces, and both side and center trusses have end web connection plates projecting from their top chords and field-riveted between the webs of the channels which are riveted together back to back to form the main columns supporting the roof. The corrugated iron roof sheathing is laid on 6 x 10-inch yellow pine purlins about 5 feet apart and 20 feet span, which are seated against transverse angle clips riveted across the top chords of the roof trusses as shown in the side elevation of the framework, where the purlins are omitted to avoid confusion.

The upper ends of the wall columns are connected by a longitudinal horizontal 8-inch channel which is supported in the middle of each panel by a short intermediate column. These members carry a horizontal line of angles and the necessary vertical angles to make the simple framing for the windows above the doors and for the corrugated sheathing between the windows. Up to a height of 7¾ feet above the floor line, all the wall space is occupied by balanced vertically-sliding doors, 10 feet wide, and all the space above them to the eaves is glazed with stationary window sash, except for a width of 10 feet at alternate wall columns, where there is corrugated iron sheathing over the pair of knee braces. The longitudinal bracing consists of a line of 8-inch channels on top of each row of columns and at the feet of the louvre posts, a line of horizontal struts on each side of the axis of the building in the center span bottom chords, a pair of long knee brace angles on each wall and intermediate column, a single long knee brace angle to each louvre post, diagonal braces in the end panels of wall framing, and ¾-inch diagonal rods in alternate panels of the top chords of the center roof trusses, and in all of their lower chord panels.



Cross-Section of Boiler House.



Details of Wall Framing.

The clere-story between the side and center roof trusses is entirely glazed with horizontally sliding sash, and the louvre has stationary wooden ventilating slats. In the gable ends of the building there are, between the main columns, 7-inch vertical channels and pairs of 3 x 3-inch vertical angles, spaced from 6 to 13 feet apart, to form studding for the door and window frames and to support the horizontal girts for the corrugated iron sheathing. There are several single and double horizontally-sliding doors and above them two horizontal rows of windows corresponding with those in the side elevation of the building. The window frames are set between top and bottom 5-inch channels with horizontal webs, and the corrugated iron sheathing is fastened to horizontal 2 x 2½-inch angles. The ends of the building are stiffened transversely by X-bracing of ¾-inch rods irregularly arranged in various panels between the vertical and horizontal members where they will not interfere with doors or windows. The principal intermediate vertical members in the ends of the building consist of pairs of angles trussed in longitudinal planes, as shown in the detail. Where these angles are connected to the bottom chords of the end trusses the latter are stiffened by diagonal braces to their longitudinal strut, as shown in the detail of the top of the trussed vertical.

The center aisle of the building is traversed by a girder crane of 56½-foot span with 20-foot track girders made with a 36 x ½-inch web and four 6 x 4 x 7/16-inch flange angles. These girders are riveted through their end vertical web stiffener angles to the cover plates of the main columns, with the tops of which their upper flanges are flush, so that the track rails are laid continuously across them. A web connection plate projects from one side of the column at the top and receives the foot of the eccentric upper section of the column which carries the roof trusses.

The 45 x 70-foot boiler house, 40 feet high, has a steel framework of five bents, making four 20-foot and one 10-foot panel. The trusses are braced together longitudinally by horizontal channels at the eaves, by light lattice girders at the feet of the louvre posts, by sway diagonals in inclined planes near the middle of each semi-truss and by the lateral systems shown in the diagram in the middle part of both top and bottom chords. In the end panels of the building there are also diagonal rods between the columns above the doors, and throughout the top chords of the trusses and in the plane of the middle vertical posts of the louvres. The framing in the side walls corresponds with that in the rolling mill, and all the columns are made of pairs of 12-inch channels, back to back. The coal bin is merely a portion of the building enclosed between the wall and a row of vertical posts 6 feet high and 8 feet away from it. They are 4-inch I-beams set in the concrete floor, riveted to the floorbeams, and receiving moveable horizontal planks between their flanges. The tops of the posts are tied to the wall by inclined angles riveted to a pair of horizontal angles latticed together to form a light girder connecting the main columns.

These buildings were designed by Messrs. Elzner & Anderson, Cincinnati, the steel work was built by the L. Schreiber & Sons Company, Cincinnati.

The Meeting of the American Society of Heating and Ventilating Engineers.

The American Society of Heating and Ventilating Engineers held its fourth semi-annual convention in the Victoria Hotel, Chicago, on July 12 and 13. The first session was opened by President Kinealy with an attendance that was remarkably large and gratifying, particularly as it came immediately after a protracted spell of very hot weather. The following candidates for admission to the society were announced elected: Members: Enoch Rutzler, New York City; Frank P. Blodgett, New York City; Chas. Robt. Bishop, Lockport, N. Y.; Geo. B. England, Brooklyn; August Kehm, Chicago; Alfred Southmayd Hamlin, Newark; Wm. K. Downey, Milwaukee, Wis. Associate: Henry B. Gombers, New York City. Junior: Joel Irvine Lyle, Syracuse.

The first paper read was presented by Prof. R. C. Carpenter, and was on the effect of circulation on the capacity of fire-box heating surface. It is given in abstract in another column. Mr. J. J. Blackmore thought the experiments indicated that the top sections of the built-up firebox, which are comparable with the usual crown sheet, did not receive the amount of heat with which they are commonly credited. It was believed by several that because of the direct exit passage which the flames and hot gases were given, notwithstanding the short vertical distance to the top sections, that surface was heated largely by direct radiation. The author cautioned the Society not to consider that the relative efficiencies of the various parts of the firebox were shown so much as was the effect of varying the velocities of the water within the sections, an increased flow resulting in a greater absorption of heat, other things being equal. He considered the action analogous to that in the marine boiler, where increased feed pumpage secures a greater steam generation, and his theory is that the flowing water keeps the inner surface of the iron cooler and thereby increases its conducting efficiency.

The second paper of the session described a hot-air furnace heating installation designed by the author, Mr. Chas. G. Folsom. The apparatus was put in an exposed frame dwelling having a basement, two main stories and an attic, costing all told about $6,000. A No. 526 Hoffman tubular furnace with a 26-inch fire-pot was used and 14 pipes had to be taken from this, occupying nearly all the available space on the furnace top. The longest round pipe is nearly 27 feet long, and is 9 inches in diameter. As the headroom was of limited height, the basement pipes could be graded upward only about 1 inch for every 10 feet. The furnace pit is 24 inches deep and the fresh-air duct to it has an area of 720 square inches. The total area of the fresh-air pipes from the furnace is 1,077 square inches, or 1.5 times as great as the duct. The house is provided with a return-air connection drawing from the hall, two parlors and dining room through a register face 28 inches square in the dining room, the system being shut off by the same damper which admits cold fresh air from out of doors, and vice versa. There are also return air ducts from other rooms of three-fourths the area of the hot-air pipes supplying them. By the side of the coal door in the furnace there are two 1-inch holes which receive pipes into the furnace over the fire connected to a galvanized-iron pipe or stack extending from basement into attic for giving a positive ventilation to two closets. The heating medium for this purpose is water supplied from a rain-water tank in the attic. There are about 30,000 cubic feet of space, and the glass surface amounts to one-eighth the area of the entire side walls.

Prof. Carpenter then read another paper entitled "Test of Radiators with Superheated Steam," practically all of which was printed in last week's issue. Considerable interest was taken in the fact that the amount of heat transmitted through the radiators decreased with the rise in the degrees of superheat, and it seemed paradoxical that the superheated steam could exist in the confined radiator chambers, the walls of which must be coated with a film of moisture. Prof. Carpenter stated, however, that he had noticed that superheated steam tended to remain so, that is, was slow either to lose its heat or take up moisture, citing an experiment in which wire-drawn, and therefore superheated, steam was introduced in a glass chemical retort holding about one quart, and containing a quantity of water in its bottom. Although open to the atmosphere, the inserted thermometer showed that the steam remained at 230 degrees a considerable number of minutes. Mr. Blackmore thought that the results might be attributable in part, at least, to a better circulation with wet steam than with dry. The likelihood of re-evaporation of the moisture in the presence of the superheated steam, similar to the action taking place in the steam-engine cylinder, was mentioned but not advanced as any means of explaining the apparent anomaly.

With an entertaining discussion of two topics: on the preparation of plans and specifications for heating work without compensation and the advisability of adopting the metric system, the session was brought to a close. Of the former question, it was believed that it would solve itself; there are many more engineers to-day practicing heating and ventilation than ten years ago. Mr. C. M. Wilkes saw an advantage in the single set of plans in the closer estimates made by contractors, mentioning a recent instance of a $100,000 contract in which the lowest and highest bids were $96,000 and $104,000, respectively.

The second session was held in the evening and was devoted to a paper by Mr. Alvin D. Reed, chief engineer of the St. Louis Board of Education, who described the St. Louis schoolhouse heating and ventilation by the aid of lantern slides. The schools are heated entirely by an air supply circulated on the plenum system. The air is brought downward from the roof level and passed successively through tempering coils, fan and heating coils. The heating chamber is centrally located and the fan is of the double discharge type, driven by a direct-connected engine which receives steam at 15 pounds pressure, the low pressure used permitting the employment of non-licensed engineers. By-pass and dampers are used with the tempering coils to maintain a temperature of 70 degrees Fahrenheit, and, similarly, beyond each outlet of the fan there is a tempered and a hot-air space. The air system beyond is of the type in which small ducts, for the individual rooms, are carried from the heating center to the various flues; double dampers operated by thermostats are placed at their mouths to supply either tempered or hot air, as desired. Velocities of 900, 600 and 360 feet per minute are calculated through the ducts, flues and registers, respectively. The fresh-air registers are located about 9 feet above the floor and besides diffusers in the face, the top of the flues are provided with air splits. The exhaust of air is effected through the cloak-rooms, which have no direct connection with the corridors, and the air rising into the attic escapes into the atmosphere through louvered openings. The cloak-room hooks are 10 to 12 inches long so as to keep clothing from hanging against the walls. The toilet rooms are ventilated by carrying the vitiated air to the space surrounding the smoke stack, which is made of cast iron.

In a 22-room building described, each room containing about 11,000 cubic feet, the fan was 11 feet in diameter and 5.5 feet wide and designed to deliver at about 125 revolutions per minute, 68,400 cubic feet of air in that time. There were in tempering and heating coils 12,264 linear feet of 1-inch pipe, designed to heat the air in the coldest weather to about 140 degrees, allowing for a drop to about 120 degrees at the registers. It takes about 30 horse-power, he said, to drive the air. During periods of non-occupancy, a return air circulation is used, the attic louvers being closed, the air being brought down to the tempering coils and the fan being turned over slowly. The apparatus for this building cost about $10,600.

The last session of the meeting was opened with the reading of Mr. W. M. Mackay's paper, reported in abstract in last week's issue, on the volume of water in hot-water heating apparatus. The author thought the large pipes and consequently large volumes of water common in green-house practice were unsatisfactory and uneconomical because of the inertia of the system, which made it slow to respond to changes of firing; it was not an unusual thing, he said, to see the roof lights of the green-house opened about midday to throw off the excessive heat resulting about that time, unless, as he advocated, the fire was allowed to sleep during the day and kept awake at night.

The following topics were than discussed: What is the life of metal air ducts and under what conditions can they be dispensed with; why not use small ducts, high velocities and high pressure (the idea being to supply a system applicable to office-building ventilation, where the value of duct space is considerable); what is the life of wrought-iron or steel nipples in connection with cast-iron radiators; and what are your experiences with anemometers? The meeting then adjourned. It was, as before stated, a highly satisfactory one and exceeded the anticipations of the managers.

Effect of Circulation on the Capacity of Fire-Box Heating Surface.

At the meeting of the American Society of Heating and Ventilating Engineers, reported elsewhere in this issue, the results of some experiments on fire-box heating surface were presented by Prof. R. C. Carpenter. The work, although ultimately intended to include further investigations, had to be restricted to the direct-heating surface in the fire box, and the results were presented largely with the idea of eliciting suggestions for the continuation of the work. The experiments were conducted by Messrs. E. G. Chandler and H. H. Clark, of Cornell University, to determine the effect of the velocity of circulation of water on the capacity of the fire-box heating surface and to determine the relative efficiency of different portions of the surface.

A fire box was constructed of elementary form to permit an accurate measurement of the heat absorbed by each part. It consisted of a combination of rectangular elements arranged to form the sides and top of a heater immediately adjacent to a grate. Each element was a hollow casting, 23.5 x 6.5 x 2.5 inches in outside dimensions and was made with several bosses for pipe connections as needed. There was a grate of 4 square feet, supported by brickwork, and the heating surface of the furnace was built up as follows: Three elements, one above the other, formed each side, making the furnace chamber thus about 19½ or 20 inches high, two elements in each case formed the front and the back, one toward the top and the other toward the bottom, with the firing door between them in the one case and the smoke connection in the other, and four elements formed the top. The whole structure was bricked over, with the brickwork about ½ inch from the iron castings. With this arrangement no heating surface existed on the sides of the furnace immediately adjacent to the fire door and the smoke pipe. The elements constituting the fire box were arranged for water circulation in such a manner that water could be passed in series through all the elements or, if desired, a measured amount could be passed through each element. Temperatures could be taken before and after passing through each element or before and after passing through the entire heater. During the test, the water was used at such a rate as to prevent steam forming. A pyrometer was placed in the smoke flue back of the fire to maintain a uniform temperature condition of the discharge gases and consequently uniform rate of firing.

The results showed that with all the conditions constant, the rate of heat transmission increases rapidly with an increase in the velocity of water circulated. This teaches an important lesson, the author said, namely, that the more rapid the circulation the higher the efficiency of the heating surface, a fact which should lead the designer of boilers to induce the highest possible velocity of water. The special form of fire box employed might not show much in a general way as to the relative efficiency of the different portions of the fire-box surface, but he referred to the fact that the greatest amount of heat was absorbed by those sections which were in closest proximity to and immediately surrounding the fire. A series of tests was also made to determine the effect on capacity and efficiency of passing water through the elements at different temperatures, and although the tests were not considered conclusive, the heat absorbed per pound of water per unit of time per degree difference of temperature between the fire and the water was substantially uniform regardless of the temperature of the feed.

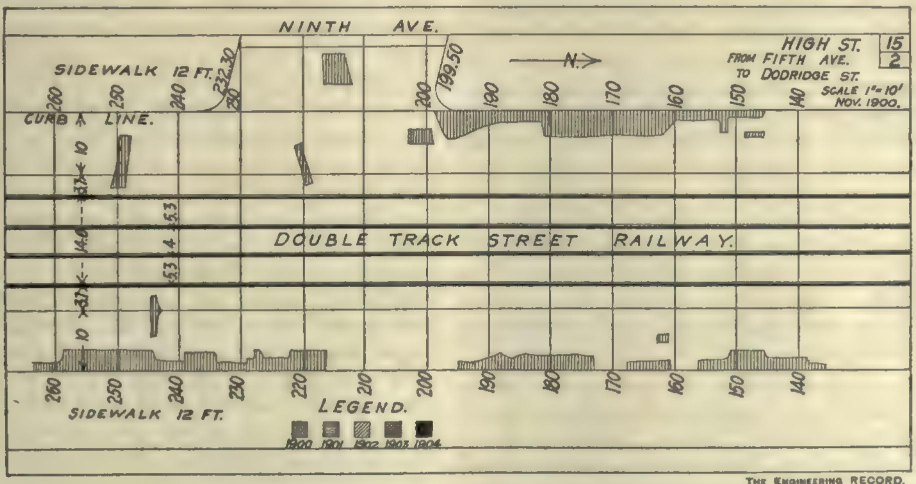
The results of the tests on the velocity of circulation are given in the accompanying table.

Effect of Velocity of Circulation on Heat Absorption.

B. T. U. per min.	Water per min., lbs.	B. T. U. per sq. ft. per min.	Vel. of flow ft. per min.
1,210	1.9	86.5	0.031
1,150	2.2	82.2	0.035
1,390	11.7	99.5	0.187
1,450	20.0	103.5	0.32
1,570	44.2	112.	0.706

The results of the heat-absorbing power of the various elements of the fire box are as follows, the figures being in B. T. U. per pound of water per minute: For the lower and upper back elements, 39.3 and 13.25; for the front elements, 30.6 and 29.1; for those on the sides, 41.5, 21.6 and 17.9; for those on the top, 5.96, 9.2, 12.4 and 5.56.

The Asphalt Pavement Repairs in Columbus, Ohio, which are made under contracts involving a five-year guarantee, are recorded on diagrams by a method described as follows by Mr. E. A. Kemmler: The street surface is divided into 10-foot squares by means of chalk lines, and the patches are then sketched in a field-book with properly ruled pages, the notes are platted to a scale of 10 feet to 1 inch, and traced on 20 x 30-inch sheets. The contractor is given a set of blue prints of each street. As it is the intention to make repairs annually under similar contracts, the patches of different years will be distinguished by various methods of cross-hatching. Should the patches of different years overlap at any time, this will be considered evidence that the first work had disintegrated; the contractor for that year will have to make good the defect. The accompanying sketch shows the style of the diagram.



THE ENGINEERING RECORD.

DIAGRAM FOR PLOTTING LOCATION OF ASPHALT REPAIRS.

A Series of Weight Tests will be started on July 22 of 3, 4, 5 and 6-foot flat floor arches of Guy Wait system of construction. They will be made at 507 West 14th Street, New York, under the supervision of the Board of Buildings.

Book Notes.

Water-works engineers and superintendents will find in Mr. James H. Fuertes' "Water Filtration Works" a far more detailed description of the works for purifying water than has previously been published. The author enjoyed unusual facilities for examining such plants abroad and has been connected in one capacity or another with the design of a number of works in this country. In this book he presents chiefly the results of his studies of the engineering features involved in the design and construction of settling basins, slow and rapid filters, and clear-water reservoirs. The potability of water as affected by variations in its chemical and bacterial character and the nature and processes of filtration have already been covered by other authors, so Mr. Fuertes wisely confines his remarks on these subjects to such brief outlines as are indispensable for a suitable presentation of his facts. A considerable part of the information has previously appeared in various reports and in this journal, but this material has been worked over with much that is new, particularly on the cost of construction and operation, into a compact and clear manual, equally useful to the designing engineer and the general reader who wishes to learn the latest views on water purification. The book is profusely illustrated, and is published at $2.50 by John Wiley & Sons, New York.

An elementary but comprehensive work entitled "Tunneling" has been written by Mr. Charles Prelini, based on notes of his lectures at Manhattan College. It describes the methods of driving tunnels in earth and rock under various conditions, and illustrates these general principles by examples taken from the technical literature of several countries. The book has the usual fault of elementary works in its failure to be definite concerning small jobs. There is need of a book which will describe step by step the work to be done in driving small tunnels in rock and earth, explaining the methods concisely yet clearly and never degenerating into generalities. Descriptions of the St. Gothard, St. Clair, Baltimore Belt Line and other noteworthy tunnels, such as fill a large part of Mr. Prelini's book, do not supply the desired information. Such a book cannot be written, however, with scissors and mucilage pot, although the latter may turn out, as in this case, a creditable compilation. It is published at $3 by D. Van Nostrand Company, New York.

The Sixth Annual Report of the Metropolitan Water Board to the General Court of Massachusetts is a volume of 274 pages, profusely illustrated, which is full of valuable information to the engineer. The great earthworks for the Wachusett reservoir and the preliminary excavation and studies for its high masonry dam are explained in unusual detail for such a document; the test of the Allis pump at the Chestnut Hill high-service station is summarized; the details of the low-service station at Chestnut Hill are explained, and the operation of the portions of this great system of work in service during 1900 is reviewed. The manner in which Mr. Stearns has presented these and many more subjects is noteworthy when the demands of the regular work upon his time and that of his staff are taken into consideration. The tables of cement tests, rainfall, stream-flow, pondage, and pumping deserve special mention. The waste and excessive use of water in the metropolitan district is evidently causing serious apprehension, for if the increase in the draft on the works during the next ten years is maintained at the rate of the last five years, the capacity of this great system will be reached by 1910. "It is time that measures should be taken to prevent or restrict the waste and excessive use of water," Mr. Stearns says, "and there is no method by which this can be done so efficiently as by providing that water shall be furnished to each taker through a meter."

The third volume of Prof. Elisha Gray's "Nature's Miracles" has just appeared. It reviews in a popular style the history of magnetism and electricity, and he explains generators, telegraphy, the telautograph and telephone, and other applications of electricity. The descriptions are as clear as it is possible to make them in a book for the general reader, the style is attractive, and there are many humorous passages and anecdotes. The book is published at 60 cents by Fords, Howard & Hulbert, New York, and will be well worth the price to the nontechnical reader interested in such subjects.

An elementary work on the telephone has been written for the general reader by Mr. James E. Homans and published under the title, "The ABC of the Telephone," by Theo. Audel & Company, New York. There is much that is valuable in the book and a great deal that is useless and irrelevant to the subject. It will, however, prove of assistance to those who desire an explanation of the general principles of different apparatus and systems.

Engineers interested in power plant design and acquainted with German literature on the subject will be glad to learn that another part of Prof. Gustav Lang's "Der Schornsteinbau" has appeared from the Helwing'sche Verlags-Buchhandlung at Hanover, Germany. The first part (price 4 marks) appeared five years ago, and opened with an interesting history of chimney construction and of the rules advanced from time to time for proportioning such structures. The remaining pages contained a discussion of the principles on which the general dimensions of chimneys are based. The second part (price 5 marks), which appeared a little later, was devoted to an examination of the influence of different forms of cross-section on the draft and on the stresses in the material, of the stresses due to temperature, and of the amount of wind-pressure on stacks of different shapes. The third part (price 9 marks), which has just appeared, is an explanation of the structural features of masonry chimneys, the shaft, the top, cowls, architectural treatment and ladders. The literature of all nations has been sifted with characteristic German thoroughness, and the numerous illustrations and explanations give a comprehensive idea of the different views as to materials and their use in various countries. For readers not already familiar with Prof. Lang's work it should be said that his methods are recognized throughout Germany as standard practice, and in order to introduce them to American engineers this journal proposes to publish shortly an abstract of one of his papers describing certain of his rules relating to subjects still untreated in English.

The second volume of Prof. F. B. Crocker's "Electric Lighting," recently published at $3 by D. Van Nostrand Company, New York, is devoted to electric distributing systems and lamps. The book is elementary, as is appropriate in a text-book for school-room purposes, and similar in detail to the previous volume on the power-house plant for electric lighting. The chapters on distribution form an excellent compendium of the different systems which have been used in practice, but unfortunately there is little said as to their relative economy. The article on transformers has been largely based on the valuable publications of the electric machinery manufacturers, which are here combined with other data into a form serviceable for reference; the treatment is not technical, like Fleming's work, nor does it furnish figures directly useful to the manager of a plant. Overhead and underground conductors are treated in a sketchy manner. The chapters on arc and incandescent lamps are probably the best in the book and contain some very useful data. While the book as a whole has little special value to the manager of a plant, it will prove of much assistance to the prospective investor or owner who desires to acquaint himself with the subject it covers.

A book on a small part of technical specialty which reaches a sixth edition in a few years manifestly has considerable merit. The first edition of Prof. William J. Hopkins' "Telephone Lines and Their Properties" was printed in 1893. Since then the advances in our knowledge of some branches of electric transmission have been very great. The delicate alternating current of the telephone line has drawn to its service all the resources of mathematical genius, and its improvement has afforded a noteworthy instance of the dependence of practice on advanced theoretical work. The last edition of this little volume, issued by Longmans, Green & Company, New York, describes in as elementary manner as the subject permits the principles involved in the telephone line, both long and short, in the composite working of telephone and telegraph service on the same lines, and in wireless telephony. The explanations are not always readily understood at the first reading, but this is due to the subject, not the author. The portions of the book describing the methods of building ducts, pole lines, stringing wires and other construction work leave nothing to be desired.

"Habitual correctness is a duty. Error should be looked upon as probable, and every precaution taken to verify data and results. . . . Habitual error is not only discreditable but dishonorable as well, and nothing except intentional dishonesty injures the reputation of the engineer more quickly or permanently." It is with such good advice that Professors William D. Pence and Milo S. Ketchum begin their "Manual of Field and Office Methods for the Use of Students in Surveying," a book it is a pleasure to bring to the attention of instructors in the subject. It gives the student just the information he needs at the beginning of his course about using instruments, keeping notes, making computations and other matters usually left for oral instruction. Its purpose is to forestall the elaborate surveying course, and for this purpose it gives a large number of well-chosen problems which will afford that practical acquaintance with instruments and methods without which class-room work is little more than a sham. The book is a gratifying indication of the importance attached to the cultivation of habits of accuracy, neatness and celerity in the authors' methods of instruction. It is published at $2 by the authors, but will be handled by the Engineering News Publishing Co., New York.

Some years ago there was printed by "Municipal Affairs," the quarterly publication of the Reform Club of New York, a "Bibliography of Municipal Problems and City Conditions" which attracted immediate attention for its comprehensive scope and careful preparation. The edition was soon exhausted, but a new one, revised and brought down to 1901, has just appeared. It is a work of 350 pages, set in small type, and contains all the matter in the first edition, all the bibliographical notes which have appeared in "Municipal Affairs," and a great number of references gathered by special investigators in English, German and French libraries and by various organizations interested in particular parts of the field. The work has been done under the direction of Prof. Robert C. Brooks, and embraces both subject and author indexes. Many notes on apparently ephemeral phases of city history are included and there are references to articles which are of little value, but this is not only unavoidable but positively valuable in a work of such a comprehensive scope. Engineering publications have been fully indexed and the student of any general problem in municipal engineering will find the book of great assistance. It is extensively cross-indexed and arranged on a scheme which makes its use easy from the start. It is sold in a cloth binding at $1.50 by the Reform Club Committee on City Affairs, 52 William Street, New York.

The Recent Explosions of Brick Pavements in Kansas City, Mo., have been so widely noticed in newspaper despatches, that the readers of The Engineering Record will appreciate the following note on the subject from Mr. Robert W. Waddell, city engineer: "It is true that several explosions (seven) have occurred on our brick-paved streets. These have either happened at an apex in the grade or at the top of a steep incline ending at a level crossing of another street. In every instance the pavement was grouted with cement after being laid, so that it formed a perfectly impervious coating over the street from curb to curb. I think that in no instance were the brick thrown more than a foot into the air, but the mortar from between the brick and the dust on the pavement were thrown to a considerable height. I was told by an eye-witness that they were thrown 10 feet. My idea is that the heated air traveled between the brick and the sand cushion until it reached the apex and materially helped the expansion of the brick to cause the upheaval. Kansas City has suffered from a continuously high temperature for about a month."

A Test of a Direct-Connected Steam Turbine and generator, which had been in regular operation for about a year, was made in January by Prof. J. A. Ewing, of Cambridge, England. The record of the trial is considered of special interest because the unit of consumption of steam has not proved to be greatly different from that obtained from a test fifteen months before, notwithstanding assertions that though steam turbines are highly economical when new, they require a large amount of steam per unit of power after a few months' service. The turbine was made for the Cambridge Electric Supply Company by Messrs. C. A. Parsons & Co., and is a so-called compound turbine of the parallel-flow type, running at about 2,700 revolutions per minute, and governed electrically to give a constant voltage, with its shaft directly coupled to the armature of a four-pole alternator giving 250 amperes at 2,000 volts. Steam was supplied at 150 lbs. per square inch; there was no steam separator nor superheater, and while there was a water pocket in the pipe line, it was believed that the steam was delivered wet. The steam consumption includes that necessary for the air and circulating pumps, which, in the tests when the plant was new, were independently driven. With an output of 518, 586, 273.5 and 160.5 kilowatts the consumption of steam per kilowatt-hour was 25, 24.4, 28.3 and 33.1 lbs., respectively; at zero load, 1,850 lbs. of steam were consumed per hour. The tests before delivery, already referred to, showed for loads of 526.4, 256.1 and 124 kilowatts, kilowatt-hour consumptions of 24.1, 27.5 and 33.7 lbs. of steam, respectively; the boiler pressure in these cases were 139, 145 and 140 pounds, respectively.

Personal and Obituary Notes.

Mr. William H. Floyd has been elected city engineer of St. Joseph, Mo.

Mr. William H. Sieverling has been elected city engineer of Springfield, Ohio.

Prof. C. W. Marx of the University of Missouri has declined the chair of engineering at the University of Cincinnati.

Mr. J. F. Coleman, of the engineering firm of Malochee & Coleman, New Orleans, has been elected engineer of the Dock Board of that city.

Mr. Samuel Whinery, 95 Liberty St., New York, has been appointed the successor of the late T. C. Clarke on the engineering commission investigating the Manhattan terminal of the Brooklyn Bridge.

Mr. Joseph M. McConnell of Omaha, formerly superintendent of motive power and machinery of the Union Pacific system, has accepted the office of general manager of the American Locomotive Company's Pittsburg works.

Mr. Clemens Herschel has been selected by the National Contracting Co. and Mr. Lewis Johnson by the New Orleans Drainage Commission to examine the differences between these parties concerning the drainage works of the city. A third gentleman will be appointed by the two named to complete the board.

It is a rather interesting comment on the accuracy of the views of the status of engineering expressed editorially last week in these pages, that Mr. Samuel Rea, M. Am. Soc. C. E., is one of the five men nominated by J. Pierpont Morgan to manage the affairs of the Northern Pacific Railway. Mr. Morgan's letter making the nomination has been characterized as the most important financial document of recent years. Another similar appointment is that of Mr. Geo. A. Thompson as general agent of the Erie Railroad at New York. He was graduated from the Worcester Polytechnic Institute in 1871 and was engaged in railway engineering for a number of years, finally passing from the office of roadmaster into the Erie's operating department.

Mr. E. H. McHenry has resigned the office of chief engineer of the Northern Pacific Railroad with which he has been connected for 18 years. He has been, next to John W. Kendrick, the best-known member of the staff of faithful and skilled men who carried that ill-starred property through its troubled career, and his resignation, following so closely that of Mr. Kendrick, must mean a decided loss to the road.

One of the most promising young American engineers, Paul D. Cunningham, was drowned in the Rio Grande River on July 13. He was born in Georgia in 1869 and educated as a civil engineer at Emery College. His practical experience began in 1887 as a rodman on surveys for the Atlanta & Florida Railroad, and he continued in railway work in various capacities until 1891, his last two engagements being as resident engineer on construction. In that year he entered the government service, with which he was connected until his death. For two years he was a transitman in charge of one of the parties on the difficult survey of the United States and Mexico boundary, and for eighteen months he was a U. S. assistant engineer on the water boundary between these countries. For two years he was the engineer clerk in two divisions of the Engineer Department, U. S. A. When the Spanish war occurred he was appointed principal civil assistant to Col. Wm. M. Black in the Porto Rico campaign, and held a similar position under Colonel Black in Cuba. Here the opportunity for constant hard work satisfied his temperament, and it was against his personal inclination that he resigned to become the consulting engineer of the International Boundary Commission. He was a man of pleasing personality and unusual capacity for engineering work, and left a wide circle of friends to deplore his untimely end.

The most important municipal engineering office in the world has recently been resigned by Sir Alexander R. Binnie, who notified the London County Council on June 18 of his desire to retire from the office of its chief engineer as soon as the public interests permit. This date was afterward fixed at December 31. The Blackwall tunnel, Tower bridge and main drainage improvements are among the great works completed since he assumed the office in February, 1890, while his plans for street improvements and for a water supply from the Welch mountains are among the greatest schemes of their class prepared in recent years. It is understood that the purpose of his resignation is to afford time for consulting practice. It may be of interest to engineers who believe that a technical school course and a few years in a surveying party or drafting office is an ample preparation for consulting practice to note some of the main incidents in the preparation of this British engineer. He was born in 1839 and studied engineering under J. H. La Trobe Bateman. He was engaged on railway work for some years and then served six years in the Indian Public Works Department, where he was several times officially commended. In 1875 he accepted the office of city engineer of Bradford, which he held for 15 years, designing and constructing among other works an earth dam 125 feet high.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Salem, Ill.—City Clk. J. N. Chance writes that there is some talk of constructing water-works.

Farmington, Mo.—John A. Sprott writes that it is proposed to secure a deep well water supply for the northwestern part of the city and correspondence is desired in regard to the furnishing of pipe, etc.

Little Boarshead, N. H.—Albert Bachelder, of the North Shore Water Co., writes that a water works plant is to be built at an estimaated cost of $40,000 to supply Little Boarshead and Ryebeach with water.

Covington, O.—C. O. Lucas, of Greenville, O., has been engaged by the City Council to prepare estimates of the cost of constructing waterworks and electric lights.

Vancouver, B. C.—City Clk. Thos. F. McGuigan writes, at a recent election a by-law was passed authorizing the raisng of $60,000 for water-works extensions.

Salem, N. H.—A correspondent writes that bids will be received at once for the construction of a pipe line. A. W. Dean, of Nashua, N. H., Engineer in charge.

East Providence, R. I.—The East Providence Water Co. is to install an additional filter. E. B. Weston, C. E., of Providence, has prepared the plans, and the New York Continental Jewell Filtration Co. will furnish the filter.

Laurel, Neb.—The question of issuing bonds for water-works will be voted upon Aug. 6. Arnold C. Koenig, of Grand Island, Neb., is preparing the plans. M. H. Dodge, Village Recorder.

Tell City, Ind.—Bids are wanted July 24 for a water-works plant consisting of a pumping plant, having 2 duplex horizontal pumps, 16 x 12 x 18; a water tower, boilers, 30,410 ft. of 4 to 12-in. pipe, tees, crosses, etc. A. H. Kennedy, Engr., Rockport; E. G. Huthsteiner, Secy., Tell City Water & Light Co.

Fremont, O.—City Clk. C. F. Bell writes that on July 11 a vote was taken in favor of issuing $35,000 water-works improvement bonds.

Buffalo, N. Y.—Bids are wanted July 25 for alterations and repairs to engine No. 8 at the water-works pumping station; for furnishing cast-iron pipe and special castings from 3-in. to 48-in. in diameter; all sizes of valves, hydrants and meters; valve boxes, etc. R. G. Parsons, Secy. Bd. Pub. Wks.

Lebanon, Ind.—City Engr. John W. Fulwider writes that bids will be opened Aug. 2 for a reservoir water-well 35 ft. deep and 30 ft. inside diameter, lower 20 ft. of wall brick 22 in., upper 15 ft. of wall 18-in. Estimated cost, $35,000.

West Springfield, Mass.—Local press reports state that contracts are about to be let for the enlargement of the Mitineague standpipe, the new pipe to be 85 ft. high and hold 275,000 gals.

Newark, O.—The Finance and Water Committees have been authorized to engage an engineer to prepare plans for a system of municipal water-works.

Hattiesburg, Miss.—Press reports state that Thos. W. Nicho, of Mobile, Ala., has been appointed engineer in charge of the construction of water-works.

Eaton, Colo.—The Board of Trustees passed ordinances calling for the issuance of $20,000 bonds for putting in water-works and $2,000 for electric lights.

Morris, Ill.—The Fire and Water Committee recommends that a deep well be sunk and a pump purchased.

Yonkers, N. Y.—Bids are wanted Aug. 3 for 300 lengths of 12-in. pipe at 1,100 lbs. per length of 12 ft. A. W. Kingsbury, Clk. Bd. Water Commrs.

Bloomfield, Neb.—An election has been called to vote bonds for water-works extensions. Arnold C. Koenig, Eng., Grand Island, Neb. W. D. Funk, City Clk.

East Liverpool, O.—Press reports state that plans and estimates for improving the water-works have been submitted by L. E. Chapin, of Canton. Estimated cost, $110,000.

Guthrie, Okla. Ter.—City Engr. T. A. White writes that the Council has under consideration reports and estimates on two plans for improving the water-works; one plan is to extend the present ground water supply, the other is to put in a filter and use surface water.

Forest, Miss.—Press reports state that a deep-well pump will be purchased and a standpipe constructed.

East Orange, N. J.—Engineer Peter Milne has appraised the value of the Orange Water Co.'s plant at $353,500. The company offers to sell the plant to the city for $800,000, including the property upon which springs are located, and franchises. Said items are not included in the engineer's estimate.

Pueblo, Colo.—W. C. Bradbury & Co., of Denver, have received a contract from the Colorado Fuel & Iron Co. for the construction of a reservoir to cover 360 acres.

Westerville, O.—The Improvement Committee has reported the estimated cost of proposed improvements as follows: Water-works, $28,000; sewerage, $20,000; street improvements, $25,000.

Cincinnati, O.—Local press reports state that the Water-Works Commissioners on July 12 awarded contracts for pumping engines and an electric crane for the Western Pumping Station, to the Holly Mfg. Co., of Lockport. For bids received June 18, see The Engineering Record of June 22.

Santa Barbara, Cal.—Water-works extension bonds to the amount of $60,000 are stated to have been sold.

Mt. Horeb, Wis.—A committee has been appointed to formulate plans for water-works.

Delta, Colo.—The Grand View Canal & Irrigation Co. has been incorporated with a capital of $105,000. Incorporators: A. J. Ingham, Asa Simpson, A. F. Bardwell, and others.

Chester, Ill.—It is proposed to issue bonds for the construction of a water-works plant, estimated to cost $45,000.

Madison, Neb.—The Special Committee has recommended that bonds be voted for the erection of a steel standpipe and for water-works extensions.

Sharpsville, Pa.—W. A. Graber, Boro. Secy., writes that it is proposed, in the near future, to drill a series of deep wells, as the present water-works system is not satisfactory.

Baraga, Mich.—The proposition to issue $20,000 water-works bonds is stated to have carried July 2.

Jasper, Minn.—Village Recorded E. E. Humphrey writes that all bids opened July 9 for the construction of water-works have been rejected, the lowest bid received was at $11,192.

Joliet, Ill.—A correspondent writes that a contract will be let at once for an air-lift pump, estimated cost $12,000, to be installed at the water-works, for temporary relief until a plan can be devised to construct the Mead system.

Hyattsville, Md.—The contract for constructing water-works has been awarded to Rosser & Castoe of Bellaire, O., for $8,755.

Bath, N. Y.—The Committee appointed to inquire into the question of municipal ownership of the water-works has recommended that Bath purchase the water system at $46,000.

Sharpsburg, Pa.—The Council has authorized the Water and Light Committee to let contracts for sinking 5 12-in. artesian wells. It is stated that new bids will be received for machinery for the water and light plant.

Scottsburg, Ind.—Water-works and an electric light plant will be built, at an estimated cost of $30,000.

Averyville, Ill.—The Village Trustees have under consideration the question of constructing water-works and an electric light plant.

Dickson, Tenn.—The cost of constructing water-works and an electric light plant has been estimated at $35,000, of which $27,500 is for water-works.

Port Oram, N. J.—Louis L. Tribus, 84 Warren St., New York, has been retained to report upon and design a water-works system.

Denver, Pa.—A vote has been taken in favor of the issue of $14,000 bonds for the construction of water-works.

Atchison, Kan.—The Council has served notice on the Water Company that unless it rebuilds its plant to suit the needs of the city a municipal water-works system will be installed.

Troy, N. Y.—Water-works extension bonds to the amount of $135,000 have been sold.

Portsmouth, Va.—The Water Committee has recommended that the Water Company be requested to install a filter to improve the city water supply.

Albany, N. Y.—The contract for furnishing pipe and castings has been awarded to Chas. Millar & Son Co., of Utica, as follows: 6-in. pipe, $25.48 per gross ton delivered; 4-in. pipe, $26.60; special castings, 2⅜ cts. per lb.

Soerabaya, Java.—Bids are wanted at the Netherlands Colonial Office, Technical Bureau, The Hague, Holland, until Sept. 18 for supplying about 3,075 tons of asphalt-coated cast-iron socket pipe (probably about 4,700 tons more will be required during 1902) for the water-works of Soerabaya. Specifications, conditions and drawings may be obtained from Martinus Nyhoff, Nobel St. 18, The Hague, on payment of Fl. 2.50, Netherlands currency. Stamped forms for the tender can also be obtained from the same on payment of Fl. 0.375, Netherlands currency.

Jersey City, N. J.—Ch. Engr. of the Street & Water Commissioners C. A. Van Keuren writes that the contract for furnishing and delivering 100 lengths of 6-in. pipe and 700 lengths of 8-in. pipe has been awarded to the U. S. Cast Iron Pipe & Fdy. Co., of Philadelphia, at $23 per ton; the contract for furnishing and laying 1,050 ft. of 36-in. cast iron water pipe has been awarded to Bernard Gannon, 41 Graham St., Jersey City, at $6.40 per ft.

Philadelphia, Pa.—Bids are wanted July 29 on the following work in connection with the improvement, extension and filtration of the water supply: low service pumping machinery, hand traveling crane, low service station, Upper Roxborugh Filters; filtering materials and underdrains for Upper and Lower Roxborough Filters, and sand washers, Lower Roxborough Filters; testing station, Torresdale Filter plant, and cast-iron water pipe, special castings, trenching and pipe laying. Wm. C. Haddock, Dir. Dept. Pub. Wks.

Mayor Ashbridge has signed the $9,000,000 loan bill and bids for bonds will be received Aug. 19.

Stoneham, Mass.—The following bids were opened July 9 by the Metropolitan Water Board, Boston, for constructing Bear Hill reservoir, Stoneham: A, J. W. Meskill, Everett, Mass., $16,950; B, C. H. Eglee Co., Boston, $19,456 (awarded); C, Frederick N. Lewis & Co., Herkimer, N. Y., $19,575; D, C. E. Trumbull & Co., Boston, $20,415; E, Cenedella Bros., Milford, Mass., $21,670; F, Jesse Moulton & Auguste Saucier, Boston & South Farmingham, Mass., $22,495.

Detail bid for Stoneham Reservoir.

Items and Quantities.	A	B	C	D	E	F
Earth exc., 12,000 cu. yds.	$.32	$.40	$.40	$.43	$.48	$.50
Rock exc., 3,000 cu. yds.	1.63	1.95	2.25	1.75	1.65	2.00
Port. cem. con. mas., 1,000 cu. yds.	7.00	7.00	5.85	7.65	9.00	8.00
Paving set in mortar, 200 cu. yds.	2.15	3.00	4.60	5.00	4.50	5.00
Riprap, 100 cu. yds.	2.00	1.50	2.00	2.00	.80	2.00
Granite dim. stone mas., 15 cu. yds.	20.00	50.00	50.00	35.00	25.00	60.00
Laying C. I. pipe:						
20-in., 320 lin. ft.	.75	.80	.75	1.50	1.75	1.00
10 and 12-in., 100 lin. ft.	.50	.50	.65	1.50	.45	.75

Hartford, Conn.—The Hartford Board of Water Commissioners has retained Allen Hazen, of New York City, to investigate and report upon a filtration plant for Connecticut River water, in comparison with a gravity supply from Granby, Conn. Although the Commission has already obtained the necessary Legislative authority for the Granby project, there is a strong public sentiment in favor of the filter system.

SEWERAGE AND SEWAGE DISPOSAL.

Elkhart, Ind.—Bids are wanted July 24 for a trunk line and lateral sewer in portions of several streets, also separate bids until Aug. 7 for a sewer in portions of several other streets. L. E. Hitchcock, City Engr.

Montpelier, Ind.—Bids are wanted July 26 for 2,000 ft. of 10-in. sewer. Address J. F. Jones, Clk.

Hamilton, O.—Bids will be received, according to local press reports, by the City Clerk until July 24 for a sanitary sewer on a portion of North C St.

Oshkosh, Wis.—Bids are wanted Aug. 7 for sewers in portions of 2 streets. Frank Monahan, Chmn. Bd. Pub. Wks.

Buffalo, N. Y.—Bids are wanted July 26 for 10 to 20-in. tile sewers in portions of 3 streets; also for tile and brick sewers in portions of 2 streets and a 5-ft. brick sewer in a portion of Hertel Ave. R. G. Parsons, Secy. Bd. Pub. Wks.

Freeport, Pa.—Bids are wanted July 25 for 2,190 ft. of sewer in East High St. G. B. Findley, Engr.; G. M. Hill, Secy.

Canton, O.—Bids are wanted Aug. 12 for the construction of Graham Ave. sanitary sewer 3,300 ft., and Shorb St. sewer, 1,720 ft. Phillip H. Weber City Engr.

South Bend, Ind.—Bids will be received July 26 for 1,550 ft. of 8- 12-in. pipe sewer with 5 manholes; bids will be received July 30 for 1,417 ft. 8- 12-in. pipe sewer with 6 manholes, and on Aug. 1 for 1,468 ft. 8- 15-in. sewer on Colfax Ave. and 3,002 ft. 8- 15-in. sewer with 9 manholes on Washington St. A. J. Hammond, City Engr.

Celina, O.—J. L. Pulskamp, Secy. of the Sewer Com., writes that on July 23 bids will be received for the preparation of plans, specifications and estimates for a system of sewerage and sewage disposal.

Mt. Vernon, N. Y.—Bids are wanted July 30 for a lateral sewer in McClellan Ave. Geo. W. Drumheller, City Engr.

Columbus, O.—A special election has been called for Aug. 3 to vote on the issue of $2,250,000 sewer bonds and $200,000 electric light bonds.

Lynn, Mass.—The Council has ordered the construction of a brick sewer through Chestnut St.

Burkhart, Ill.—Bids are wanted by the Drainage Commissioners of Drainage Dist. No. 1, Town of Burkhart, at Edinburg, until July 24, for furnishing and delivering 14,817 12 to 16-in. first-class salt-glazed or vitrified tile; also 44 junctions and 11 curves. A. M. Firey, Chmn.

Birmingham, Ala.—The first issue of $20,000 bonds has been sold for the Jefferson County sewerage system.

Syracuse, N. Y.—It is proposed to construct two intercepting sewers, one to relieve Onondaga Creek, estimated cost $200,000, and the other to relieve Harbor Brook, estimated cost $75,000.

El Paso, Tex.—Local press reports state that City Engineer Wimberly is in favor of the installation of a sewage purification plant.

Hoboken, N. J.—The ordinance providing for the installation of a new sewerage system has passed its second reading in the Council. Cost of system not to exceed $100,000 in any one year.

Huntington, Ind.—It is stated that bids are wanted Aug. 13 for 1,500 ft. of 10, 12, 15 and 30-in. sewer, estimated to cost $3,500. Frank Guthrie, City Engr.

Milwaukee, Wis.—The contract for constructing the third section of the West Side Intercepting Sewer, 970 ft., has been awarded to Geo. E. Zimmerman, of Milwaukee, at $6.93 per ft.

Brookhaven, Miss.—Press reports state that an engineer is to be engaged to make surveys, plans and specifications for a sewerage system.

Boonton, N. J.—Local press reports state that P. H. Flynn, the contractor for the Jersey City Water-Works, will build a $20,000 sewer system in Boonton in order to prevent the pollution of the Jersey City water supply.

Westerville, O.—See "Water."

Allentown, Pa.—The Sanitary Sewerage Commission is investigating various methods of sewage disposal.

Toronto, Ont.—City Engineer Rust in a recent report as to various methods of sewage disposal favors the construction of an intercepting trunk sewer discharging directly into Lake Ontario. Estimated cost, $1,750,000.

Kankakee, Ill.—City Engr. Robt. D. Gregg writes that the Committee on Sewers has rejected all bids, received July 8, for Soldier Creek and Riverview sewers.

Sandy Hill, N. Y.—Local press reports state that the Village Clerk will receive bids Aug. 1 for $62,000 sewer bonds.

Mansfield, O.—Bids are wanted Aug. 7 for $35,000 bonds to be used for the purpose of proper sewage and garbage disposal. F. M. Remy, City Clk.

Appleton, Wis.—City Engr. C. H. Gillett writes that bids are wanted until Aug. 7 for sewers as follows: 320 ft. 30-in., 2,500 ft. 15-in., 1,130 ft. 12-in. and 72 ft. 16-in. cast-iron pipe.

Springfield, Ill.—Local press reports state that contracts are about to be let by the City Council for the reconstruction of the town branch sewer, where it crosses under the Armory site, for a distance of 450 ft., the new sewer to be a triple-ring brick structure, inside diameter 10 ft. Estimated cost, $9,000.

St. Louis, Mo.—Waller Edwards, Secy. of the Board of Public Improvements, writes that the contract for the construction of sewers in Cora Ave. Sewer District No. 1, has been awarded to August Herman and Louis Skrainka, of St. Louis, for $160,342. The work includes 106,000 cu. yds. earth excavation, 300 cu. yds. loose rock excavation, 800 cu. yds. solid rock excavation. Pipe sewers: 9,000 ft. 12-in., 17,340 ft. 15-in., 10,150 ft. 18-in., 6,660 ft. 21-in., 5,380 ft. 24-in.; 3,260 junctions; 6,240 sq. ft. inlet stones, and 7,400 cu. yds. brick masonry.

Wauwatosa, Wis.—The County Board is said to have decided to ask for bids for a new sewage disposal plant for the Wauwatosa Institution.

Canon City, Colo.—Extensive sewer construction is said to be in contemplation. L. C. Hall, City Engr.

San Diego, Cal.—The City Engineer has been directed to prepare plans and estimates for a sewer system for University Heights Addition.

Irwin, Pa.—Bids are wanted July 23 for about 4 miles of sewers. S. D. Lauffer, Boro. Secy.

Oelwein, Ia.—The Council has given notice of intention to construct sewers in certain streets. H. V. Hoyer, City Clk.

Allegheny, Pa.—Ordinances before the Council provide for the construction of sewers in several streets.

Mansfield, O.—Bids are wanted Aug. 10 for sewers. F. M. Remy, City Clk.

North Vernon, Ind.—Bids are wanted July 26 for sewers in several streets. Chas. H. Everett, City Clk.

Reynoldsville, Pa.—An ordinance has been passed providing for the construction of a sewer along Pitch Pine Run and Hill St. C. Mitchell, Ch. Burgess.

Somerville, N. J.—The Sewer Committee has reported in favor of building sewers estimated to cost $13,000.

Edwardsville, Ill.—A committee has been appointed to decide on a plan for the improvement of the streets and the construction of a sewer system.

Metropolitan, L. I., N. Y.—Preliminary measures have been adopted for the construction of public sewers in several streets.

Mobile, Ala.—In a recent report submitted by Ch. Engr. J. N. Hazlehurst the estimated cost of constructing sewers, for the drainage of a section of the city between the river and Cedar St., Government and State Sts., is placed at $30,000.

Gloversville, N. Y.—City Clk. M. V. B. Stetson writes that the contract for constructing 2,118 ft. of 10-in. pipe sewer, with 8 manholes and 1 lamp hole, has been awarded to Albert M. Banker of Gloversville for $9,303. The trench to average 18 ft. in depth and be excavated in clay, sand and gravel.

Hartford, Conn.—The contract for constructing Garden and Liberty St. sewer has been awarded to the Hartford Paving & Construction Co. as follows: 360 ft. 10-in. tile at 65 cts.; 60 ft. 15-in. tile at 95 cts.; 425 ft. 20-in. tile, $1.45; 90 ft. 36-in. brick sewer, $2.90; 10 cu. yds., concrete at $7; 6 manholes, $35; 28 house connections, $6.50; total, $1,749. The contract for Preston St. sewer has been awarded to Michael O'Neil for $2,500.

Washington, D. C.—The following bids for furnishing and erecting the pumping machinery, boilers, etc., for equipping the sewerage pumping station were opened July 13 by the Commissioners D. C.: *a*, full equipment; *b*, partial equipment: Allis-Chalmers Co., Milwaukee, Wis., *a*, $253,000; alternate bids, $231,000 and $241,000; *b*, $158,750; alternate bid, $146,000. Camden Iron Wks., Camden, N. J., *a*, $323,000; *b*, $212,000. The United Engineering & Contracting Co., New York City, *a*, $329,450; *b*, $239,375.

Lebanon, Ind.—City Engr. John W. Fulwider writes that the following bids were opened July 12 for the construction of a sewer system; the work to include 95,000 ft. of 8 to 24-in. pipe sewers, 205 manholes, 83 lampholes and 20 flush tanks; the trench to average 12 ft. in depth and be excavated in earth. Bidders: A, George W. Seibert, Indianapolis (awarded); B, William Bossert, Indianapolis; C, Woods & Derheimer, Decatur; D, M. A. Talbot & Co., Logansport; E, Chas. W. McKinney, Toledo, O.; F, D. W. Norton & Co., Terre Haute; G, J. D. Hoss, Indianapolis; H, Jas. M. Waugh, Crawfordsville; I, C. D. Browder, Indianapolis; J, Shahan & Adams, Lebanon.

	Sewer Pipe.							Cast Iron Pipe.		Manholes.						Drain Tile.					Extra Material.				
Bidders.	3,370 ft. 24-in.	3,395 ft. 20-in.	2,020 ft. 18-in.	430 ft. 15-in.	11,846 ft. 12-in.	7,020 ft. 10-in.	66,835 ft. 8-in.	60 ft. 10-in.	360 ft. 12-in.	Plain, 204.	Intercepting, 1.	Flush-tanks, 6-in, siphon, 19.	Lamp-holes, 83.	Masonry Bulkhead, 43.6 cu. yds.	Flush-tank, 8-in. siphon.	12-in.	10-in.	8-in.	6-in.	4-in.	Gravel for found., per cu. yd.	Concrete for found., per cu. yd.	Timber in found., per M. ft.	Timber in trench, per M. ft.	Total.
A	$1.34	$1.09	$.85	$.60	$.63	$.49	$.49	$1.80	$2.35	$15.00	$20.00	$55.00	$6.00	$6.50	$65.00	$.18	$.12	$.10	$.08	$.05	$1.25	$3.00	$20.00	$15.00	*$59,733
B	1.22½	1.15	.97	.62	.54	.52	.50	1.80	1.92	30.00	35.00	67.00	9.80	7.80	.....	.20	.18	.16	.15	.12	1.25	2.50	25.00	25.00	63,104
C	1.48	1.05	.85	.75	.74	.60	.48	1.75	1.90	28.00	60.00	48.00	5.00	4.75	55.00	.25	.20	.18	.15	.10	2.40	4.50	25.00	21.00	63,801
D	1.43	1.15	.79	.79	.67	.62	.46	1.50	1.50	40.00	40.00	65.00	10.00	8.00	65.00	.10	.08	.06	.04	.03	.60	5.00	12.00	12.00	65,001
E	1.43	1.13	.88	.80	.65	.63	.51	1.75	2.00	26.00	38.00	60.00	7.50	9.50	65.00	.12	.08	.07	.06	.04	.75	5.00	22.00	20.00	65,394
F	1.71	1.15	.79	.67	.67	.56	.51	1.50	2.00	25.00	40.00	60.00	7.50	9.50	70.00	.12	.10	.08	.06	.04	1.00	5.00	16.00	16.00	65,701
G	1.75	1.35	.90	.64	.64	.57	.47	1.30	1.40	28.00	50.00	120.00	14.00	12.00	120.00	.60	.50	.40	.35	.30	1.40	8.00	40.00	40.00	65,998
H	1.80	1.34	1.00	.85	.75	.67	.55	1.25	2.00	27.00	40.00	70.00	12.00	6.00	80.00	.36	.30	.24	.18	.12	.70	7.00	17.00	17.00	72,359
I	1.56	1.15	.80	.72	.71	.60	.62	2.00	2.35	27.00	50.00	73.00	7.00	5.00	80.00	.12	.10	.07	.05	.03	1.00	4.00	16.00	16.00	73,937
J	1.51¼	1.06¼	1.02½	.92½	.81¼	.66¼	.63¼	1.00	1.20	25.00	35.00	70.00	12.50	6.00	80.00	.10	.16	.04	.03	.02	.85	2.75	17.50	12.50	76,267

*Contract awarded. The bids on drain tile and extras were not considered in computing totals.

Visalia, Cal.—The Board of City Trustees has sold $60,000 worth of sewer bonds.

Scranton, Pa.—Joseph P. Phillips, Ch. Engr. of the Dept. of Pub. Wks., writes that T. T. Walsh & Co., Moosic, Pa., bid as follows for the construction of sewers in the 10th Ward: Sewer complete, $2.19 per lin. ft., with either stone cover basins or Pierce casting basins; extra basins, $95 each stone cover, and $90 Pierce casting; extra manholes, $40 each; extra house connections, $1.62 per lin. ft. This work includes 3,970 ft. of 8 to 15-in. pipe sewers, 30 manholes, 7 catch basins and 1,260 ft. of 6-in. pipe for house connections. The trench to average 10 ft. in depth and be excavated mostly in rock.

Cleveland, O.—The following bids were opened July 9 for the construction of sewers along the L., S. & M. S. Ry., 2,400 ft. of 13 ft. 6-in: (the bids are on Plan A and Plan B respectively): Northern O. P. & Const. Co., $208,765, $171,030. Hunken Bros., $230,245, $201,490. J. Connelly & Son (awarded), $160,498, $128,891. Reaugh Const. Co., $169,970, $134,150. John Wagner, Detroit, Mich., $166,834, $134,275.

Bids opened July 9 for the construction of a portion of Doan Brook Valley sewer were as follows: Reaugh Const. Co., $49,425 (awarded) Hunken Bros., $58,425. J. Connelly & Son, $51,478. Clements Bros., $50,520. N. O. P. & Const. Co., $53,553. Beers & Dolittle, $53,972. W. J. Townsend, $59,608. John Wagner, Detroit, $51,315. Bidders all of Cleveland, except John Wagner.

Swissvale, Pa.—Boro. Engr. C. B. Judd, Park Bldg., Pittsburg, writes that contracts for three sections of the sewer system have been awarded as follows: Section 1, to Lee & Casey, of Pittsburg, for $12,006; Sections 4 and 5, to Cronin & O'Herron, of Pittsburg, at $17,137 and $5,093 respectively. Detail bids for above sections were as follows: * for 18-in. pipe:

	Pipe sewer.				C. I. pipe.		
Sections.	15".	12".	10".	8".	18".	M.H.	F.T.
1	$1.26	$1.00	$.96	$.89	$5.00	$ 45	$ 75
4	1.65	1.35	1.10	.90	5.00	55	95
5	*1.65	1.15	1.15	1.00	....	55	90

New bids will be opened July 22 for the three other sections. Section 2 calls for 10,200 ft. of 24, 15, 12, 10 and 8-in. pipe sewer, 10 flush tanks and 20 manholes; Section 3 calls for 24,800 ft. of 30 to 8-in. pipe sewer, 24 flush tanks, 60 manholes and 110 ft. of 18-in. C. I. pipe under railroad; Section 6 calls for 7,400 ft. of 18 to 8-in. pipe sewer, 5 flush tanks, 19 manholes, 115 ft. 18-in. C. I. pipe under railroad and 100 ft. of 18-in. C. I. pipe at river outlet.

BRIDGES.

Pingree, N. D.—Bids are wanted Aug. 5 for constructing a bridge across Pipestem River, southwest of Pingree. L. B. Niemeyer, Co. Aud., Jamestown.

Three Rivers, Mich.—It is stated that the City Clerk has been authorized to procure plans and specifications for a cement arch bridge to cross Portage River.

Miamisburg, O.—The King Bridge Co. has secured the contract for constructing the iron span to the lower river bridge at Linden St., Miamisburg, for $13,600.

Canby, Ore.—E. D. Olds, of Oregon City, is reported to have received the contract for constructing a wagon bridge across Molalla River, between Canby and Barlow, for $9,145.

Williamstown, W. Va.—Plans and specifications for the proposed bridge across the Ohio River from Williamstown, W. Va., to Marietta, O., have been approved by the Secretary of War. Work will begin as soon as the preparation can be made.

Tacoma, Wash.—The County Commissioners have approved plans for the construction of a drawbridge across the Puyallup River on St. Paul Ave.

Milwaukee, Wis.—Bridge bonds, amounting to $100,000, have been sold.

Battle Creek, Mich.—At a recent special election the city voted $10,000 bonds for a new bridge.

Croton Falls, N. Y.—The New York Central R. R. has made application to the Aqueduct Commissioners for permission to construct a bridge across Croton River at Croton Falls, with a center pier resting in the river.

Plain City, O.—Hermon W. Tapp of Ft. Wayne, Ind., has secured the contract for masonry work on 6 double track bridges, between Columbus and Plain City, O., on the Indianapolis Division of the Panhandle R. R.

San Jose, Cal.—The County Board of Supervisors has accepted plans and specifications for a bridge to replace present structure over Saratoga creek on Saratoga turnpike; also for 2 concrete culverts over San Tomas Aquina creek, and it is stated bids will soon be asked. The County Surveyor has been instructed to prepare plans for a bridge over the Coyote creek on Tully road, and for a concrete bridge over Labreya creek on Monterey road. All these bridges will be built this year.

Marinette, Wis.—The Marinette County Supervisors have decided to construct a bridge across Menominee River to connect Quinnesec, Mich., and Niagara, Wis. Probable cost of bridge, $6,000.

Dravosburg, Pa.—Maj. Chas. F. Powell, Corps Engrs., U. S. A., has received permission from the Secretary of War for C. Jutte & Co., to construct a bridge on the Monongahela River from Dravosburg to the mouth of the Youghiogheny.

Bridgeport, Conn.—See "Railroads."

Savannah, Ga.—Ch. Engr. T. S. Tutwiler of the Plant System writes that bids for bridge construction will probably not be asked until next year.

Vicksburg, Miss.—The Warren County Board of Supervisors proposes to build a drawbridge across Big Black River. Wm. Curphey Pres. of the Bd.

Cleveland, O.—The Findlay & Southern Railway is preparing plans for the following bridges: 3 over the Big Darby Creek at Unionville and Plain City; 1 over Mill Creek at Marysville; 1 over Scioto River at Kenton; 2 over Blanchard River, and Wolff Creek. All to be deck bridges averaging from 80 to 150 ft. R. Rosenstock, Ch. Engr., Cleveland.

Milwaukee, Wis.—Bids are wanted July 23 for constructing east abutment and making alterations to the west approach and center pier of Chestnut St. bridge, and moving the superstructure of Grand Ave. bridge to the center pier of Chestnut St. bridge. Chas. J. Poetsch, Chmn. Commrs. of Pub. Wks.

Zanesville, O.—Bids are wanted Aug. 13 for constructing the superstructure of the draw span at the easterly end of the new "Y" bridge over the lateral canal of Muskingum River at Zanesville. Jas. L. Starkey, Co. Aud.

Quincy, Mass.—Plans, specifications and bids are wanted July 22 for constructing an iron foot bridge with foundations and approaches at Warren Ave. over the N. Y., N. H. & H. R. R. tracks. C. F. Knowlton, Commr. of Pub. Wks.

Glassport, Pa.—Bids are wanted Aug. 1 for constructing the superstructure of a bridge over Monongahela River at Glassport. John P. McIntyre, of McKeesport, Pres. of the Glassport Bridge Co. E. K. Morse of Pittsburg, Engr. in Charge.

Iola, Kan.—Bids are wanted Aug. 6 for constructing a steel or cement bridge across Marmaton River, in Marmaton Township. C. A. Fronk, Co. Clk.

Pittsburg, Pa.—The contract for constructing 4 piers for the Wabash R. R. bridge over the Monongahela River has been awarded to Arthur McMullen, of New York, at a unit bid of about $200,000.

Cincinnati, O.—The Board of Public Service will soon sell $425,000 bonds for the purpose of constructing the Harrison and Delta Ave, viaducts, which will cost $250,000 and $175,000, respectively.

Mt. Jackson, Va.—The County Court has appropriated $5,000 for the construction of an iron or steel bridge across Shenandoah River, near Mt. Jackson.

East Hartford, Conn.—It is stated that the Hartford Street Railway Co. has submitted to the Board of Selectmen a map and plans for a trestle bridge over the steam railway crossing on Main St.

Philadelphia, Pa.—Mayor Ashbridge has signed 3 bills granting privileges as follows to the Pennsylvania Railroad Co., to build a bridge at 52d St., to revise grades at 31st St. and Powelton Ave., and to build a bridge over Filbert St.

Nashville, Tenn.—A charter has been granted to the Caney Fork Bridge Co., of Smith County, capital $9,000. Incorporators: E. M. McDonald, Wm. Gwaltney, and others.

Atlanta, Ga.—See "Electric Railways."

Binghamton, N. Y.—Local press reports state that the City Engineer has been directed to have plans prepared for a bridge over the Susquehanna River to replace the old Exchange St. bridge, and to expend $100 in consulting an expert engineer before making such plans.

Pittsburg, Pa.—Bids are wanted July 26 for building stone abutments for several bridges on the Moon Run R. R. E. J. Taylor, Ch. Engr., Pittsburg Coal Co., 232 5th Ave.

Chicago, Ill.—The contract for the substructure of Randolph St. bridge was awarded July 1 to Jackson & Corbett Co. of Chicago, for $81,628; contract for the superstructure awarded to American Bridge Co. of New York for $107,000. For detail bids received June 12 see The Engineering Record of June 22.

Stockton, Cal.—County Surveyor F. E. Quail writes that the contract for constructing a steel bridge across San Joaquin River at Dunham's Ferry has been awarded to Clark & Henery of Stockton, for $17,843.

The Board of Supervisors of San Joaquin County will receive bids until Aug. 6 for the construction of 1 240-ft. bridge consisting of 3 80-ft. steel poney trusses, concrete end piers and cylinder piers where spans abut; also 1 80-ft. steel poney truss and one 70-ft. steel poney truss, foundations of the last two will be steel cylinders. Plans have been adopted by the board for a drawbridge on Burris' Cut-off at San Joaquin River, bridge to be of steel, 160-ft. draw and one 50-ft. approach span.

PAVING AND ROADMAKING.

Findlay, O.—The Council has passed an ordinance providing for the issue of $7,000 bonds for paving Second St.

Atlanta, Ga.—Local press reports state that bids will be opened Aug. 5 for asphalt pavement on the business section of Whitehall St.

Westerville, O.—See "Water."

Chicago, Ill.—The Board of Local Improvements has ordered pavement as follows: Ada St., asphalt, $22,000; Campbell Ave., asphalt, $11,000; Center Ave., asphalt, $9,249; Lincoln St., asphalt, $13,000; Walnut St., granite-top macadam, $30,500; 37th St., asphalt, $46,176.

Martinez, Cal.—It is stated that bids are wanted Aug. 13 for macadamizing 6 streets. M. H. Hurly, Town Clk.

Huntington, Ind.—It is stated that bids are wanted Aug. 13 for 15,000 sq. yds. brick pavement on an 8-in. crushed stone foundation, estimated to cost $25,000. Frank Guthrie, City Engr.

Marysville, O.—It is stated that bids are wanted July 25 for brick pavement on West 6th St. J. C. Kennedy, City Engr.

East Liverpool, O.—It is stated that bids are wanted July 29 for brick pavement on Bradshaw Ave. J. N. Hanley, City Clk.

Sparta, Wis.—The contract for the proposed granite-macadam paving in this city has been awarded, according to local press reports, to the Western Granite Co., of Chicago, for $21,098.

Michigan City, Ind.—Bids are wanted July 30 for 20,000 yds. of asphalt paving. H. M. Miles, City Engr.

Oneonta, N. Y.—Bids are wanted July 30 for about 34,000 sq. yds. of vitrified brick pavement and about 6,000 lin. ft. of bluestone curb, 4 x 16 in. Specifications may be obtained by application to Village Clk. D. McLaury. O. A. Miller, City Engr.

Woodbury, Conn.—An appropriation of $9,000 has been made for good roads for 2 years.

Maryville, Mo.—The proposition to issue $30,000 bonds for street paving carried at the election held July 9.

Pittsburg, Pa.—An act has been signed by the Governor authorizing $500,000 yearly bond issues for road improvements.

Bowling Green, O.—Local press reports state that the contract for paving with Nelsonville block on a portion of Main St. has been awarded to Henry Gantz, of Columbus, at $76,729.

Boston, Mass.—Mayor Hart has approved an order to lay out and construct a portion of South Huntington Ave. to be 70 ft. wide; cost of construction estimated at $65,000; also the laying out and construction of a portion of Mead St., to cost $10,355, and extending portions of Milk and Newland Sts., cost of construction estimated at $14,312 and $3,380, respectively.

Reading, Pa.—Plans are under consideration for the paving of Perkiomen Ave. with brick; total cost about $35,000; city's share, $10,000.

La Salle, Ill.—The Council has ordered about 2½ miles of brick paving.

Lowell, Mass.—The Committee on Streets has voted to recommend a loan of $15,000 for the macadamizing of Nesmith and a part of Rogers Sts.

Lima, O.—Bids are wanted July 23 for 1,735 sq. yds. brick pavement on Cole St. C. E. Lynch, City Clk.

Irwin, Pa.—Bids are wanted July 23 for about 40,000 sq. yds. paving. S. D. Lauffer, Boro. Secy.

Greenburg, N. Y.—Bids are wanted July 26 for the completion of Road No. 17, Hastings-Ardsley Road, 6 miles in length; also Road No. 18, Ardsley-Elmsford road, 3.06 miles in length, both in Greenburg. Edw. A. Bond, State Engr. & Surveyor, Albany.

Atchison, Kan.—Fred Giddings, City Engr., writes that resolutions have been adopted declaring it necessary to grade, curb and pave the following streets, paving to be 1 course vitrified brick on 3-in. sand; curbing to be of Portland cement concrete, 5-in. on top, 6-in. on bottom, 20 in. deep: Atchison St., 12,800 sq. yds. paving and 7,800 lin. ft. curbing; 5th Ave., 5,342 sq. yds. paving and 3,544 lin. ft. curbing; Kearney St., 1,060 sq. yds. paving, 790 lin. ft. curbing; Kansas Ave., 407 sq. yds. paving.

Evansville, Ind.—City Engr. Jas. D. Saunders writes that two or three streets are to be paved with asphalt.

Ogden, Utah.—The City Council has passed an ordinance for paving with asphaltum 4 blocks of Washington Ave. A. F. Parker, City Engr.

Meriden, Conn.—City Engr. W. S. Clark writes that the contract for paving a portion of State St. with sheet asphalt has been awarded to the Central Paving Co. of Hartford, as follows: 3,130 sq. yds. of asphalt at $2.98; 900 lin. ft. new curb on concrete, 88 cts.; 700 ft. old curb on concrete, 53 cts.; total, $10,490.

Woonsocket, R. I.—The Mayor has approved the appropriation of about $25,000 for macadamizing and repairing macadam streets.

Dayton, O.—City Engr. F. M. Turner writes that the contract for paving a portion of Richard St., 5,650 sq. yds., has been awarded to David Beard, of Dayton, at $1.50 per sq. yd., for Wassall block, 21-in. curbing at 48 cts. per lin ft.; total, $10,369.

Moline, Ill.—City Engr. H. G. Paddock writes that the contract for 15,427 sq. yds. of brick paving on 5th Ave. has been awarded to the Walsh Construction Co., of Davenport, for $24,262.

Binghamton, N. Y.—I. C. Hull, City Clk., writes that Wm. A. Park, of Rochester, Pa., has received the contracts for paving three streets (bids opened July 9) with Park brick, at $1.84 per sq. yd.

Washington, N. J.—Local press reports state that bids received by the Borough Council June 29, for macadamizing about 1 mile of roads, have been rejected, and new bids will be received Aug. 10.

Columbus, O.—Bids are wanted July 23 for macadamizing a portion of Linwood Ave. Clarence M. Addison, Clk. Bd. Pub. Wks.

New York, N. Y.—Bids are wanted July 30 for paving and repaving with asphalt on portions of several streets in Boroughs of Manhattan, Brooklyn, Bronx and Queens. James P. Keating, Commr. of Highways.

Battlecreek, Mich.—At a recent special election $15,000 bonds were voted for paving.

Buffalo, N. Y.—Bids are wanted July 26 for paving portions of 6 streets. R. G. Parsons, Secy. Bd. Pub. Wks.

Lincoln, Mass.—Bids are wanted July 30 for building about 1 mile of road in Lincoln. Levi S. Gould, Co. Commr., East Cambridge.

Freeport, Pa.—Bids are wanted July 25 for 2,480 ft. curbing, 2,000 cu. yds. grading, 2,725 sq. yds. paving on East High St. G. B. Findley, Engr.; G. M. Hill, Secy.

Vincennes, Ind.—Bids will be received by the City Council July 22 for 50,943 sq. ft. artificial-stone sidewalks and 15,503 lin. ft. dressed limestone curbing on 9th St.

Mansfield, O.—Bids are wanted Aug. 5 for improving a portion of East 4th St. and Weldon Ave.; separate bids will also be received Aug. 7 for $12,400 East 4th St., and $2,400 Weldon Ave. street improvement bonds. F. M. Remy, City Clk.

Wapakoneta, O.—Bids are wanted Aug. 2 for brick pavement on Anglaize St. Chas. E. Fisher, Clk.

Fostoria, O.—Bids are wanted July 26 for block pavement on a crushed-stone and sand foundation in a portion of Fremont St. J. M. Schatzel, City Clk.

Napoleon, O.—Bids are wanted July 26 for 3,078 sq. yds. brick pavement on a stone foundation. C. N. Schwab, Engr.

Buffalo, N. Y.—Bids are wanted July 25 for repaving and repairing asphalt streets, as may be required. R. G. Parsons, Secy. Bd. Pub. Wks.

Sullivan, Ind.—Bids are wanted Aug. 5 for constructing over 7 miles of gravel roads in Fairbanks Township. J. M. Lang, Co. Aud.

Canton, O.—Bids are wanted Aug. 12 for paving North St., for a distance of 3,900 sq. yds. Philip H. Weber, City Engr.

Appleton, Wis.—Bids are wanted Aug. 7 for about 6,000 sq. yds. of asphalt paving, 36 ft. between curbs, with single-track street railway in the center. C. H. Gillett, City Engr.

Mobile, Ala.—In a recent report Ch. Engr. J. H. Hazlehurst estimates the cost of paving upon several streets as follows: With concrete base, $2.86 per sq. yd. for brick, $2.85 for asphalt and $3.50 for granite block.

Little Falls, N. Y.—Bids are wanted July 26 for brick paving on a portion of South Ann St. Frank W. Klock, City Clk.

Indianapolis, Ind.—Bids are wanted Aug. 2 for brick pavement on a portion of Scioto St.; also cement sidewalks on 3 streets. Albert Sahm, Chmn. Bd. Pub. Wks.

Palestine, Tex.—City Secy. C. A. Sterne writes that it was voted July 15 to issue bonds for paving the business streets.

Chester, Pa.—Wm. T. Cullis, Chmn. Street Com., writes that on July 15 the contract for paving a portion of 24th St. with Mack brick was awarded to John Hanna, of Chester, at $2.28 per sq. yd., and the contract for paving Rose St. with sheet asphalt, 10-year guarantee, was awarded to the Vulcanite Paving Co., of Philadelphia, at $2.23 per sq. yd.

Indianapolis, Ind.—The contract for asphalting the roadway and paving with brick the gutter of Massachusetts Ave., from Pennsylvania to Delaware Sts., has been awarded to the Barber Asphalt Paving Co., of Indianapolis, for $4 per lin. ft. on each side. The contract for paving with cement and curbing sidewalks of a portion of 11th St. has been awarded to Daniel Foley, of Indianapolis, for $1.17 per lin. ft.

Newark, N. J.—Local press reports state that the lowest bid received July 11 for asphalt pavement on 8 streets was submitted by the Barber Asphalt Paving Co., as follows: Brunswick St., 7,900 sq. yds., $15,112; Hampden St., 1,100 sq. yds., $2,032; Monroe St., 8,100 sq. yds., $15,235; Blum St., 2,700 sq. yds., $5,357; Milton St., 1,100 sq. yds., $2,118; Hunterdon St., 4,200 sq. yds., $7,694; Orleans St., 1,700 sq. yds., $3,196; Park St., 1,500 sq. yds., $2,959.

Allegheny, Pa.—The contract for paving with sheet asphalt on Brighton Road has been awarded, according to press reports, to the Atlas Construction Co., for $192,920.

The contract for grading and repaving River Ave. is stated to have been awarded to the North-Side Coal & Sand Co., for $31,875.

Denver, Colo.—Bids were opened July 12 for paving Colfax Ave., Paving District No. 3; the work includes 13,112 sq. yds. of sheet asphalt paving, 24,921 cu. yds. grading, 6,218 ft. 5 x 16-in. sandstone curb, circular curb, pipe drain, 8 manholes, inlets, bends, Y branches, etc. Bidders were the Bermudez-Blake Contracting Co., of Denver, $2.25 per yd. for paving, all other work $21,473; total, $50,975. Colorado Paving Co., Denver (awarded), $2.15 per yd. for paving, all other work $22,306; total, $50,497.

St. Paul, Minn.—Local press reports state that contracts for paving have been awarded as follows: To the Barber Asphalt Paving Co., Minnesota St., one portion with sandstone for $12,158, and another portion with asphalt, for $5,647. To R. F. Conway Co., with asphalt, portions of Western and Marshall Aves., at a total of $29,900; and Central Park Place, with asphalt, at $4,575.

Hamilton, O.—Contracts for paving with Bermudez sheet asphalt on 4 streets are stated to have been awarded as follows: To Ayres Asphalt Paving Co., Zanesville, Ross Ave. and North 7th St., at $32,022 and $17,431, respectively; to Barber Asphalt Paving Co., N. Y. City, Dayton and South B Sts., at $44,973 and $4,224, respectively.

St. Louis, Mo.—Waller Edwards, Secy. Bd. of Public Improvements, writes that paving contracts, for which bids were opened July 9, have been awarded as follows: To Fruin Bambrick Const. Co., St. Louis, brick paving with 6-in. concrete base on Whittier St., 243 squares granitoid curb and gutter, 3 ft. wide, for $6,349; to Skrainka Const. Co., St. Louis, same as above on Pleasant St., 426 squares for $11,951; to H. Ruecking & Co., St. Louis, same as above on Union Boulevard, 686 squares for $17,846; to Herman Const. Co., St. Louis, same as above on another section of Union Boulevard, 803 squares for $21,357. Numerous smaller contracts for street improvements were let at the same time.

POWER PLANTS, GAS AND ELECTRICITY.

Trenton, N. Y.—The Village Trustees are stated to have granted a franchise to the Utica Electric Light & Power Co.

Covington, O.—See "Water."

Gold Hill, N. C.—The Whitney Reduction Co. will develop the water power of Stanley and Montgomery Counties. Estimated cost of proposed improvements, $2,500,000. J. J. Kennedy, 40 Bway., New York, N. Y., is the engineer in charge.

Port Deposit, Md.—The Port Deposit Electric Light & Power Co. is stated to have been reorganized, and extensive repairs will soon be commenced. Directors: Harry A. Nesbitt, Washington W. Hopkins and others.

Binghamton, N. Y.—Sands, Buckley & Kane of Binghamton, are stated to have received the contract for lighting the city by electricity for 3 years from July 14, 1902. A committee has reported amendments to the franchise asked by the new company and when the franchise is granted the company will start constructing its plant. The company will not set any new poles, but use poles already erected.

Annapolis, Md.—See "Government Work."

New Orleans, La.—The stockholders of the New Orleans & Carrollton R. R. Co., J. K. Newman Pres., are stated to have voted to absorb the Edison and the Merchants' electrical properties, and reorganize them under one company, to be known as the New Orleans & Carrollton R. R., Light & Power Co., with a capital of $7,500,000.

Pullman, Wash.—The proposition to issue $5,000 bonds to establish an electric plant in connection with the water-works is stated to have carried.

Dickson, Tenn.—See "Water."

Terre Haute, Ind.—Bids will be received by the Board of Trustees of the State Normal until Aug. 10 for supplying the institution with one 100 H. P. boiler, 2 dynamos, 2 engines and other apparatus and doing all the work necessary to install an electric lighting plant.

Doylestown, O.—Mayor G. W. Barkhamn writes that bids will be opened Aug. 12 for the construction of an electric light plant, estimated to cost about $9,000. Chas. F. Sturtevant of Chicago, Ill., Engr. in Charge.

Averyville, Ill.—See "Water."

Eastport, Me.—The Eastport Electric Light Co. has been incorporated with a capital of $60,000, to make, generate and distribute gas and electricity in Eastport and Lubec, Me. Promoters: N. Curtis Fletcher, Providence, R. I.; Henry E. Smith, Cranston, R. I., and A. J. Desmond, Harry L. Cram, Portland, Me.

Ellicott City, Md.—The Patapsco Electric & Mfg. Co. is stated to have received the contract for lighting the town with electricity for 3 years, the price for 16.-c.p. lights is 80 cts. each per month from sundown until 1 o'clock and $1 each for all night service and for arc lights 30 cts. each per night.

Temple, Tex.—The Belton Light & Power Co. of Temple has been incorporated, with a capital of $30,000, to construct a plant in Bell County to supply electric light and power in Temple and Belton. Incorporators: F. E. Merrill and W. A. Stewart.

Corning, N. Y.—It is stated that the Corning Gas & Electric Co. is to double the capacity of the gas plant. Elbert B. Seymour Gen. Mgr.

Sisseton, S. D.—F. A. Leavitt, of the Sisseton Roller Mills, is stated to have received a franchise for an electric light plant.

Sharpsburg, Pa.—See "Water."

Trenton, N. J.—The Gould's Rift Power Co. has been incorporated in Trenton, with a capital of $100,000, to construct a dam across the Delaware River, near the island owned by the Park Island Canoe Club, and generate power and electricity. Incorporators: E. C., Harry and Thos. C. Hill.

Scottsburg, Ind.—See "Water."

Akron, N. Y.—The Akron Natural Gas Co. has been incorporated with a capital of $40,000 to do business in Erie, Genesee and Niagara counties. Directors: Robt. H. Rose of Binghamton and Jas. W. Sterns and Richard H. Bell of Akron.

Kearny, N. J.—Plans and specifications are stated to have been prepared for a $150,000 power house and plant to be erected in Kearny by the New Jersey Light & Power Co. recently incorporated with W. Hanna, a former Freeholder of Hudson County, as Pres.,, and Adam Groel, who is connected with the Clark Thread Mills, as Secy.

West Orange, N. J.—The National Electric Light, Heat & Power Co. in which Thos. A. Edison is interested, has filed articles of incorporation. The principal office to be at the corner of Valley road and Lakeside Ave., West Orange. Incorporators: John E. Helm and Fredk. C. Fischer, both of Newark.

St. Louis, Mo.—It is stated that bids are wanted July 23 for lighting the city buildings, etc., for one year from Sept. 1. Waller Edwards, Secy. Bd. Pub. Wks.

Dayton, Ky.—The City Council will let, on Aug. 12, an exclusive gas lighting franchise for 20 years. C. B. Hayward, City Clk.

Chatham, N. J.—It is stated that bids are wanted July 24 for furnishing material and constructing an electric light plant. W. M. Sheehan & Co., Engrs., 136 Liberty St., N. Y. City.

Frankfort, Ky.—E. B. Weitzel, Mgr. Capital Hotel, is reported interested in a new company which proposes to furnish light, heat and power.

Georgetown, Tex.—The Council is reported to be considering the construction of an electric light plant.

Columbus, O.—See "Sewerage and Sewage Disposal."

Eaton, Colo.—See "Water."

Jacksonville, Cal.—Bids are wanted until Sept. 1 by the Tuolumne Power & Development Co. of New Jersey for the construction of a power plant for the mines in this locality. Estimated cost, $250,000. C. T. Lindner, Pres.; Jas. A. Kennedy, Vice-Pres.; John G. Hopper, of Sonora, Cal., Engr. in charge.

ELECTRIC RAILWAYS.

Ottumwa, Ia.—J. W. Garner, Jr., of the Ottumwa Electric Light & Steam Heating Co., writes that 2½ miles of street railway is to be built at an estimated cost of $30,000.

Hillsboro, O.—The Hillsboro & Ohio River Traction Co. has been incorporated, with a capital of $10,000 to construct an electric railway from Hillsboro to Aberdeen. Incorporators: Chas. Orr, Thos. H. Hogsett and others.

Seattle, Wash.—Hale & Smith of Portland, Ore., are stated to have received the contract to grade the right of way for the Seattle & Tacoma Interurban Ry.; contract price reported to be $200,000. Rails have already been purchased.

San Jose, Cal.—Local press reports state that Geo. T. Dunlop has applied for an electric-railway franchise on several streets and bids for same will be received Aug. 19.

Collingwood, N. J.—The Council is stated to have granted a franchise to the Camden & Suburban Ry. Co. W. E. Herrington, Mgr., Camden.

Hamilton, O.—Bids are wanted July 31 for constructing and operating Street Railway Route No. 5. M. O. Burns, City Clk.

Salem, Ore.—The Oregon City Southern Ry. Co. of Oregon City, is reported to be considering the construction of a line from Salem to Silverton.

Hagerstown, Md.—The Hagerstown & Boonsboro Ry. Co. is stated to have been formed with a capital of $120,000. Incorporators: Christian W. Lynch, Wm. Jennings and others.

Colorado Springs, Colo.—The Colorado Electric Power Co. of Colorado Springs, is reported interested in the construction of an electric railway between Colorado Springs and Canon City, a distance of about 80 miles.

Madison, Wis.—P. L. Spooner of Madison, is reported interested in the construction of an electric railway from this city to Stoughton, Evansville, Janesville and Oconomowoc.

San Bernardino, Cal.—Henry B. Ely and A. C. Denman, directors of the San Bernardino Valley Traction Co., have applied for a franchise to construct and operate an electric road on Mt. Vernon Ave. and 3d St., and bids for same will be received by the Supervisors until Aug. 6.

Steward, Ill.—The Northern Illinois Electric Ry. Co. has been incorporated with a capital of $700,000 to construct a line from Steward through Dixon and Amboy to Lee Center. Incorporators: E. L. Titis, Steward; S. D. Frost, Amboy; Sherman L. Shaw, Dixon, and others.

Muncie, Ind.—The Muncie, Hartford & Ft. Wayne Ry. Co. has been incorporated with a capital of $100,000, to construct an interurban line from Muncie to Ft. Wayne, through Eaton, Hartford City, Montpelier and Bluffton, with branches to Dunkirk and Red Key.

Montpelier, Ind.—The Council is stated to have granted a franchise to A. L. Johnson of Muncie, who proposes constructing an electric railway from Muncie to Ft. Wayne.

Milwaukee, Wis.—The Wisconsin Interlake Electric Ry. Co. has been organized to connect the lakes of southern Wisconsin with an electric railway; capital, $100,000.

Omaha, Neb.—The Omaha & Suburban Traction & Power Co. is stated to have petitioned the Commissioners for a franchise in Douglass County.

Indianapolis, Ind.—The Indianapolis, Danville & Western Traction Co. is stated to have been incorporated to construct an electric railway from Indianapolis to Danville. Henry Leisure of Cincinnati, O., is reported interested.

Valparaiso, Ind.—The City Council is stated to have granted P. W. Clifford and C. W. Bartholomew of Ashley, Ind., a franchise for an interurban railway in Valparaiso.

Kenton, O.—R. Rosenstock, Cleveland, Ch. Engr. of the Findlay & Southern Ry. Co., is preparing plans for a power house to be located at Kenton, also plans for 10 sub-stations, car shops and barns.

Steubenville, O.—The Jefferson County Commissioners are stated to have granted W. B. Francis of Martin's Ferry, a franchise for a line which he contemplates constructing from Martin's Ferry to the Belmont County line, and to Brilliant, in this county.

Syracuse, N. Y.—Local press reports state that Harry J. Clark will prepare plans for the proposed trolley road to be constructed between Syracuse, Utica, Onedia and Sylvan Beach by the Oneida Construction Co.

Concord, N. H.—The city has granted locations for about 2½ miles of new tracks to the Concord St. Ry. Frank A. Merrill, Ch. Engr., Concord.

New Albany, Ind.—Amos Stout of Paoli and Chas. F. Coffin of Indianapolis, are reported interested in the construction of an electric railway between new Albany and Paoli.

Lancaster, O.—Chas. Spenny of Columbus, is reported to be securing right of way for a line which the Ohio Central Ry. Co. proposes constructing between Lancaster and Newark.

Cheshire, Mass.—The contract for constructing 42 miles of railway for the Berkshire St. Ry. Co. from Cheshire to Great Barrington golf grounds, has been awarded to Fredk. T. Ley & Co., of Springfield, for about $600,000. Durkee, White & Towne, of Springfield, Engrs.

Rochester, N. Y.—The State Board of Ry. Commissioners, in session in Syracuse, July 16, is reported to have granted the Buffalo, Rochester & Niagara Falls R. R. Co. an electric railway franchise; the capital of the company is $3,500,000. Work will begin at once. Allen C. Beach, Pres., Watertown.

Parkersburg, W. Va.—It is stated that bids are wanted Aug. 1 for constructing about 13 miles of electric railway for the Parkersburg & Marietta Electric Ry. Co. C. M. Jackson, Ch. Engr., Parkersburg.

Suffield, Conn.—The Suffield St. Ry. Co. has been organized to construct a street railway about 5 miles in length. Incorporators: Fredk. Harris, Springfield; Chas. L. Spencer and L. P. Bissell, of Suffield, and others.

Meyersdale, Pa.—A charter is stated to have been issued to the Meyersdale & Salisbury St. Ry. Co., with a capital of $36,000, to construct an electric railway from Meyersdale to Salisbury. Incorporators: A. O. Lorentz, Meyersdale; T. N. Nelson, Chambersburg, and others.

Yorktown, Va.—The Stockholders of the Yorktown & Hampton Electric Ry. Co. are stated to have ordered the survey begun for the proposed line. The terminus to be on Hampton Roads, near Hampton.

Center Square, Pa.—Engineers are stated to have begun surveying the route of the Ambler & Jenkintown St. Ry., which is to extend from Center Square to Jenkintown and Fox Chase. It will be about 17 miles long.

Atlanta, Ga.—The Council on July 15 passed an ordinance granting the Atlanta Rapid Transit Co. a franchise on Peters St. to West End, with the stipulation that the road is not to be constructed until a contract, for a public viaduct over Peters St. crossing, has been signed.

St. Clairsville, O.—The Belmont County Commissioners are stated to have granted the Ohio Rapid Transit Co. a franchise for a trolley line from Colerain to Barton.

St. Joseph, Mo.—The Buchanan County Court is stated to have granted the St. Joseph Ry., Light, Heat & Power Co. permission to build a branch line to Hyde Park, a distance of about 1 mile. W. T. Van Brunt, Mgr., St. Joseph.

Sandusky, O.—The Sandusky, Clyde, Tiffin & Southern Electric Ry. Co., of Sandusky, is stated to have been incorporated, with a capital of $10,000. Incorporators: I. C. Parker, Ira S. Comstock, and others.

Rochester, N. Y.—The Monroe County Electric Belt Line Co. has been incorporated with a capital of $250,000 to operate in Monroe County. Directors: Percy R. McPhail and Geo. W. Aldridge, of Rochester; Andrew H. Bawn, of Penfield; Walter A. Parce, of Fairport, and others.

RAILROADS

Madisonville, Ky.—The Western Kentucky Coal & Coke Co., is stated to have been incorporated with a capital of $3,000,000, to construct a railroad from Madisonville to Dawson Springs. C. E. Morton of Madisonville, is reported interested.

Kirkwood, N. J.—The Directors of the West Jersey & Seashore R. R. Co. are stated to have decided to eliminate some of the grade crossings on the Atlantic City branch. The crossings to be abolished at present are those in Camden County at Kirkwood, Ancora and Atco. Wm. H. Brown, Ch. Engr., Philadelphia, Pa.

Elizabethton, Tenn.—The Directors of the Virginia & Southwestern R. R. are stated to have decided to construct an extension from Elizabethton to Mountain City, a distance of about 30 miles. Jas. L. Brass, Gen. Mgr., Bristol, Tenn.

Bridgeport, Conn.—Dwight & Daly, John C. Sheehan & Co. and John J. O'Brien, all of New York City, are stated to have received contracts, for the work of abolishing grade crossings of the Consolidated R. R. in Bridgeport, with the exception of the bridge and depot contracts, which are yet to be let; the entire cost of the improvement is $3,000,000. John M. Hall Pres. New Haven, Conn.

Vicksburg, Miss.—The Vicksburg & Southeastern R. R. Co. is reported organized, to construct a railroad about 125 miles in length; the terminals to be Vicksburg and Hattiesburg.

Portchester, N. Y.—The Portchester Terminal R. R. Co. of Portchester, has been incorporated with a capital of $10,000 to operate a terminal railroad in the village. Directors: Richard H. Burdsall, Ellwood Burdsall and others of Portchester.

Ft. Scott, Kan.—J. E. Henderson is stated to have received the contract for constructing 10 miles of railroad from Moran to Gas City for the Ft. Scott, Iola & Western R. R. Co. The road will also be extended to Piqua and Florence but the contracts for this section not yet let. B. P. McDonald, Pres.

Liberty, N. M.—The Dawson R. R. Co. has been incorporated with a capital of $3,000,000 to construct a railroad 130 miles in length, from Liberty to the Dawson coal fields. Principal office to be at Alamogordo, N. M. Incorporators: Clarence D. Simpson, Scranton, Pa., Wm. A. Hawkins, Alamogordo, and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Centerville, Ia.—J. W. Sanderson of Burlington is stated to have received the contract for erecting the Drake Public Library, for $23,522.

Charlotteville, Va.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Milwaukee, Wis.—The city has purchased four engine house sites, 18th, 21st, 22d, and 23d Wards, and bids for erection of buildings will be asked as soon as plans can be prepared.

Boston, Mass.—F. G. Coburn & Co., Tremont B'dg., have received the contract for a 4-story brick fireproof building 81 x 131 ft., to be used as an out patients hospital at the City Hospital. Architects, Kendall, Taylor & Stevens, 93 Federal St.

Grand Rapids, Mich.—St. Andrew's R. C. Cathedral, recently destroyed by fire, is to be rebuilt at a cost of $30,000. Architect, C. A. Brehmer, South Bend, Ind.

Ludington, Mich.—It is stated that St. Simons R. C. congregation will erect a $20,000 edifice.

Hazlehurst, Miss.—Court house bonds amounting to $50,000 have been sold.

Stillwater, Minn.—Andrew Carnegie is stated to have offered this city $25,000 for a public library.

Vicksburg, Miss.—Bids are wanted Aug. 5 (not Aug. 15 as previously stated) for erecting a 3-story city hall. W. L. Trowbridge, Mayor; J. Riley Gordon, Archt., Dallas, Tex.

Newark, N. J.—Bids are wanted July 25 for a public bath house on Morris Ave. Estimated cost, $12,000. J. Crowell Mundy, Gen. Supt. of Wks., Bd. Street & Water Commrs.

Greenville, Miss.—Bids are wanted July 31 for erecting a Presbyterian church at Greenville to cost about $15,000. Address J. E. Negus, Chmn. Bldg. Com.; H. Wolters, Archt., Louisville, Ky.

Quincy, Mass.—Bids are wanted July 25 for erecting an addition to the hospital of the Soldiers' and Sailors' Home, at Quincy. John C. Black, Chmn. Bd. Trus.

Gowanda, N. Y.—Bids are wanted July 26 for the construction, plumbing, heating and electric wiring of two hospital buildings at Gowanda State Homeopathic Hospital, as advertised in The Engineering Record.

Janesville, Wis.—Bids will be received until July 22 for the erection of a public library building estimated to cost $40,000. Michael Hayes, Chmn. of Com.

Greenville, O.—Bids are wanted July 23 for erecting a Carnegie Library, also for plumbing, heating, electric wiring, etc., for same. Geo. W. Mannie, Jr., Clk. Bd. Educ.; W. S. Kaufman, Archt., Richmond, Ind.

Chillicothe, Mo.—Bids are wanted Aug. 5 for erecting a county infirmary. Jas. V. Ramsey, Co. Clk.

Abilene, Kan.—Bids are wanted Aug. 7 for heating the court house by steam. M. Low, Chmn. Bd. Co. Commrs.,

Chicago Heights, Ill.—E. Stanford Hall, 153 La Salle St., Chicago, is stated to have been selected to prepare plans for a $25,000 edifice for the First Baptist Church. Rev. Geo. Armour Fair, Pastor.

Braddock, Pa.—Chas. M. Schwab, of the U. S. Steel Corporation, is stated to have given St. Thomas' R. C. Church $50,000 for a new edifice. Rev. Mr. Hickey, Pastor.

Great Falls, Mont.—Andrew Carnegie is stated to have offered this city $30,000 for a public library.

Martinez, Cal.—The contract for erecting Contra Costa court house is stated to have been awarded to the Pacific Construction Co. for $177,383.

Newark, N. J.—The congregation of St. Michael's Church is stated to have decided to erect a $25,000 edifice at Main and Franklin Sts.

Billings, Mont.—The plans of J. G. Link of Butte, are stated to have been accepted for a city hall, to cost about $25,000.

Detroit, Mich.—It is stated that plans are being prepared by R. E. Roseman, 38 Buhl Blk., for an operating building for the Harper Hospital, to cost about $30.000.

Leadville, Colo.—Andrew Carnegie is stated to have offered this city $100,000 for a public library.

Bottineau, N. D.—O. A. Braseth of Grand Forks, is stated to have received the contract for erecting the Bottineau County court house for $22,906, and Pond & Hasey of Minneapolis, Minn., secured the contract for heating same for $2,698.

Johnson City, Tenn.—The plans of Joseph H. Freedlander, 244 5th Ave., N. Y. City, are stated to have been accepted for the National Home for Disabled Volunteer Soldiers to be erected near Johnson City, the buildings will cost about $1,000,000.

Chester, Pa.—Isaac Pursell, 119 S 4th St., Philadelphia, is stated to have prepared plans for a new memorial church to be erected here for the Emanuel Baptist congregation from funds donated by S. A. Crozier of Chester.

Omaha, Neb.—The Omaha R. C. Diocese is about to build a cathedral to cost from $150,000 to $200,000.

Waterville, Me.—The following bids are stated to have been opened July 11 for the erection of a city hall: Maurice H. Maney, Haverhill, Mass., $34,842; Jas. Dorman, Lawrence, Mass., $34,600; Elic Roy, Lewiston, $27,558; A. G. Bowie, Waterville, $25,884; Horace Purinton & Co., Waterville, $24,834 (awarded).

Philadelphia, Pa.—Bids are wanted July 26 for a bath house in the 31st Ward. Abraham L. English, Dir. Dept. Pub. Safety.

Olympia, Wash.—D. B. Garrison, Secy. State Capitol Commission, writes that the contract for a hydraulic elevator for the State House annex has been awarded to the Otis Elevator Co., New York, N. Y., at $3,750. Contracts for plumbing, steam heating and vault doors have not yet been awarded.

Pine Bluff, Ark.—Bids are wanted Sept. 2 for erecting a deaf mute asylum to replace the structure recently destroyed by fire. Probable cost, $80,000. Frank W. Gibbs, Archt., Little Rock.

Green Bay, Wis.—The Council is stated to have authorized an issue of $35,000 bonds for the erection of a city hall.

Richmond, Va.—Local press reports state that a R. C. Cathedral will be erected on Laurel St. and Floyd Ave. at a cost of about $250,000 to be the gife of Thos. F. Ryan of New York.

Guthrie, Okla. Ter.—Bids will probably be wanted in August for the construction of a city hall, to cost $25,000. Mr. Bennett, of Guthrie, Architect.

Burlington, Ia.—Three buildings of the Des Moines County Poor Farm at this place are stated to have been destroyed by fire July 15.

Muscatine, Ia.—Press reports state that bids will be received July 25 for erecting a 2-story hospital; also separate bids for plumbing, hot-water heating and electric wiring. Address, P. W. Francis.

Lake City, Fla.—Plans and specifications will be received by the County Commissioners until Aug. 8 for a court house. Cost not to exceed $35,000.

Two Harbors, Minn.—Bids are wanted July 30 for erecting a jail and sheriff's residence. John Olson, Co. Aud.

Houston, Tex.—It is stated that bids are wanted July 26 for erecting a church for the First German Lutheran Congregation. C. W. Doering, Chmn. Bldg. Com.

Ortonville, Minn.—Detailed plans and specification will be received by the County Commissioners until Aug. 17 for a court house, cost not to exceed $30,000. H. L. Zwiener, Co. Aud.

Ansonia, Conn.—A site has been selected for a city hall, the building to cost about $44,000. Wm. H. Matthews, Chmn. Com.; Lockwood Hotchkiss, Mayor.

BUSINESS BUILDINGS.

Newark, N. J.—Chas. M. Valentine in the office of Geo. Brown & Co. of Newark, is stated to have been selected to prepare plans for an 8-story office building to be erected on Clinton St. for Gilbert C. Brown.

Birmingham, Ala.—It is stated that plans have been completed for a car barn which the Birmingham Ry., Light & Power Co. will erect on Avenue F and 22d St. to replace the one recently burned. J. B. McClary, Mgr., Birmingham.

Milwaukee, Wis.—A building permit has been issued to Schlitz Brewing Co. for the erection of a 2-story brick and stone building at Grove and National Aves. Kirchoff & Rose, Archts, 201 Grand Ave.

Frankfort, Mich.—It is stated that the Ann Arbor R. R. Co. will expend about $100,000 in the erection of a hotel and cottages at Frankfort. W. R. Burt, Pres., Saginaw.

Detroit, Mich.—Malcomson & Higginbotham, Moffat Bldg., are stated to have been selected to prepare plans for a warehouse 75 x 200 ft. for the Standard Oil Co.

Manistee, Mich.—It is stated that John O. Plant proposes to build a summer hotel at Manistee, to cost $100,000.

Traverse City, Mich.—David Mahaffy, 84 La Salle St., Chicago, Ill., is stated to have been selected to prepare plans for a summer hotel to be erected here, to cost $25,000.

Steubenville, O.—D. J. Sinclair, Cashier Union Deposit Bank, is reported interested in the erection of a building to contain apartments, an opera house and bank, to cost about $75,000.

Chicago, Ill.—It is stated that a 12-story addition will be erected to the Union League club house, on Jackson Boulevard, to cost about $275,000. Volney W. Foster Pres.

Butte, Mont.—The Butte Hotel, on Broadway, is reported to have been seriously damaged by fire on July 13.

Louisville, Ky.—It is stated that plans are being prepared for a building to be erected on 2d and Water Sts. for the Illinois Glass Co. to cost about $40,000. Albert C. Larsen, Mgr., Louisville.

Lorain, O.—Geo. H. Verbeck of Oil City, Pa., is stated to have prepared plans for a $30,000 opera house.

Allenhurst, N. J.—It is stated that the Allenhurst Inn, recently burned, will be replaced by a fireproof hotel to cost about $250,000.

Jacksonville, Fla.—It is stated that Prof. B. F. Massey of Massey's Business College, has decided to erect a building on Main and Monroe Sts. to cost about $25,000.

Shamokin, Pa.—It is stated that the Knights of Columbus will erect a building here to cost $30,000.

San Antonio, Tex.—It is stated that plans are being prepared for a $60,000 building for the Alamo National Bank. Chas. Hugo, Pres.

San Antonio, Tex.—Bids are wanted July 31 for erecting a passenger depot, for the G. H. & S. A. Ry. Co., at Walnut and East Commerce Sts., San Antonio. Address E. B. Cushing, Engr. Main. of Way, South Pacific Co., Houston.

Norristown, Pa.—The contract, to build car barns for the Schuylkill Valley Electric Ry. Co., has been awarded to Oliver Bros. for about $35,000.

Kenton, O.—See "Electric Railways."

Jennings, La.—It is stated that the Directors of the Citizens' Bank have decided to erect a new building, to cost about $25,000.

Akron, O.—Chas. Henry & Son, 120 S. Main St., are stated to be preparing plans for two 1-story buildings for the Webster, Camp & Lane Co., one to be 260 x 440 ft., the other 110 x 300 ft.

It is stated that the Akron Wholesale Grocery Co. will erect a 1-story warehouse 90 x 140 ft. on E. Exchange St., near the Erie R. R.

Yonkers, N. Y.—F. Poels, of Middletown, is stated to have been selected to prepare plans for a $20,000 addition to the German Turn Verein club house on Elm St.

Marion, O.—Wilbur T. Mills is stated to have been selected to prepare plans for a $40,000 Masonic temple.

Pittsburg, Pa.—Local press reports state that two new buildings, a hotel 4 stories high and a new stock exchange will be erected at the new Union stock yards on Herrs Island, at a cost of from $80,000 to $100,000. Saml. W. Allerton and Simon O'Donnell are Pres. and Gen. Mgr., respectively, of the new yards.

Kansas City, Mo.—A $25,000 addition is about to be built to the warehouse located at 1208 W. 11th St. Owner, Kingman Moore.

Des Moines, Ia.—Benson & Marxer, of Des Moines, have secured the contract to erect a 6-story wholesale grocery warehouse for the Warfield-Pratt-Howell Co., at W. First St. and Court Ave., contract price $60,000; bids wanted for elevators and steam heating. Frank Crocker, Marshalltown, Ia., Archt.

Hallett & Rawson, 615 Walnut St., have prepared plans for a $75,000 bank and office building to be built at E. 5th and Locust Sts., for the Capital City Bank.

Allegheny, Pa.—It is stated that the Monterey Hotel Co. will erect a 14-story hotel on North Ave. and Palo Alto St., to cost about $600,000.

Syracuse, N. Y.—A press report states that the freight house of the New York Central & Hudson River R. R. Co. at this place is to be enlarged at a cost of $200,000. W. J. Wilgus, Ch. Engr., New York, N. Y.

Buffalo, N. Y.—The plans of Green & Wicks, 110 Franklin St., are stated to have been accepted for a bank building to be erected on Main and Swan Sts., for the Fidelity Trust Co.

Mobile, Ala.—Bids will be received by the Elks Association until Aug. 1 for erecting a club house. Chas. Pearson, 208 Pollock Bldg., Archt.; C. L. Schweizer, Chmn. of Com.

Grand Rapids, Mich.—The Luce Building, a 4-story structure occupied as a department store, is reported to have collapsed and burned July 18.

DWELLINGS.

Kansas City, Mo.—L. N. Leslie is about to build a $35,000 brick dwelling on 1th St.

Boston, Mass.—The Carlton Hotel Trust is to build a 6-story apartment house on Boylston and Hemmenway Sts. Contractors: Geo. A. Fuller Co., New York City; Architect, A. H. Bowditch, 112 Water St.

SCHOOLS.

Muncie, Ind.—The plans of Wing & Mahurin of Ft. Wayne, are stated to have been accepted for the Congerville school. Bids for its erection will be received by John W. Dragoo, School Trustee, up to Aug. 1.

Milwaukee, Wis.—Bids are wanted July 26 for erecting a school on 28th and Clark Sts. Chas. J. Poetsch, Chmn. Commrs. Pub. Wks.

Springfield, Mass.—Bids are wanted Aug. 14 for erecting a school on Chestnut and Prospect Sts. Edw. J. Murphy, Chmn. City Property Com.

Norton, O.—Bids are wanted Aug. 5 for erecting a school in Norton Township. S. S. Wagoner, Clk. Bd. Educ.

Russellville, Ala.—Bids are wanted July 23 for erecting a brick school. R. J. Moody, Secy. School Bd.

Jersey City, N. J.—Bids are wanted July 25 (readvertisement) for alteration and improvement to school No. 19, also separate bids on same date for erecting school No. 29, including plumbing and heating. Jas. J. Wiseman, Clk. Bd. Educ.

Lost Nation, Ia.—Bids are wanted Aug. 3 for erecting a school in Sharon Township. Wm. Kuehn, Secy.

Georgetown, O.—Bids are wanted July 30 for erecting a school in Clark Township. R. Rich, Clk. Bd.

Rolla, Mo.—Bids are wanted Aug. 2 for erecting an addition and altering the chemical laboratory and metallurgical buildings and erecting a mechanical building at the School of Mines and Metallurgy, Rolla. B. Cunliff & P. C. Pape, Achts., 308 Lincoln Trust Bldg., St. Louis.

Clinton, Mass.—The citizens are stated to have voted to erect a $20,000 school.

Gilmore, O.—Bids are wanted July 22 for erecting a school in Sub-Dist. No. 3 Washington Township. M. Kail, Clk.

Elmira, N. Y.—Swan & Murray, 613 Baldwin St., are stated to have received the contract for erecting a 2-story brick annex to school No. 4 for $16,537.

Chicago, Ill.—Geo. L. Harvey, 115 Monroe St., is stated to be preparing plans for the reconstruction of the College of Phycicians and Surgeons at 813 W. Harrison St., at a cost of about $40,000. The upper two stories were recently destroyed by fire.

Guthrie, Okla. Ter.—Arthur J. Williams of Oklahoma City, is stated to have been selected to prepare plans for a new building for the University, to cost about $90,000.

Pontiac, Mich.—John Schmidt of Monroe is stated to have received the contract for erecting 2 schools for $52,000.

Waynesboro, Pa.—The School Board is stated to have decided to erect a $20,000 school on Snyder Ave.

Ithaca, N. Y.—A new geodetic observatory will be erected as an addition to Cornell University, to be the gift of Alfred G. Barnes. It will be a brick and marble building, 80 x 40 ft.

Princeton, N. J.—Cope & Stewardson, 320 Walnut St., Philadelphia, Pa., are stated to be preparing plans for a new dormitory for Princeton University, to cost about $100,000.

Southbridge, Mass.—It is stated that a 4-room school will be erected to cost $12,000. H. S. Cheney, Chm. Bldg. Com.

Providence, R. I.—Hartwell, Williams & Kingston are stated to have received the contract for erecting the Ralph St. school, for $23,750.

Ann Arbor, Mich.—All bids opened July 10 for erecting a new science building for the University are stated to have been rejected. Plans will be altered and new bids received; estimated cost, $100,000.

Weyauwega, Wis.—It is stated that it has been voted to issue $25,000 bonds for the erection of a school.

Perry, Mich.—Haug & Scheurman of Saginaw are preparing plans for a $10,000 school.

Montreal, Que.—J. Emile Vanier, 107 St. James St., is stated to have been selected to prepare plans for the Polytechnic School to be erected on St. Denis St., in connection with the Laval University, to cost about $75,000.

York, Pa.—The City School Board is stated to have accepted the plans of J. A. Dempwolf of York, for a 16-room brick school and authorized the architect to receive bids for the erection of same.

Lorain, O.—It is stated that bids are wanted July 24 for erecting 2 schools.

Shepherdstown, W. Va.—Bids are wanted July 27 for erecting a State Normal School at Shepherdstown. Wm. Strause, Secy. Bd. Regents, Parkersburg.

Indianapolis, Ind.—Bids are wanted July 23 for a steam-heating plant in Benjamin Harrison School. John E. Cleland, Business Dir.

Conneaut, O.—Bids are wanted July 31 for erecting a school on Dean Ave. F. F. Rieg, Clk. Bd. Educ.

Buffalo, N. Y.—Bids are wanted July 31 for improvements and repairs to several schools, including an 8-room brick addition to school No. 53 and a 3-story brick addition to the north wing and alterations in connection with old building at the Central High School; also for plumbing, heating, etc. R. G. Parsons, Secy. Bd. Pub. Wks.

Detroit, Mich.—Bids are wanted July 23 for erecting 2 additions to Higgins Public School in Springwells Township. Address Bd. of School Trustees, Dist. No. 7, Springwells Township, Woodmere Cemetery office.

STREET CLEANING AND GARBAGE DISPOSAL.

Pittsburg, Pa.—Bids are wanted July 23 for 4 street-sweeping machines. E. M. Bigelow, Dir. Dept. Pub. Wks.

Findlay, O.—Bids are wanted Aug. 1 for a garbage crematory having 3 manholes of not less than 15 tons per day of 24 hours' capacity, supplied with stench consumer in the stack. Frank C. Ray, City Clk.

New York, N. Y.—The Board of Estimate has declined to sanction a new 5-year contract with the N. Y. Sanitary Utilization Co. for the disposal of garbage.

Washington, Pa.—The question of garbage disposal has been referred to the Street Committee.

GOVERNMENT WORK.

Sitka, Alaska.—Bids are wanted Aug. 26 for erecting one set of officers' quarters at the Marine Barracks, Sitka. Col. F. L. Denny, Q. M., U. S. Marine Corps, Washington, D. C.

Seattle, Wash.—Bids are wanted Aug. 13 for excavating on Lake Washington Canal, Wash. Maj. John Mills, Corps Engrs., U. S. A.

Hot Springs, Ark.—The following bids were opened July 11 for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Hot Springs: C. Stafford Bldg. & Con. Co., St. Louis, $99,026; D. H. Hayes Co., Chicago, $84,711; M. Yeager & Son, Danville, Ill., $79,979; J. M. Brown & Co., Houston, Tex., $88,750; Congress Construction Co., Chicago, $94,575.

Fisherman's Island, Va.—Bids are wanted Aug. 8 for erecting buildings at the U. S. Quarantine Station, Cape Charles, Fisherman's Island. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Chicago, Ill.—Bids are wanted Aug. 5 for constructing the boiler plant, laundry fixtures and heating apparatus of the boiler house, Isolation Ward, etc., U. S. Marine Hospital, Chicago. Walter Wyman, Superv. Surgeon-Gen., M. H. S., Washington, D. C.

Ft. Washington, Md.—Bids are wanted Aug. 9 for plumbing and heating officers' quarters at Ft. Washington. Capt. Abe. S. Bickham, Q.-M., U. S. A., 419 N. Washington St., Alexandria, Va.

San Juan, Porto Rico.—Bids are wanted Aug. 31 for constructing 2 coal hoisting towers and furnishing coal handling machinery at Naval Station, San Juan. Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington.

Annapolis, Md.—Bids are wanted July 31 for enlarging the power plant at the U. S. Naval Academy, Annapolis. A. S. Crowninshield, Ch. Bureau of Navigation, Navy Dept., Washington, D. C.

Ft. Greble, R. I.—Bids are wanted July 26 for erecting, plumbing and wiring quarters for engineer and assistant at Ft. Greble. H. P. Young, Q.-M., Newport.

New York, N. Y.—The following bids were opened July 13 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for electric subway and conductors at the New York Navy Yard: *a*, Conduit, excavation, manholes, etc., complete, ready for installation of cables. *b*, Cables, complete, delivered in the yard and installed. *c*, The whole complete, according to specification. United Eng. & Con. Co., *a* $6,000, *b* $36,993, *c* $42,984. Stone & Thurston, *a* $7,204 to $7,959, *b* $34,167 to $45,559, *c* $41,371 to $50,516. Supply Incandescent Wire & Cable Co., *a* $6,691, *b* $29,268, *c* $35,959. Ed. Heaton, *a* $5,676. Western Electric Co., *a* $5,206, *b* $33,250, *c* $38,455. G. M. Gert, *a* $6,050. J. T. McRoy, *a* $9,930. Abbot-Gamble Construction Co., *a* $3,860, *b* $28,322.65, *c* $34,184.65. Bidders all of New York.

Philadelphia, Pa.—The following bids were opened July 13 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a brick and steel building, Angle Smithery Bldg., at the League Island Navy Yard. Available appropriation, $34,000: Henderson Co., Philadelphia, $42,548, $33,171, $31,771. Jno. Milnes, New York, $42,268. Snare & Triest, New York, $43,000, $33,700, $32,100. Chas. McCaul Co., Philadelphia, $41,995, $33,731, $32,131. Penn Bridge Co., Beaver Falls, $33,970. L. L. Leach & Son, Chicago, $39,000, $33,873, $32,373. R. H. Hood & Co., New York, $38,820, $33,400, $32,800. J. F. Oliver, New York, $42,000, $34,000, $31,790. Cramp & Co., Philadelphia, $42,576, $32,987, $31,111.

Bids opened at the same time for the construction of a brick and steel building 63 x 207 ft., smithery shop, at the Navy Yard, were as follows: Chas. McCaul Co., $29,915, $34,175, $38,310. Henderson & Co., $30,094, $34,760, $39,397. Cramp & Co., $30,900, $35,200, $39,200. Penn Bridge Co., $41,940. L. L. Leach & Son, $29,000, $33,000, $37,000. Cort. Construction Co., New York, $30.320, $35,879, $40,225. R. H. Hood Co., $34,270, $37,100, $34,840. R. A. Griefen, Chicago, $31,000, $35,000, $38,800. Snare & Triest, $29,915, $34,175, $38,310.

Boston, Mass.—The following bids were opened July 13 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of a steel and brick building at the Boston Navy Yard, available appropriation $89,000: *a*, *b*, *c* and *d*, are for building complete with concrete trimmings and without 2d story floor; *a* and *c* call for slate covered roof, with copper gutter and flashings, cornice and conductors; *b* and *d* call for tin covered roof with tin gutter and galvanized iron cornice and conductors; *c* and *d*, provide for an equivalent fireproof roof construction in place of expanded metal system specified; *e*, *f*, *g* and *h*, are the same as *a*, *b*, *c* and *d*, but with limestone instead of concrete trimmings; *i*, alternate bid in case other bids exceed appropriation: C. A. Dodge Co., Boston, *a* $111,526, *b* $109,022, *e* $110,926, *f* $108,527. Mead, Mason & Co., Boston, *a* $102,703, *b* $99,900, *e* $103,300, *f* $100,300, *i* $89,000. Snare & Triest, New York, *a* $99,000, *b* $94,000, *c* $99,000, *d* $94,000, *e* $97,000, *f* $98,000, *i* $82,500 to $87,300. F. G. Osborne, Melrose, Mass., *a* $91,800, *b* $88,400, *c* $92,400, *d* $88,800, *e* $92,400, *f* $88,800, *g* $92,800, *h* $81,200, *i* $84,000. Norcross Bros., Worcester, *a* $108,000, *b* $105,000, *e* $110,000, *f* $107,000, *i* $88,000. J. H. Colson, Boston, *a* $102,600, *b* $101,200, *c* $102,600, *d* $101,200, *e* $105,500, *f* $88,000, *g* $105,500, *h* $104,100. R. H. Griefen, Chicago, *a* $99,000, *b* $94,000, *c* $99,000, *d* $94,000, *e* $97,000, *f* $92,000, *g* $97,000, *h* $92,000, *i* 89,000. L. L. Leach & Son, Chicago, *a* $102,000; *b* $98,000, *c* $102,000, *d* $98,000, *e* $102,000, *f* $98,000, *g* $102,000, *h* $98,000.

New York, N. Y.—Bids are wanted Aug. 3 for dredging 100,000 cu. yds. of material from the waters of the Navy Yard; also separate bids on same date for removing 20,000 cu. yds. of crib work, mud, silt, sand, etc., at Navy Yard, N. Y. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Erie, Pa.—Major Thos. W. Symons, Corps. of Engr. U. S. A., in charge of river and harbor work in this district, recommends the expenditure of $150,000 to replace 1,200 ft. of old timber superstructure on south pier with concrete and to build one projection jetty.

San Francisco, Cal.—The following bids were opened July 15 at the Treasury Dept., Washington, D. C., for the new boiler plant, feed pumps, etc., at the U. S. Branch Mint, San Francisco: Parke & Lacy, $12,360; G. H. Fay Co., $14,950; P. P. Dundon Iron Wks., $26,373; Risdon Iron & Locomotive Wks., $16,800; Byron Jackson Machine Wks., $14,656; C. F. Morse Co., $14,650. Bidders all of San Francisco.

MISCELLANEOUS.

Syracuse, N. Y.—Bids are wanted July 22 for $50,000 Columbus Park bonds; also $49,500 Local Improvement bonds. E. F. Allen, City Treas.

Mt. Vernon, N. Y.—Bids are wanted until Aug. 6 for improvements to Hartley Park. Geo. W. Drumheller, City Engr.

Memphis, Tenn.—The bid of M. J. Roach, of Memphis, at 16.24 cts. per cu. yd. for the construction of about 15 miles of levee has been recommended for award by O. N. Killough, Pres. of the St. Francis Levee Board.

Worcester, Mass.—The Council Committee on Sewers has voted to recommend the adoption of an order for straightening and widening the channel of Middle River, at an estimated cost of $24,585. The work will be done according to plans prepared by City Engr. Frederick A. McClure, providing for a channel wall 6 ft. in height above the foundation.

Astoria, Ore.—The Columbia Dry Dock Co. has filed articles of incorporation. Capital, $1,000,000. Principal place of business, Astoria. The incorporators are: D. K. Warren, of Warrenton; A. B. Hammond, of Missoula, and Walter C. Smith, of Portland. The company proposes to construct a large modern dry dock.

Buffalo, N. Y.—The Park Commissioners have under consideration the construction of a permanent dam at Grant St. bridge, which is now the westerly end of Delaware Park Lake.

NEW INDUSTRIAL PLANTS.

The Crescent Cement Works, Longue Pointe, Can., recently burned, will be rebuilt with a daily capacity of 300 bbls. The power plant, consisting of a 400-H.-P. cross-compound condensing engine and boilers, was saved from the fire.

The Peterboro, Ont., Shovel Co. is being organized with a capital of $60,000. The company has secured a site for a factory having a daily capacity of 100 doz.

The J. M. Guffey Petroleum Co., Port Arthur, Tex., will erect a new refinery and install a power plant of about 1,000 H.-P.

The Boydell Bros. White Lead & Color Co., Detroit, Mich., is figuring on putting up an 8-story, 53 x 138-ft. power building for rental purposes, power to be supplied from its present plant. The cost of the building will be about $65,000.

Chas. B. Pride, Appleton, Wis., has secured the contract for the new buildings of the Remington Watch Co., in that city, to include a 2-story, 257 x 30-ft. factory building, a 3-story office tower 41 ft. square, and a 46 x 30-ft. engine and boiler house.

The Centerville, Miss., Delinting Co. will purchase a 75-H.-P. gasoline engine.

The St. Marys, Pa., Sewer Pipe Co. is building a 4-story, 100 x 250-ft. plant, with 4-story, 100 x 60-ft. annexes for machinery, and will erect twenty 32-ft. round down-draft kilns. The power plant will consist of a 300-H.-P. engine and a 500-H.-P. boiler.

The Eagle Mfg. Co., Kansas City, Mo., makers of agricultural implements, is adding a 2-story, 122 x 182-ft. brick and stone warehouse and a 50 x 150-ft. paint shop extension to its plant, and will add a 100-H.-P. engine and boiler to its power plant.

For grain elevator at Montreal, Que., see Proposals.

Glenn, Tannehill & Co., Staunton, Va., expect to add a 10-ton refrigerating plant to their present plant in the fall.

The Danville, Ill., Window Glass Co. is constructing a 30-blower continuous window-glass furnace.

Raymond P. Lipe, St. Clair Bldg., Toledo, O., is rebuilding a grain elevator at Bryan, O., recently burned. It will be 32 x 60 x 77 ft. and, with additions, have a capacity of 80,000 bu. A 50-H.-P. steam power plant will be installed in a separate brick building, and power shovels will be used for handling grain.

The two main buildings of the new plant of the Buckeye Malleable Iron & Coupler Co., Columbus, O., will be 720 x 150 ft. and 550 x 100 ft. The Wellman-Seaver Engineering Co., Cleveland, O., can give information concerning the power plant.

M. F. Schooley, Laurel, Md., expects to build a 4-story, 32 x 40-ft. roller mill having a capacity of 50 bbls., and install a 50-H.-P. boiler and a 40-H.-P. engine.

The Jupiter Steel Co., 511 Hamilton Bldg., Pittsburg, Pa., will erect a new plant, installing a power plant of 250 to 400 H.-P.

The Ault & Wilborg Co., Cincinnati, O., makers of printing inks, is building a 5-story and basement, 80 x 90-ft. addition to its factory and a 4-story 30 x 90-ft. wing and installing a 300-H.-P. boiler and engine.

BUSINESS NOTES.

The power plant of the New England Structural Co., Everett, Mass., was recently destroyed by fire, and the company is operating the departments not destroyed with electrical power obtained from an outside company. No definite plans have been made for rebuilding.

The Riter-Conley Mfg. Co. is erecting a 120 x 275-ft. machine shop for the Pittsburg, Pa., Valve, Foundry & Construction Co., in which the company's various plants will be consolidated. A contract has been let to the Keystone Engineering Co. for four 80-H.-P. gas engines.

The Ohio and Kentucky Asphalt Co. of Cincinnati has been incorporated with a càpital of $50,000 by Frank H. Kirshner, Frank F. Dinsmore, M. F. Bramley, of Cleveland, P. R. Quinlan and C. M. Warner.

The Sprague Electric Co. reports large sales of the Lundell fans this season. The Lundell motors and split-pole generators are now being made in sizes up to 1,000 H.-P. and 1,000 K.W., respectively. The company is also doing a large business with the Greenfield interior conduits and cables. The Boston Elevated Railway is so satisfied with the Sprague multiple unit system on the 100 cars it now has in operation that it has contracted for 50 more equipments for the additional cars needed to meet the traffic demands. At all stations on the elevated and subway lines transfers are issued to the surface cars, which makes the service unique. Nearly every station thus serves as a terminal, and the number of passengers entering and leaving the cars at each station is far in excess of the average on other elevated roads.

The State Lunatic Asylum, Austin, Tex., is being equipped with electricity, the power to be furnished by a 125-H.-P. and a 60-H.-P. engine, direct-connected to Westinghouse generators, built by the Ball Engine Co., Erie, Pa. An electric plant consisting of two 100-H.-P. engines, direct-connected to Northern generators, built by the same company, is being installed in the Bush Building, Chicago.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
July 22.	Pipe, Atlantic City, N. J Adv., Eng Record, July 6, 13.	July 6
July 23.	Sanford, N. C Adv., Eng. Record, July 6, 13.	July 6
July 24.	Tell City, Ind	July 20
July 25.	Buffalo, N. Y	July 20
July 25.	Boston, Mass Adv., Eng. Record, June 29 to July 13.	June 29
July 25.	Pumps for sale, Lancaster, Pa Adv., Eng. Record, July 6, 13.	July 6
July 25.	New London, Conn Adv., Eng. Record, July 13.	July 13
July 26.	Kansas City, Mo	July 13
July 29.	Philadelphia, Pa	July 20
Aug. 1.	Rimouski, Que	May 25
Aug. 2.	Well, Lebanon, Ind	July 20
Aug. 3.	Yonkers, N. Y	July 20
Aug. 6.	Filter plant, Reading, Pa Adv., Eng. Record, June 15 to 29.	June 15
Aug. 6.	Dam, Centralia, Ill	July 13
Aug. 8.	Reservoir, Newark, N. J Adv., Eng. Record, July 20.	July 20
Aug. —.	Reservoir, Dauphin Pa	May 4
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 18.	Soerabava, Java	July 20
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29.	June 29
——	Salem, N. H	July 20
	SEWERAGE AND SEWAGE DISPOSAL.	
July 22.	Swissvale, Pa	July 20
July 23.	Irwin, Pa	July 20
July 23.	Plans, etc., Celina, O	July 20
July 24.	New Orleans, La Adv., Eng. Record, May 11 to June 29.	May 11
July 24.	New York, N. Y	July 13
July 24.	Elkhart, Ind	July 20
July 24.	Hamilton, O	July 20
July 24.	Burkhart, Ill	July 20
July 25.	Freeport, Pa	July 20
July 26.	Buffalo, N. Y	July 20
July 26.	Montpelier, Ind	July 20
July 26.	South Bend, Ind	July 20
July 26.	North Vernon, Ind	July 20
July 27.	Washington, D. C Adv., Eng Record, June 29.	June 29
July 27.	East Cleveland O	July 6
July 29.	Oshkosh Wis	July 6
July 29.	Sharon, Pa Adv., Eng. Record, July 20.	July 20
July 30.	Mt. Vernon, N. Y	July 20
July 30.	South Bend, Ind	July 20
Aug. 1.	South Bend, Ind	July 29
Aug. 1.	Sewage disposal, Napanoch, N. Y Adv., Eng. Record, July 20.	July 20
Aug. 1.	Plattsburg, N. Y Adv., Eng. Record, July 20.	July 20
Aug. 2.	Shreveport, La Adv., Eng. Record, July 13, 20.	July 13
Aug. 3.	Galion, O Adv., Eng. Record, July 6 to 20.	July 6
Aug. 5.	Akron O	July 13
Aug. 5.	Concordia, Kan	July 13
Aug. 5.	Sewage purification, La Grange, Ill	July 13
Aug. 6.	Laramie, Wyo	July 13
Aug. 7.	Birmingham, Ala	July 13
Aug. 7.	Oshkosh, Wis	July 20
Aug. 7	Elkhart, Ind	July 20
Aug. 7.	Appleton, Wis	July 20
Aug. 10.	Visalia, Cal	June 22
Aug. 10.	Mansfield, O	July 20
Aug. 12.	Wabash, Ind	July 13
Aug. 12.	Canton, O	July 20
Aug. 12.	New Castle, Pa Adv., Eng. Record, July 20.	July 20
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Sydney Harbor Bridge.

The Department of Public Works of New South Wales has invited tenders for both the design and construction of a high-level bridge across Sydney Harbor to connect Sydney with North Sydney. The structure is of considerable magnitude, the least clear width between the piers being 1,200 feet, with 600 feet of that distance affording a clear headroom of 170 feet above ordinary high water, while the roadway platform is composed of two 30-foot clear roadways paved with wooden blocks, on one side of which is a 12-foot sidewalk and on the other a 25-foot space for two railroad tracks, another 12-foot sidewalk being placed outside of these tracks, making a total width of platform of about 120 feet. The contractor or tenderer is expected to make his own plans for the entire structure under certain general specifications as to limiting dimensions, working stresses, quality of material and other general conditions. Judging from the main features of the invitation and specifications it would appear that the structure will be of either the suspension or cantilever type.

This is not the first time that similar competitive invitations for bridge structures in Australia have been sent out in an international way, nor is this the first invitation for tenders for a bridge across Sydney Harbor. In view of the fact that competitions for both bridge plans and tenders are becoming, so to put it, rather fashionable, it is a matter of considerable interest to observe just what conditions are prescribed in this instance. All designs and tenders must be received in Sydney not later than the twenty-eighth day of next February, and are then to be submitted to an advisory board consisting of six members, four of whom are officers of the Colonial government; one of the others, however, Prof. W. H. Warren, of Sydney University, is probably best known to American engineers, and is eminently well qualified for such work.

There is undoubtedly some hazard in a competition of this character unless the terms under which it is conducted include conditions wiser than those usually found. In the present instance the bare engineering specifications are certainly safe, but it is not clear why at least the general type of structure is not specified. The officials of the Department of Public Works should certainly have some well-formulated ideas as to the type of structure best adapted to the situation in question, or, if they have not, competent engineering advice within their reach would probably help them out of their difficulty. If professional men competent to pass upon such questions and who are familiar with the physical features of the location cannot determine the kind of structure best adapted to its requirements, it would seem that those who have never even seen the location nor have any idea other than that imperfectly conveyed by skeleton maps, would be far less likely to reach a correct conclusion. Competitions are undoubtedly excellent methods for determining some classes of results, but they are not automatic or self-regulating; they are much like other procedures in that they need to be wisely conducted. The Engineering Record ventures to suggest that the competition for the Sydney Harbor bridge would have been more attractive to many prominent engineers and contractors if the general type of structure had been specified and complete data for the design given, leaving a legitimate and wide latitude for the play of individual judgment and taste.

Somewhat in line with the preceding observations, it may be reasonably stated that a lack of definition as to the character of structure needed is aggravated by a further lack of necessary data regarding sub-surface material. If the suspension type of structure should be adopted, the designer is without knowledge as to the amount or kind of anchorage which may prove available for him. In fact, he is warned in the specifications that he must make such provision as he deems necessary in the absence of specific information which should have been given to him. The specifications state that "it is impossible to furnish exact particulars of the formation and strata at the sites of anchorages." Borings of all kinds to and into rock for the purpose of disclosing just such information as is here needed are certainly common enough at the present time. It is therefore, difficult to understand why it was "impossible" to secure the desired information in this instance.

The specifications for loads, unit stresses, workmanship and quality of material are well in line with those ordinarily employed at the present day for first-class work; indeed, they bear the ear-marks of those frequently found in good American practice. They are sufficiently complete to afford a designer reasonably full guidance in this part of his work. Occasionally a detail will raise a question in the mind of an engineering reader, like that regarding the upper flanges of the longitudinal railway stringers, which, if possible, are to be designed without cover plates in order that the timber ties need not rest over rivet heads. In this country the specifications would rather call for the cover plates in order to gain increased stiffness of the upper flange against the deflection of the timber ties. Again, our specifications regarding quality of structural steel frequently exact a less quantity of phosphorus than 0.08 per cent., and that without any remonstrance from steel makers. This, of course, is due to improved processes of manufacture; and the last observation is particularly applicable to rivet steel.

On the whole, the specifications are well adapted to their purposes. It will be a matter of no little engineering interest to note, when the time arrives for the reception of designs and tenders, what the results of the competition reveal.

The Expert Report on the Carnegie Technical University.

When Mr. Carnegie left to the trustees of the Carnegie Institute and the Carnegie Library the task of preparing a scheme for the technical school he proposes to endow at Pittsburg, he certainly unloaded a lot of hard work on that body. Nearly everyone who has been through a technical school of any kind or has employed graduates of such schools, thinks his ideas on the subject of technical education are a little in advance of those of any other man and far preferable to those of most people. Fortunately for all concerned, the trustees are men of affairs and understand the gentle art of making others do the delving while they attend to the reaping. So they first called to their aid a number of experts in technical education, Dr. Thurston, of Cornell, Prof. Johnson of the University of Wisconsin, Prof Gray, of the Rose Polytechnic Institute, and Prof. Anderson, of Armour Institute. These professors made individual reports which have, unfortunately, not been made public, because it would be interesting to learn how much of agreement there was in their views. The trustees were evidently somewhat nonplused by the result of their quest for advice, for they requested these experts to try to agree on some one plan. The latter recently succeeded in doing so by recommending a complete technical university, where the wants of the young girl who needs a little instruction in pie construction and hemstitching will be filled as completely as those of the erudite scientist who needs space, quiet and costly apparatus on a scale elsewhere unavailable in order to bring his important thoughts to fruition. The plan is comprehensive enough in respect to technical science and art to satisfy even the famous words of the founder of a great university, "I would found an institution where any person can find instruction in any study." It is accordingly interesting to examine in some detail the ambitious project these eminent professors have proposed for the dispersion of part of the Carnegie fortune. This is particularly true because they state that nothing short of such a complete system should be planned.

There are to be three distinct divisions of the school, according to this project, the technical college, the technical high-school and the artisan day and evening classes.

The technical college is to prepare graduates of high schools for leadership in commercial and industrial pursuits. To fit these youths the following grand equipment is proposed: "This college should be made attractive to the greatest scholars in the fields of physical and chemical science. To obtain and hold such men they must be given ample opportunities for research. This college must be supplied, therefore, not only with great experimental shops and laboratories for students' use, but in all departments there should be splendidly equipped laboratories of investigation and research, under the direction of the head of such department, and with a full corps of assistants for the carrying on of lines of investigation which are now partly or wholly unprovided for in America. These well-equipped workshops and these experimental and research laboratories would form the chief distinction of this technical college, and they would also be the chief item of expense. The college would support one or two publications in which the fruits of this research department would be given freely to the world."

It is frankly confessed in the expert report that this school will not have many scholars as compared with the technical high-school, but the work done in it would form "the chief, if not the only, feature of the whole scheme to attract attention and to extend its beneficent influences beyond the immediate vicinity of Pittsburg." A school without scholars is an impracticable sort of institution which has not yet succeeded in this country. It has been tried at Johns Hopkins University and at Clark University, both institutions designed to foster post-graduate investigations, but the results have not been such as to revolutionize science in any of its branches. If the purpose of the enormous expenditures contemplated in such a programme as that outlined is to advertise the city of Pittsburg as the home of "Culture," well and good. But the trustees of the Carnegie funds are men of far less acumen than they are commonly rated, if they can be persuaded that such a glorified technical school is needed to-day. Our great universities are the places for such research laboratories, for there scholarly calm and precision and self-effacement for the sake of lofty thought are inculcated. A technical school is a very different kind of institution, its very name implies something practical; its purpose is to educate young men to use time, money and the resources of nature to material advantage. The engineer must be quick and his thoughts must never get above the limit of practicability. Without in any way denying the great advantages of costly equipment for research, The Engineering Record has yet to be convinced that an enormous plant is necessary for teaching engineering. Moreover, as costly laboratories are not needed for the technical school so much as for the university, just so advanced investigators in the various branches of science are similarly out of place, for they also belong to the university. A technical school is a technical school, and anything that tries to make it a rival of the university is to be deplored.

The second department of the proposed institution is a technical high-school, drawing its pupils from the graduates of grammar school courses. The courses are to be largely elective. "In this school the boy who wishes to fit himself for industrial pursuits would find equal advantages with the boy who desired to prepare himself for professional engineering, or the girl who wished a general high-school education supplemented by instruction in the home-making arts." Shops and experimental laboratories are proposed on a scale greater than anywhere now afforded in the country for the purpose, and the courses would be as follows: 1, The ordinary English high-school studies. 2, Physics, chemistry and biology, with students' laboratory practice. 3, The elements of the calculus and applied mechanics. 4, French, German and Spanish. 5, Commercial studies. 6, Domestic arts and sciences. 7, Freehand and mechanical drawing. 8, Technical studies fitting for the industries of the locality, such as blast-furnace and foundry practice, glass making, brass founding and finishing, pattern making and joinery, metal working, engine and boiler management, power-station management, gas making, railway transportation, plumbing and domestic sanitation, surveying, clay working and ceramics, industrial art.

The third branch of the school comprises day and evening classes in elementary mechanics, mathematics, physics and chemistry, freehand and mechanical drawing, modern languages and elementary instruction in such technical subjects as are taught in the technical high-school, supplemented by courses of lectures on subjects of interest to artisan classes.

With all deference to the eminent professors who have proposed this triparty institution, it must be acknowledged that to those who are hoping to see the Carnegie school become a great power in the land the project seems very insipid. With the example of the Cooper Union in New York, turning away every year about two thousand young people for whom it cannot provide, a project for an industrial school which can offer nothing better as its leading attraction than enormous laboratories and a score of deeply-learned specialists is not the last word on the subject by any manner of means. Now that the trustees have received the pedagogical report, it would be a very good thing to get one from an equal number of men who, beginning life as water boys, time-keepers and printers' devils, have won success by unaided native ability. It would be worth the time to hear from these captains of industry and of engineering, who have not been through technical schools, for they may very likely be able to point out a few things which are overlooked in the present ready-made scheme of education.

There are many foremen for every engineer and there are many artisans for every foreman. When all is said, it is the artisan's instruction which should be considered first, then that of the foreman, and finally that of the engineer, for the last needs the least attention just now. Years ago Peter Cooper, himself familiar with the trials and hardships of the laborer's life, determined that the best use to which he could put his fortune was the education of laboring men, not only in the scientific principles underlying their work but also in the elementary facts of law and of civil government, so that they would become better workmen, better citizens and able to secure enjoyment from a wider range of subjects. The institution which bears his name and has steadily carried out his ideas with remarkable success has not been regarded with uniform favor by teachers of technical subjects, possibly because its fundamental idea was the good of the pupil and not the advancement of the scientific reputation of the instructors. Nevertheless it has been a grand success. It was the recognition by this great philanthropist of the real needs of the workman, just as it was a like recognition of the same needs by the correspondence schools, that caused their unparalleled success. So before the Carnegie trustees adopt any recommendations for great schools, it will be highly desirable for them to decide whether they wish to provide for the citizens of Pittsburg educational advantages now beyond their means or to provide a place where a select few can carry on recondite advanced study. The question simmers down really to this choice, because the project for the technical college, stripped of its distinctive feature of advanced work, is merely a plan for another technical school of the familiar type. The Engineering Record sincerely hopes that the choice, when it is made, will be to the advantage of the workers in the industrial establishments of the city where the Carnegie fortune was made, for while they may not add quite so much to pure science possibly their better education will redound more to the welfare of the municipality and to the fame of the man who places his wealth at the trustees' disposal for such a noble aim.

The Utilization of Niagara Falls has been the theme of so many articles that it would seem at first thought as though the subject was exhausted. Nevertheless the first comprehensive statement of the business conditions which warrant the enormous expenditures for developing the power has just been issued by the Cataract Power & Conduit Company of Buffalo. Owners of industrial plants are advised to write for a copy, for it gives many hitherto unpublished facts concerning the great variety of uses to which the power is now put and the saving in operating costs it has accomplished.

The Quebec Bridge Piers.

The Quebec bridge, with a total length of 3,310 feet, and a clearance of 150 feet above high water, will have the longest span in the world over the main channel of the St. Lawrence River, which will be crossed by two cantilever arms and a supended span, making an unsupported structure 1,800 feet long between the centers of the main piers. The trusses will be about 300 feet high over the tops of the piers, 120 feet deep in the middle and 67 feet apart. They will have a much greater capacity than any of the greatest spans yet built, being designed for two railroad tracks, two street car tracks and two highways. The river span and anchor arms are estimated to weigh about 25,000 tons and are to be built by the Phoenix Bridge Company, Mr. John Sterling Deans, chief engineer. Mr. A. A. Stuart, chief engineer for Mr. M. P. Davis, the contractor for the substructure, has furnished the following information concerning the work done up to the last of June.

This bridge is to be located about eight miles west of the city of Quebec, over the narrowest portion of the waterway between Montreal and Quebec. Here the St. Lawrence flows between high rocky formations on both sides of the river, the waterway being about 2,000 feet at low tide, and about 2,800 feet at extreme high tide, the tidal rise varying from a minimum of about 14 feet to a maximum of about 19 feet. The maximum depth of water at the site of the bridge is about 180 feet, increasing very rapidly toward the center from the two main piers, which are separated a distance of 1,800 feet.

On the north side of the river, the hill forming the river bank rises to a height of about 200 feet above the water, and slopes at an angle of about 45 degrees, the material being solid rock of the nature of hard sandstone, but unsuited for reducing for ashlar masonry. On the south side of the river the bank has about the same height as on the north side, but rises almost vertically, and is composed of rock of the same nature.

The substructure will consist of two heavy U-shaped abutments, two anchor piers and two main piers. The two abutments will contain about 2,500 cubic yards of masonry each, the two anchor piers about 7,000 yards each and about 250 tons of anchorage metal each, and the two main piers will contain about 16,000 cubic yards of masonry each, all told. It is proposed to construct and complete, if possible, the north abutment, the north anchor pier and the north main pier during this season, leaving the similar work on the south shore to be executed next season.

The accompanying photograph shows the location and character of part of the plant which will be employed in executing the work, and as concrete will enter largely throughout the construction, a very complete plant has been installed for crushing the stone and mixing the concrete mechanically, using a minimum of labor. This plant is set up on the face of the cliff and adjoining the west end of the north anchor pier. The stone is quarried above the top of the stone crusher, and descends to the latter, where it is crushed and drops into a small bin holding about 25 cubic yards. From this bin it is drawn through a trap door into a charging hopper which delivers it to the concrete machine. The concrete is discharged from the machine into cars which run on tracks along the line of the north anchor pier, and also across the trestle which extends from this concrete plant across the rocky shore, a distance of 500 feet, to the working platform which surrounds the north main pier. From these cars the skips containing the concrete are lifted by derricks and deposited at any point within the range of each derrick. The sand required is gathered in carts from the adjacent beach, and is elevated to the mixing platform by link belts carrying malleable iron buckets, which deposit the sand into a rotary screen, which latter removes the gravel. From the moment the stone is quarried it is passing downward by gravity through the entire process of converting it into concrete. The crusher is capable of producing about 30 cubic yards per hour, which is the maximum consumption when all the work is in operation. This entire plant is driven by a high-speed engine located underneath the crusher platform, and on a level with the mixer platform, steam being supplied to both this engine and the two hoisting engines, which operate the two adjacent derricks by a 100 horse-power boiler, the stack of which is shown in the photograph where the tops of the first set of anchor bars are also showing just above the masonry of the north anchor pier.

The two derricks standing on top of the hill will be used in building the north abutment, the site of which has been partially excavated.

The shore is covered with huge boulders, which are brought down and deposited by the ice during winter, and which make it very hazardous to bring any materials to that point by water unless deposited on the shore at about low water. For this reason a double-track railway has been constructed from a dock located about 4,000 feet east of the site of the bridge, and over these tracks are conveyed all the cut stone, steel and cement required in the construction of the north abutment and north anchor pier. A trestle work connects these tracks with the working platform which surrounds the north main pier, and can be used for conveying all classes of material to the latter work should it become necessary. It is proposed, however, to bring all of the cut stone for the north main pier on scows and land it at high tide under the two derricks which will command this pier, and unload it before the water descends, as the scows could not lie in this berth at low tide, owing to the bottom being covered with huge boulders.

The working platform is constructed of ample strength to store a supply of cut stone to last several days if the emergency should arise, and it is therefore expected that the trestle work leading to the shore will be used only for conveying concrete and mortar, which will be produced by the concrete plant. The working platform at the north main pier site is about 40 feet wide and extends across the west end of the pier site and along the north side, and is built of spruce piles driven to refusal on about 7 feet centers. These piles were cut, capped and decked over very like ordinary dock work about New York City.

The compressing plant is located in temporary buildings at the west end of the working platform and consists of four 100 horse-power boilers, a boiler feed pump, a feed water heater, two high-pressure jet pumps, three duplex 16 x 18 x 18-inch air compressors, two high-speed automatic engines driving two electric generators for supplying light, and two powerful hoisting engines for operating the two derricks, which have booms 75 feet long and 16 inches square in the middle, these latter being British Columbia fir. The lighting plant is connected with the caisson and also with the concrete plant, so that the latter can be operated at night while filling the cribwork of the caisson and while sealing the air chamber.

The masonry of the entire sub-structure will be built of a fine granite, which is being quarried for the purpose at Riviere a Pierre, P. Q., located 60 miles north of the city of Quebec, the stone being brought to Quebec by railway, and thence on scows by a powerful tug, which constitutes part of the working plant.

The caissons on which will rest the two main piers are 49 x 150 feet in lateral dimension and 25 feet high. They are built of southern pine, brought to the site in the rough and milled by a plant set up for the purpose, which comprises a circular saw, a butting saw and a sizing machine cutting four sides at a time. This plant is supplemented by a miniature machine shop containing a number of small machines, where most of the repair work is done.

The caisson for the north main pier was constructed on the north shore about 4,000 feet east of the pier site, and was successfully launched on June 20 and towed into position. At the sites of the two main piers the water has a depth of about 10 feet at low tide, and as the caisson draws about 12 feet unloaded, it grounds at each low tide but floats at high tide, the water then being about 25 feet deep. The concrete was being placed in the cribwork on the north main caisson on June 28, and exacavation in the chamber was being carried on only during low tide, and it was to be so continued until sufficient concrete was put in to overcome the buoyancy of the air pressure.

Concrete Plant and Anchor Pier on North Shore.

The active officials of the Quebec Bridge Company are the Hon. S. N. Parent, president; Mr. E. A. Hoare, chief engineer; Mr. Theodore Cooper, consulting engineer; Mr. R. T. Gough, resident engineer; and Mr. Alexander McDougall, assistant engineer. The contractor for the substructure is Mr. M. P. Davis of Ottawa, his working staff consisting of Mr. Stuart as the local manager of his business, with Mr. W. L. Scott as assistant.

From the photographs and blueprints which accompanied Mr. Stuart's letter data have been selected for the following supplementary description of the caisson and construction plant and the illustrations of its essential features. The caisson resembles in some respects those for the Brooklyn towers of the New East River bridge, which have been described in several issues of The Engineering Record, and of which Mr. Stuart was chief engineer for the contractors. The latter, however, were somewhat larger than these are, were sunk to a greater depth than it is here anticipated will be necessary, and differed somewhat in the cutting edge and other details.

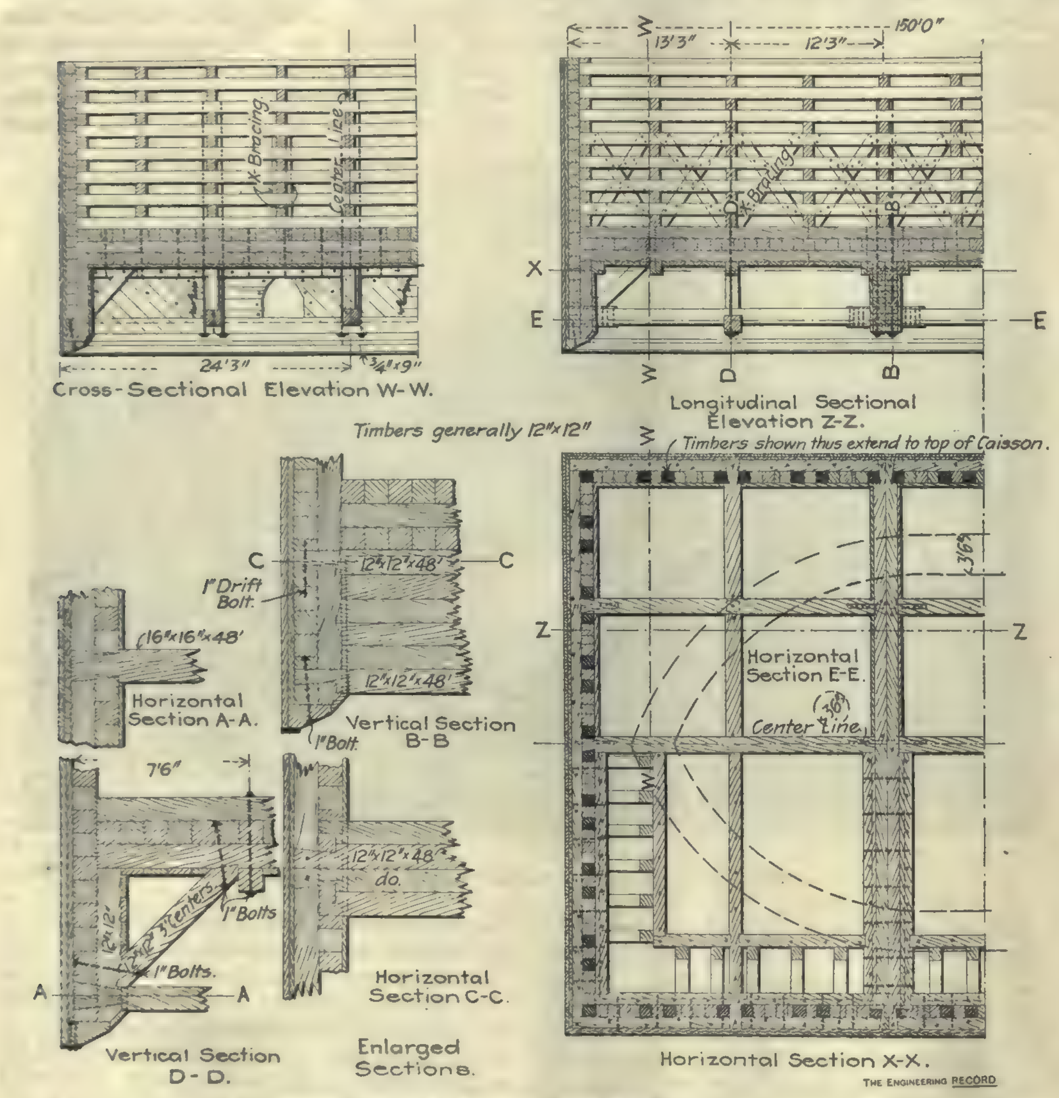
The walls of the caisson are vertical and are made with double courses of planed timber, the outside course being laid horizontally and the inside course, which does not extend above the deck, being set vertically. The timbers in the outer course are halved together with oblique joints at the corners, have three square lapped splices, breaking joints, in every course, and are fastened together with 1-inch drift-bolts 30 inches long and 3 feet apart up to the eleventh course from the bottom and 4 feet apart above that. The walls are sheathed outside with a double course of crossed diagonal planks, each course being secured with a row of ½-inch spikes 2 feet apart and staggered. There is a deck of three crossed layers of timber which forms the roof of the working chamber 7¼ feet high in the clear above the cutting edge. The ends of these timbers extend through the vertical wall timbers and abut against the horizontal wall timbers. The ceiling and inside walls of the working chambers are lined with plank, calked, and all the main timber in the caisson deck and wall is 12 x 12-inch.

The working chamber is divided into three equal parts by two transverse bulkheads or double walls of horizontal 12 x 12-inch timber. Double rows of 1½-inch vertical bolts extending nearly to the top of the caisson pass through the bulkheads and tie them very strongly to the interior cross braces above the caisson deck The upper and lower courses of the bulkhead timbers are dovetailed into the walls of the caisson, and there are flange timbers bolted to it and to the deck at each side at the top of the walls as shown in the framing detail. The walls are beveled at a very flat angle to make a cutting edge 9 inches wide, which is shod with a ¾-inch steel plate.

It is stiffened laterally by 12 x 12-inch knee braces about 3 feet apart on centers, which are bevelled and gained into the wall and roof timbers at both ends and also abut at the upper end against the vertical sides of timbers bolted to the deck of the caisson parallel to the walls. Additional stiffness is also secured by 16 x 16-inch horizontal struts parallel to both walls, which divide the working chamber into squares of about 12 feet. These braces are dovetailed and strap bolted into the walls just above the cutting edge, and at intersections one is halved over the other and both are clamped in place by a vertical strut to the roof of the working chamber and two 1½-inch vertical rods which have nut bearings on the lower side of the bottom strut and on the upper cross timbers of the caisson bracing. Above the caisson deck there are horizontal 12 x 12-inch cross struts in the vertical planes of the bulkheads and of the struts for the cutting edge, and intermediate between each pair of these, dividing the caisson in plan into squares of about 6 feet centers. The transverse and longitudinal struts are in alternate planes so as to clear each other at intersections, where they are drift-bolted together. At the ends they are dovetailed into the horizontal courses of the side walls.

There are six 36-inch steel air shafts in sections about 8 feet long bolted together with gaskets and outside flanges and connected to the deck with twenty-four ¾-inch bolts passing through a special cast flange and the three deck courses. This flange has a Z-shaped cross-section with transverse stiffening webs for the flanges. The cross-section of the main shaft is about 300 degrees of a circle with a bent plate offset beyond the circumference for the remainder of the distance to afford an extension for the ladder outside of the 3-foot cylinder which is left clear for the passage of buckets. The shafts which are used exclusively for materials are plain cylinders without extensions. The air locks are about 12 feet high and 5½ feet in diameter, very much resembling the Moran-Stuart material lock used on the caissons of the New East River bridge and illustrated in The Engineering Record of December 24, 1898. The lower end of the lock has an extension to receive the double-hinged circular door and allows it when open to swing clear of the bucket. The upper door is made with two leaves hinged to links which work in guides carrying them back out of the way of the bucket as they descend. The doors close on rubber gaskets and are operated by shafts counter-balanced at both ends. A long stuffing box is set in the center of the upper door and allows the bucket hoist rope to render through it when the lock is closed.

A 4-inch water pressure pipe is run along the deck of the caisson and has six 3-inch vertical branches into the working chamber. There are also six 4-inch blow pipes through the deck, all of which terminate in valves screwed up tight against flat washers on the ceiling of the working chamber. The water pipes have gate valves, and the blow pipes have special cast-iron plug valves with a clear way for the passage of mud, sand and small stones. Air pressure is supplied to the caisson by a 6-inch vertical pipe passing through the roof and terminating in the working chamber with an elbow which is screwed up tight against a washer on the ceiling. On the upper side of the deck an outside sleeve is screwed down tight on a corresponding washer. The open horizontal end of the bottom elbow is closed by an iron disc, faced with leather and hinged at the top to make a flap falling to a vertical position by gravity and closing the end of the pipe against escape of air from the caisson and opening automatically to admit pressure from the compressors.



Details of Caisson for Main Pier.

The Septic Tank and Filtration Works for treating the sewage of Columbus, O., recommended by Mr. Rudolph Hering, have been authorized by the State Board of Health on the following conditions: 1. That the sewage disposal plant shall be fully completed at the earliest time practicable. 2. That the area of filter beds shall be amply sufficient to purify all the sewage. 3. That in the operation of the plant after its completion, raw or partially purified sewage shall at no time be discharged into the river in amounts sufficient to create a nuisance.

The Harbor Works at Tampico, Mexico.

A few months ago an interesting lecture was given by Mr. E. L. Corthell at Buenos Aires on the Tampico harbor works, of which he was the chief engineer. Although much has been written concerning these improvements and Mr. Corthell himself has described them in an important paper before the Institution of Civil Engineers, the following brief account of the nature and result of the works, taken from the report of the lecture, is of much interest. Tampico itself, it should be said by way of preface, is seven miles from La Barra, at the mouth of the Panuco River, where the improvements have been made. In 1888 the Government gave a concession to the Mexican Central Railway Company to build the harbor works. In 1889 Mr. Corthell made an examination and plans which were approved by the Government and the railway company, contemplating the construction of two parallel jetties from the deep water inside out over the bar to the deep water in the gulf, the jetties to be about 6,700 feet long and 1,000 feet apart. The contract was let in 1890, the work was begun that year and completed in December, 1892, and the full channel required by the law developed in 1893. The cost of the work up to December 31, 1892, in United States gold was $2,466,876.23, including all expenses.

The tides of the Gulf of Mexico are diurnal and have a range of only 1 foot to 15 inches with a maximum of about 2½ feet. The River Panuco has a drainage area of about 36,000 square miles. The rainfall over this area averages about 40 inches per annum, but it is very irregular, consequently the volume of water in the river is very variable; sometimes for a year, sometimes for two years, there are no floods. This river drains the great valley of Mexico, and the mouth of the river is, by the Mexican Central Railroad, about 850 miles from the City of Mexico. The river is one of the great rivers of the country; the area of its cross section at the mouth is about 25,000 square feet. It is about ¼ of a mile wide and about 30 feet deep. It discharges a volume of water of 150,000 cubic feet per second in time of floods, and in great floods as much as 200,000 cubic feet per second. It can be navigated 300 miles by river steamers. In time of floods it brings down to the Gulf a great amount of sediment in suspension, and deposits much of it immediately in front of its mouth in the Gulf, causing a sea bar on which there was only from 5 to 12 feet of water. The channel through the bar varied in position as well. It was a very stormy bar, exposed to the violent and persistent winds, called northers, which sweep across the Gulf from the shores of Texas. The commercial business was carried on by lighters between Tampico and the ships which anchored four or five miles out in the Gulf. This business was very precarious; sometimes for many days, at times for many months, it was impossible to cross the bar.

The principle on which the works of improvement were based was the contraction of the river flow (which in its natural condition spread out widely) into a width somewhat less than that which it had between its natural banks inside of the shore line. This contraction was accomplished by the jetties above mentioned—projected straight out into the Gulf—and they were raised from 3 to 5 feet above the surface of the water. They were built of mattresses made of brush, covered and consolidated with heavy stone. The method of construction was peculiar. On account of the uncertain condition of the sea and the delays and losses to which the work would be subject by using a floating equipment, an ordinary double-track railroad trestle on piles was built out over the location of the proposed jetties. This trestle work was about 8 feet above average high tide at the shore and 12 feet above it at the sea-end of the work. This trestle was connected with the railroad terminal at Tampico by a railroad seven miles in length. Most of the brush used in the mattresses was obtained along the line of the railroad above Tampico. Most of it was brought down to the works on flat cars with high sticks on the sides of the cars, the loads looking very much like great loads of hay. These were hauled by a locomotive upon the trestle; a framework of pine scantling was suspended by ropes to the caps of the trestle. The workmen placed the brush on this framework of scantling in alternate layers, making a total thickness of 3 to 7 feet, and then, by means of iron rods passing upward from the lower scantling, other scantlings were placed on top of the mattresses and the brush was bound down by levers into a compact mass. Lengthwise with the jetties the mattresses were invariably 60 feet long; crosswise of the jetties they varied according to the depth of the water into which they were placed, from 40 feet to 84 feet at the sea ends. They were placed one on top of the other, gradually diminishing in width toward the surface of the water. When the mattress was completed, it was dropped into the water, and even into heavy waves, by letting go the rope lashings. In the meantime a train of cars loaded with rock was hauled to the point where the mattresses were dropped and they were soon sunk to the bottom by throwing rock upon them. By this method the work could be carried on even in quite a heavy seaway. The trestle work was carried out by large swinging pile-drivers. The rock came from about 75 miles above Tampico on the line of the railroad and its weight was equal to that of granite, about 175 pounds per cubic foot, a limestone rock. About 375,000 cubic yards of mattress work, about the same amount of stone, 2,000,000 feet B.M. of timber in the trestle and 250,000 lineal feet of piling (all the timber employed came from the United States) were used, and the total weight of material in the works was over 500,000 tons.

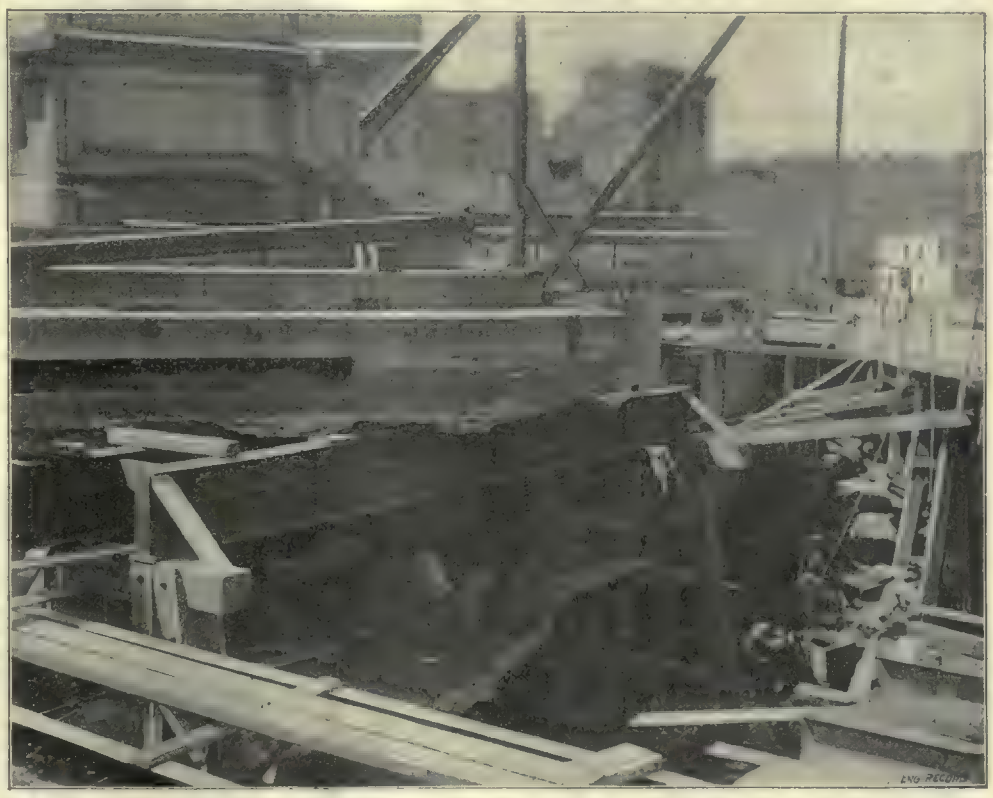
The physical and commercial results of the work are, of course, the most important of all. The concentration of the force of the current produced by the jetties gave to it such an increased velocity that it scoured out of the great sea-bar over 4,000,000 cubic yards of sand and clay and made a channel through it with a minimum depth of 27½ feet. The 26-foot channel was over 400 feet wide. The entire excavation was done by the force of the currents with the exception of a small amount which needed to be excavated by a large suction dredger from among a great mass of wreckage of vessels which had been lost on that stormy bar during the last 300 years. As might have been expected, the vast amount of material scoured out by the force of the current caused at first a slight shoaling in the gulf beyond the jetties, but the jetties themselves, extending as they do into sea currents, accelerated these currents across the sea-ends of the works and this protrusion of the bar was soon carried away completely, leaving deeper water at the sea ends of the jetties than originally existed.

The commercial results have been equally satisfactory. Previous to the works, on account of the great obstacles in the way of commerce, most of the commercial business had gone to Vera Cruz, when the Mexican Railway was built, but by the opening of the channel at Tampico, furnishing to commerce a land-locked harbor, which has an available frontage of about 14 miles, all in deep water, the business rapidly increased; a railroad was built to Tampico from Monterey and steamship and other companies built ocean terminals.

In 1898, 973 vessels entered and cleared with a registered tonnage of nearly 1½ million. In five years after the construction of the works the number of the vessels was doubled, the tonnage doubled and the value trebled. The value of exports was $10,000,000 greater than that of all the United States entrepots at the border, El Paso, Laredo and Eagle Pass.

Underpinning the Columbus Monument, New York.

The Columbus Monument, at Fifty-ninth Street and Broadway, New York, is a tall stone column about 4 feet in diameter, which rises from a molded pedestal on a cut stone base, at the street level. The shaft is surmounted by a statue of heroic size. The base, about 35 feet across the bottom, and consisting of three square steps with the corners cut off, is seated on a rubble masonry foundation, 45 feet square and 12 feet deep, with a 2-foot footing of concrete, which is partly on rock and partly on sand, gravel and clay. Above the rubble foundation the monument is 75 feet high and weighs about 724 tons.



Temporary Support of Columbus Monument Foundation.

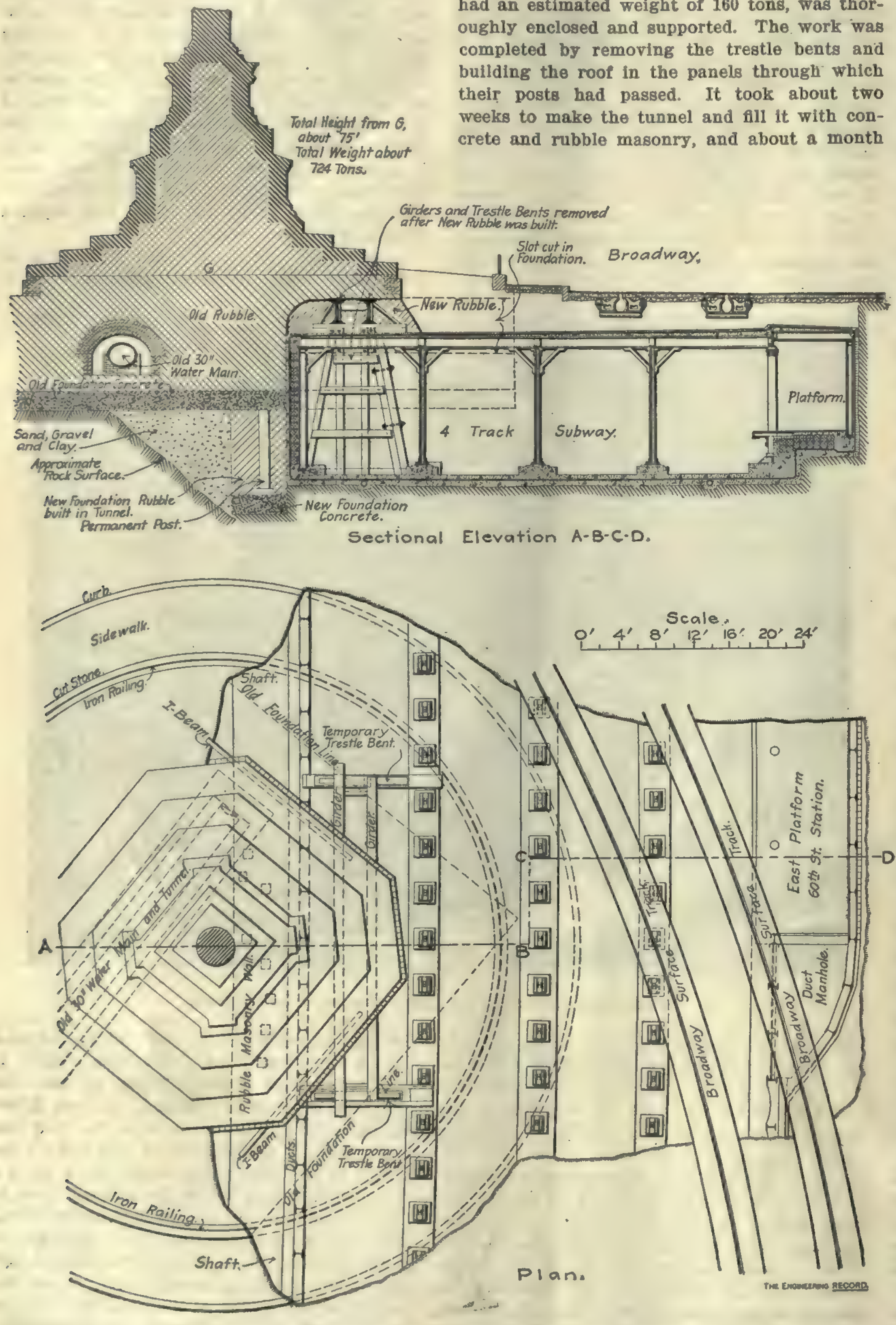
The Rapid Transit Railroad subway intersects the foundation and passes from south to north under the east side of the monument on a line nearly parallel with the diagonal of the plan of the foundation and within 8 feet of its center, thus cutting out about 30 per cent. of the original support of the foundation. Excavations made on different sides of the monument showed that in the subway location the soil was sand and gravel, which stood well while dry, and that the rock, which was found 3 feet below the surface on the opposite side, probably dipped at an angle of about 45 degrees under the subway, making it difficult to maintain the stability of the monument when undermined.

The subway excavations were stopped within 3 feet of the foundations of the monument, and shafts about 6 feet square, 25 feet deep and 50 feet apart, were dug on the north and south sides of the foundation just beyond the west line of the subway trench. These shafts were connected by a tunnel 6 feet wide and 7 feet high, with its bottom 3 feet below the level of the subway excavation. The old concrete footing for the monument formed the roof of the tunnel, and its east side was in the plane of the west side of the subway wall. The bottom of the tunnel was covered with a 2-foot bed of rubble concrete, and after it had hardened 12 x 12-inch vertical yellow pine shores, about 5 feet apart, were set on it and wedged up tight against the concrete roof. Then the tunnel was completely filled with rubble masonry, built from the middle out to both ends, wedged tight on top and permanently enclosing the wooden shores. A solid masonry wall was thus built, which extended well below the subway trench and served as a retaining wall for it and also provided complete support for nearly all of the east side of the pedestal and for the old foundation north and south of it. This afforded all the underpinning requisite for the stability of the shaft, but left beyond it a strip of the old foundation 25 feet wide, extending over and into the subway location. This had to be partly cut away, and required support when undercut.

A horizontal slot about 6 feet high, with its upper edge 4 feet above the upper surface of the subway construction, was cut in the east side of the monument foundation. When it had been carried in about 6 feet its roof was supported on four 12 x 12-inch vertical shores and the cutting was continued to the west line of the subway. At each end of this slot, on the outside of the foundation, trestle bents of 12 x 12-inch timber were set on the finished concrete floor of the subway, several feet lower down, and two second-hand steel plate girders, 30 inches deep and 35 feet long, were skidded into the slot and set on the trestle bents. A cushion plank was laid on top of the rivet heads in the top flange of each girder and any inequalities between it and the old foundation masonry in the roof of the slot were packed with iron fishplates. A 60-ton hydraulic jack was placed successively under both ends of both girders and lifted them against the foundation masonry while steel plates or wedges were driven between the bottoms of the girders and the tops of the trestle bents. The vertical shores were at first wedged so firmly in the slot that when one of the girders was being skidded in and stuck a shore it tore out nearly half the timber without loosening its bearings, but after the girders were jacked up they took so much of the weight of the foundation that all the shores were easily knocked out with sledges.

The upper part of the foundation and pedestal being thus supported, the lower part was entirely removed from the bottom of the slot to the bottom of the old footing, and back as far as the face of the rubble masonry in the tunnel. The excavation under the monument was completed for the subway, and the east face of the tunnel wall and the foundation masonry were plastered and waterproofed. The subway columns and beams were set, the roof and wall arches laid, and its construction finished under the monument, except where two panels of the roof arches were omitted to clear the trestle bents passing through and supporting the old foundation above. A pier of rubble masonry was built under the east edge of the foundation on top of the subway roof, two courses of cut stone were laid on top of it, and pairs of steel wedges were driven between them to transfer part of the load from the girders to the subway roof, and the interstices between the wedges were filled with cement. The west and east girders were successively removed and similar piers built in their places, and additional piers were built on the subway roof under the north and south sides of the foundation, so that the portion of the foundation above the subway, which had an estimated weight of 160 tons, was thoroughly enclosed and supported. The work was completed by removing the trestle bents and building the roof in the panels through which their posts had passed. It took about two weeks to make the tunnel and fill it with concrete and rubble masonry, and about a month to cut into the side of the old masonry foundation and insert the girders there.

The work was done in Division 2 of the Rapid Transit Railroad, Mr. W. B. Parsons, chief engineer, and Mr. Alfred Craven, division engineer. It was executed by the sub-contractor, Naughton & Co., Mr. G. W. McNulty, chief engineer, and Mr. G. W. S. Wilson, engineer in charge.



TUNNELING AND UNDERPINNING UNDER THE COLUMBUS MONUMENT.

Structural Steel for Bridges, Ships and Buildings.

Somewhat over a year ago The Engineering Record printed the standard specifications for structural steel for bridges, ships and buildings which were recommended by a committee of the American Section of the International Association for Testing Materials. These have been under consideration by engineers and representatives of the steel mills for a sufficiently long time to warrant their adoption by the Section. The changes made at the recent convention were very slight and the revised draft of the specifications which has been sent out to the members for letter ballot differs only in the following respects from the form published in this journal on May 19, 1900:

The yield point, in pounds per square inch, has been reduced and is now placed at one-half the ultimate tensile strength.

In the clause relating to test specimens for bending, the following sentence has been added: "The sheared edges of bending test specimens may be milled or planed."

The clause relating to annealed test specimens has been modified to read as follows: "Material which is to be used without annealing or further treatment shall be tested for tensile strength in the condition in which it comes from the rolls. Where it is impracticable to secure a test specimen from material which has been annealed or otherwise treated, a full-sized section of tensile-test specimen length shall be similarly treated before cutting the tensile test specimen therefrom."

The clauses relating to variation in weight have been considerably modified and now read as follows: "The variation in cross-section or weight of more than 2½ per cent. from that specified will be sufficient cause for rejection, except in the case of sheared plates, which will be covered by the following permissible variations:

"Plates 12½ pounds per square foot or heavier, up to 100 inches wide, when ordered to weight, shall not average more than 2½ per cent. variation above or 2½ per cent. below the theoretical weight. When 100 inches wide and over, 5 per cent. above or 5 per cent. below the theoretical weight.

"Plates under 12½ pounds per square foot, when ordered to weight, shall not average a greater variation than the following: Up to 75 inches wide, 2½ per cent. above or 2½ per cent. below the theoretical weight; 75 inches wide up to 100 inches wide, 5 per cent. above or 3 per cent. below the theoretical weight; when 100 inches wide and over, 10 per cent. above or 3 per cent. below the theoretical weight.

"Plates will be considered up to gauge if measuring not over 0.01 inch less than the ordered gauge."

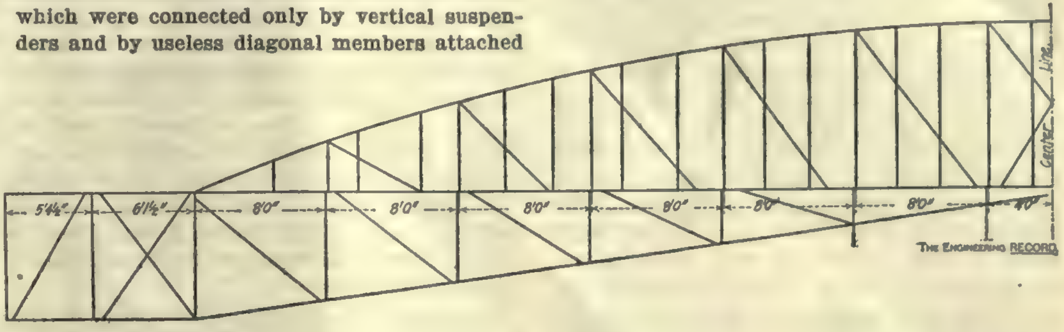
In view of the exhaustive study which has resulted in these specifications, it is to be hoped that the members of the Section will vote to adopt them. It is out of the question to expect that some very large purchasers, such as the Pennsylvania Railroad Company, will deem it wise to consider the proposed standards as anything more than suggestions for the possible improvement of their own specifications, which they have tried and found satisfactory. On the other hand, the greater part of the structural steel rolled to-day is bought under specifications of engineers and architects who do not claim to be specialists in materials of construction. If they are broad-gauge men they accept the results of the deliberations of such an influential body of specialists as compose the working members of the American Section of the International Association for Testing Materials. The adoption of the proposed standards in no way prevents any member from using any modifications of them he thinks proper for any special case, while it will mean a great and wholly desirable simplification of the innumerable and often silly requirements for structural steel now in vogue in some offices.

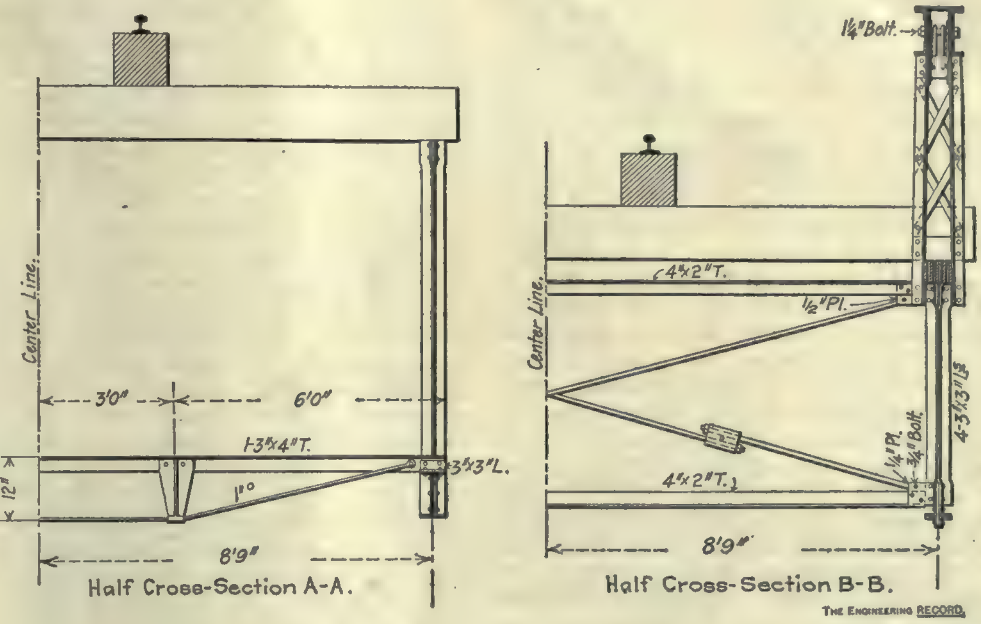
Curiosities of Early Iron Railway Bridges.

In a trip through New Brunswick the late Job Abbott, M. Am. Soc. C. E., examined some very early examples of single-track iron railway bridges, probably built in England and used many years before being replaced by structures of modern design. The proportions and details were so remarkable that he measured and sketched them and afterward had drawings made from which the accompanying illustrations have been prepared.

One span of 103½ feet had two bow-string plate girders, 10½ feet deep in the middle and 14¼ feet apart on centers, and was remarkable for the thinness of the web and the peculiar floorbeam connections. The curved top flange, 15 inches wide and 5 inches deep, was made of two Z-bars, apparently braced at panel points by flanged triangular cast-iron brackets riveted to the web and forming transverse diaphragms. The 17-foot horizontal bottom-flange angles were spliced by flat bars on each flange, and intersected the top flange at the ends of the span where the web projected beyond the top flange and was extended to form a sidewalk-guard across the abutment. The web was made of vertical strips of 36 x ⅛-inch plates, lapped 3 inches and having a single row of 5/16-inch rivets, 2½-inch pitch at each joint. It was divided into panels from 10½ to 15¾ feet long by single outside vertical T-bar stiffeners, at the bottoms of which were single transverse T-bar struts. Knee-braces were secured to the top-chord stiffener brackets with single rivets and to the transverse struts with four rivets. The ¾-inch lateral rods had flattened ends with single ¾-inch rivets through the bent lower ends of the knee-braces. U-shaped suspenders of 2 x ⅜-inch iron, bent edgeways, were riveted to the web between the bottom-flange angles, and the wooden floorbeams were passed through them and seated on the tops of webbed castings with semicircular grooves which engaged the bottoms of the suspenders. All T-bars were 4 x 3-inch, and all rivets were ¾-inch except in the web splices. The span projected about 2 feet beyond the face of each abutment and had bearings on thin 8 x 12-inch plates riveted to the ends of the lower flanges and resting on the top of the masonry without anchor-bolts or bed-plates.

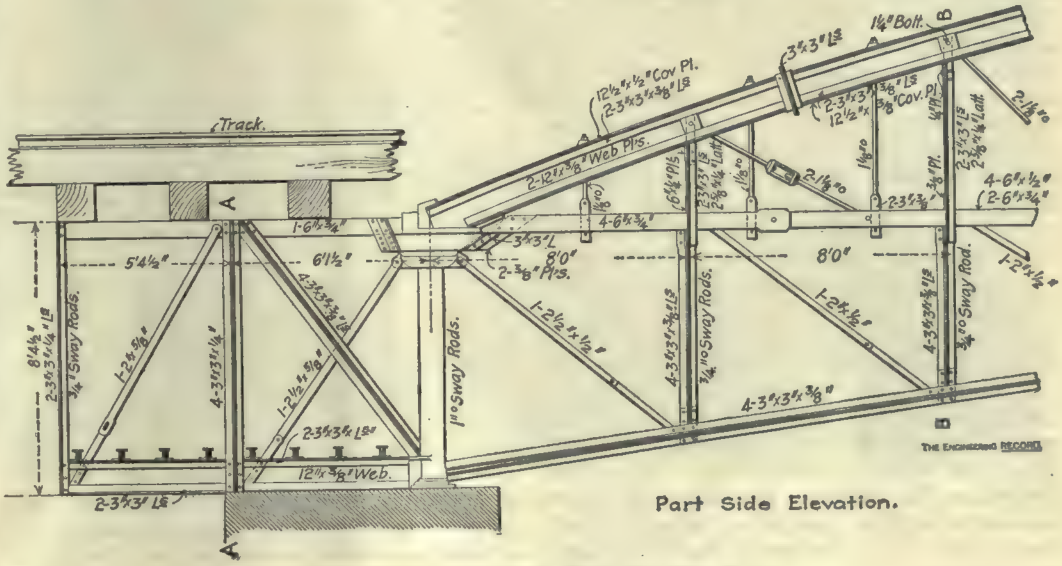
Another bridge had two through trusses of 104 feet span, which were a combination of arch, bowstring and cantilever, with riveted connections, pin connections, and adjustable members. The truss was 10 feet deep in the middle and about 7½ feet deep at the ends, on centers. There was no efficient trussing between the top chord and the horizontal chord, which were connected only by vertical suspenders and by useless diagonal members attached to the horizontal chord at points intermediate between the verticals. The suspender rods passed through the top chords and took bearing with nuts and bevelled washers on their cover-plates. The lower ends were bolted between two plates which passed between the chord





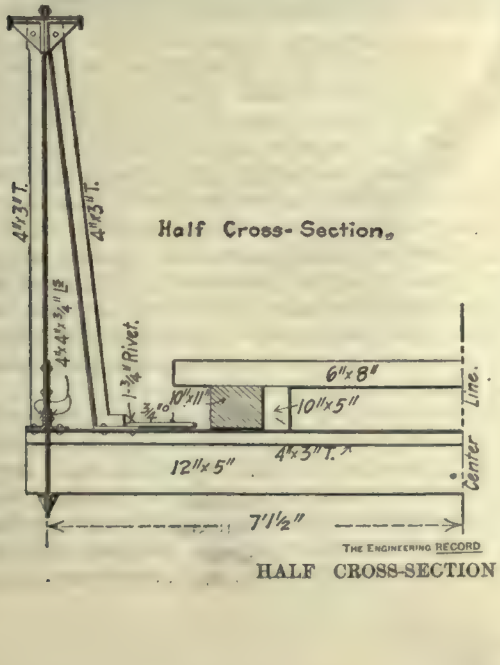
Half Cross-Section A-A.

Half Cross-Section B-B.

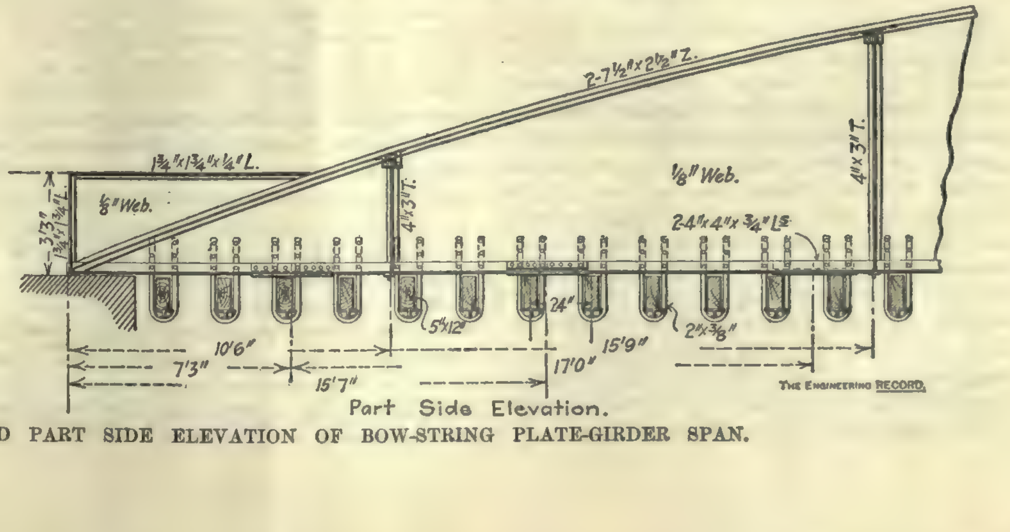


Part Side Elevation.

DETAILS OF COMBINATION TRUSS THROUGH SPAN.



Half Cross-Section.



Part Side Elevation.

HALF CROSS-SECTION AND PART SIDE ELEVATION OF BOW-STRING PLATE-GIRDER SPAN.

bars and supported them on horizontal keys. The lower member of the truss had a cruciform cross-section formed of four angles riveted together back to back in the middle of the span, and separated about 2 inches by fillers at the abutments. It formed a flat arch, with straight sections between panel points, and was spandrel-braced with comparatively heavy verticals and very slender diagonals, which were made in two lengths adjustably-connected with a tapered key in slotted holes, and were fastened at the ends with single rivets or small bolts. The angles of the vertical posts were crimped top and bottom to receive connection plates. At the top one pair of crimped jaw plates was riveted to the center chord bar, and two more plates at right angles to it were riveted across the flanges of a pair of vertical angles from the top chord, and formed a shelf to support the horizontal chord. The bottom chord connections were made with single 1¼-inch bolts which could not develop the full strength of the bars. The top chord was made in 12-foot lengths with angle-iron collars bent around the outside corners and fillered out from the webs. The cast-iron end vertical posts were also members common to cantilever trusses which extended across and beyond the tops of the piers. Their bottom chords were plate girders which had continuous support on the masonry and received the floorbeams for a lower deck to carry a counterweight. One of the 6 x ¾-inch horizontal chord bars in each end panel was continued beyond the end post to form the top chord of the cantilever truss, and had riveted to it diaphragms with angle flanges engaging the bevelled seats on the post and locking it to both trusses. The sway-brace diagonals under the main floor were each made in two lengths lapping past each other and having eccentric nut bearings on a cast-iron block, which was a crude substitute for a sleeve nut.

Both bridges were on the line of the New Brunswick Railway, the plate girder being at Fredericktown Junction, and the truss bridge at Magaguadavic. Another truss bridge of 150-foot span, similar to the one here described, was in use at Fredericktown Junction. The drawings from which the accompanying illustrations were prepared were loaned by Mr. Phelps Johnson, Manager of the Dominion Bridge Company, Montreal.

A Taylor Air Compressor, which operates on the principle of the air lift reversed, has been built by the Kootenay Air Supply Company at Ainsworth, B. C., to supply air for the drills of the Highlander mine. According to a note in the report of the Provincial Mineralogist, the plant consists of a 4 x 6-foot shaft 200 feet deep, with a chamber 20 feet in diameter at the bottom. The water is brought from a source 200 feet above the mouth of the shaft and carries down with it to the chamber enough air to operate 60 drills. Only one man is required to operate the plant.

The Injury to the Brooklyn Bridge on July 24, of which wild reports have been telegraphed about the country, was an insignificant matter. About a dozen of the short suspension rods connecting one of the cables to the transverse floor-girders had their connections to the cable or the girders broken. These rods are used at the center of the span where the distance between the cables and girders is too short for the rope suspenders employed at most places on the bridge. The connections are not of the most modern type and gave way when the temperature strains in that part of the bridge put an unusual load on them. The so-called stiffening trusses of the bridge have a joint at the center of the span where the breaks occurred.

A Topographical Survey of the Reservoir System at the Headwaters of the Mississippi River.*

Surveys showing the detail configurations of a stretch of country are becoming more frequent as their advantages are better understood. A description of such a survey, covering approximately 600 square miles, made with a degree of accuracy and detail used heretofore only in cities and on small areas, will possibly be of interest to students and engineers. Only an outline of the method, which contains some new features in topographical work, can be given. The results attained in the field work must be taken as approximate and not final, since a final discussion and report on the survey cannot at present be made.

History of the reservoirs.—Reservoirs at the headwaters of the Mississippi River have, for some thirty years, had the attention and consideration of Congress through the army engineers. In 1869 a reconnaisance survey of the Mississippi Basin above St. Paul, Minn., was made under the direction of the U. S. Engineer's Office at St. Paul by a Mr. Cook, of Minneapolis, but was paid for by private milling interests. This reconnaisance led to a survey by the general government in 1874 under Maj. F. W. Farquhar which was completed in four months' time. From this survey was obtained the area of the lakes and rivers, the probable flowage lines, the elevation of the lakes, and the slope of the river. Some gaugings were made. Following closely came the project for a reservoir system, under which the work was finally completed. The wording of the law providing for the reservoir system is: "The construction and maintenance of reservoirs, at the headwaters of the Mississippi River in the State of Minnesota, for the purpose of collecting the surface water, principally from precipitation in winter, spring, and early summer, to be systematically released so as to benefit navigation upon the Mississippi River below the dams and as far down as Lake Pepin. Reduction of heights of floods in the vicinity immediately below the dams is expected to obtain to some extent, but control of extended floods or freshets is not expected." No idea is here entertained of ever effecting the low water stages of the Lower Mississippi River, as many have erroneously thought and who have consequently considered the reservoir system to be a failure. Traffic on the Mississippi above St. Paul consists principally of large quantities of logs, which are floated to market. In 1896 this was given as in excess of 1,000,000 tons, and it is constantly growing. Steamboat navigation is only possible on certain stretches of the river.

TABLE I.—Data Concerning Reservoirs at the Head of the Mississippi River.

Reservoir.	Areas in Square Miles. Water-shed.	High Water.	Low Water.	Over-flow.	Capacity, cu. ft.	Length in Feet. Dam.	Embank-ment.	Overall.	Height of Dam, ft.	Material in Dam.
Winnibigoshish, a	1,442.5	161.26	117.00	44.26	45,024,000,000	114	.....	114	25	Concrete
Leech Lake	116.0	233.80	173.19	60.61	33,094,000,000	448	3,152	3,600	12	Concrete
Pokegama, b	660.0	45.29	24.13	21.16	4,700,000,000	232	378	610	9	Timber
Pine River	562.0	23.76	18.30	5.46	7,500,000,000	235	440	675	20	Timber
Sandy Lake	421.5	16.52	8.00	8.52	3,158,000,000	125	650	775	11	Timber
Totals	3,202.0	480.63	340.62	140.01	93,476,000,000	...	.....	.....	..	

a.—Includes Cut Foot, Sioux and Cass Lakes.
b.—Includes White Oak and Ball Club Lakes. Pokegama proper is only about half the area given.

Up to the present time five reservoirs have been built, the first four between 1881 and 1884, and the last was completed in 1895. Table 1 gives some interesting data concerning these reservoirs. Up to June 30, 1896, the cost of this reservoir system has been $8.78 per million cubic feet storage capacity.

The watershed of the Mississippi River above St. Paul is 36,081 square miles. The average yearly rainfall is 27 inches. Evaporation on the lake surface is about equal to the rainfall. The average run-off for the years 1885-1895 was 15.9 per cent. counting the lake areas, and 19.4 per cent. not counting the lake areas.

The average low water discharge for the summer season at St. Paul is 5,000 cubic feet per second. If all the reservoirs were full, their combined capacity is sufficient to maintain a flow of another 5,000 cubic feet per second for seven months of the year. In 1885 they did add an average of 2,000 cubic feet per second for 76 days during the low water season from August to November. This flow raised the water at St. Paul 1½ feet, and the effect of same disappeared at Winona, Minn., some miles below Lake Pepin, the prescribed lower limits in the project. Up to 1897 these results were steadily improved. During that year enough water was collected to double the average low water flow at St. Paul for five months. Since then very little water has been held in Leech Lake and Winnibigoshish Reservoirs owing to the weakness of the dams. These were originally built of timber, but are now being replaced by concrete structures.

Object and administration of survey.—Shortly after the completion and first use of the dams, damage claims for overflowed lands were made. To determine what claims might justly be made a detailed topographical survey of the reservoir basins was started in June, 1899, under the direction of Maj. F. V. Abbott with Capt. A. O. Powell in personal supervision and T. M. Fowble and Horace Dunaway in charge of the two field parties. The writer was topographer in the later party, and can describe only the methods used under Mr. Dunaway, although in general the methods are the same in both parties. For much of the foregoing data and history thanks are due Mr. Dunaway.

Table I shows the overflowed lands to be 140 square miles; to this may be added about 25 per cent. for the 4 feet extra which is taken above the flowage line, making a total of 175 square miles. Of this 107 is found in Leech Lake and Pokegama Reservoirs, and 25 square miles along Leech Lake River and Mud Lake. The 107 plus the 25 square miles, or 132 square miles in all, was to be surveyed by the party under Mr. Dunaway. It is stretched around 90 miles of shore line on Pokegama, 400 miles on Leech Lake, and along 50 miles of river valley, no account being taken of the winding of the river. Upon the reservoir basins 2-foot contour intervals were used; upon some 30 square miles below Leech Lake Dam, the country lying between the reservoirs and carrying the flood water from the upper reservoirs, 1-foot contour intervals are used.

Considering the extent of the country and the detail with which this work is being done, this survey is the largest of its kind that has ever been undertaken, so far as the writer can learn. About half of the field work and one-third of the mapping has been completed.

The reservoir system is glacial drift formation with very little symmetry in its drainage. It abounds in large tamarack and spruce swamps, cranberry marshes, hay meadow bogs, innumerable lakes of all sizes, and on the high ground heavy pine timber. The high ground is very broken, presenting the appearance of an immense honeycomb. This forms a tedious and most exasperating country in which to take topography, for when your swamp has been nearly circled you often discover in its center a number of pine covered knolls. These are surrounded by an almost impassable swamp, to go through which means to set the instrument upon stakes 1 to 6 feet in length, the observer standing in swamp-bog and water knee-deep. The high ground or knolls are covered with pines or the stumps of those noble trees. If the latter be the case, they are overgrown with a second growth of poplar filled in with hazelnut, tagalder, and poplar brush. This undergrowth, troublesome in winter, is simply impenetrable 5 feet by the eye in the summer. Heavy windfalls, caused by tornadoes or fires, are often met both on the high ground and in the swamps. In these windfalls, trees lay piled upon each other so as to make it necessary to travel in the air, or correctly speaking, in the tree tops. Winter time has its advantages for taking topography in such country. Ice in those places does not leave the ground entirely until some time in August unless heavy rains occur.

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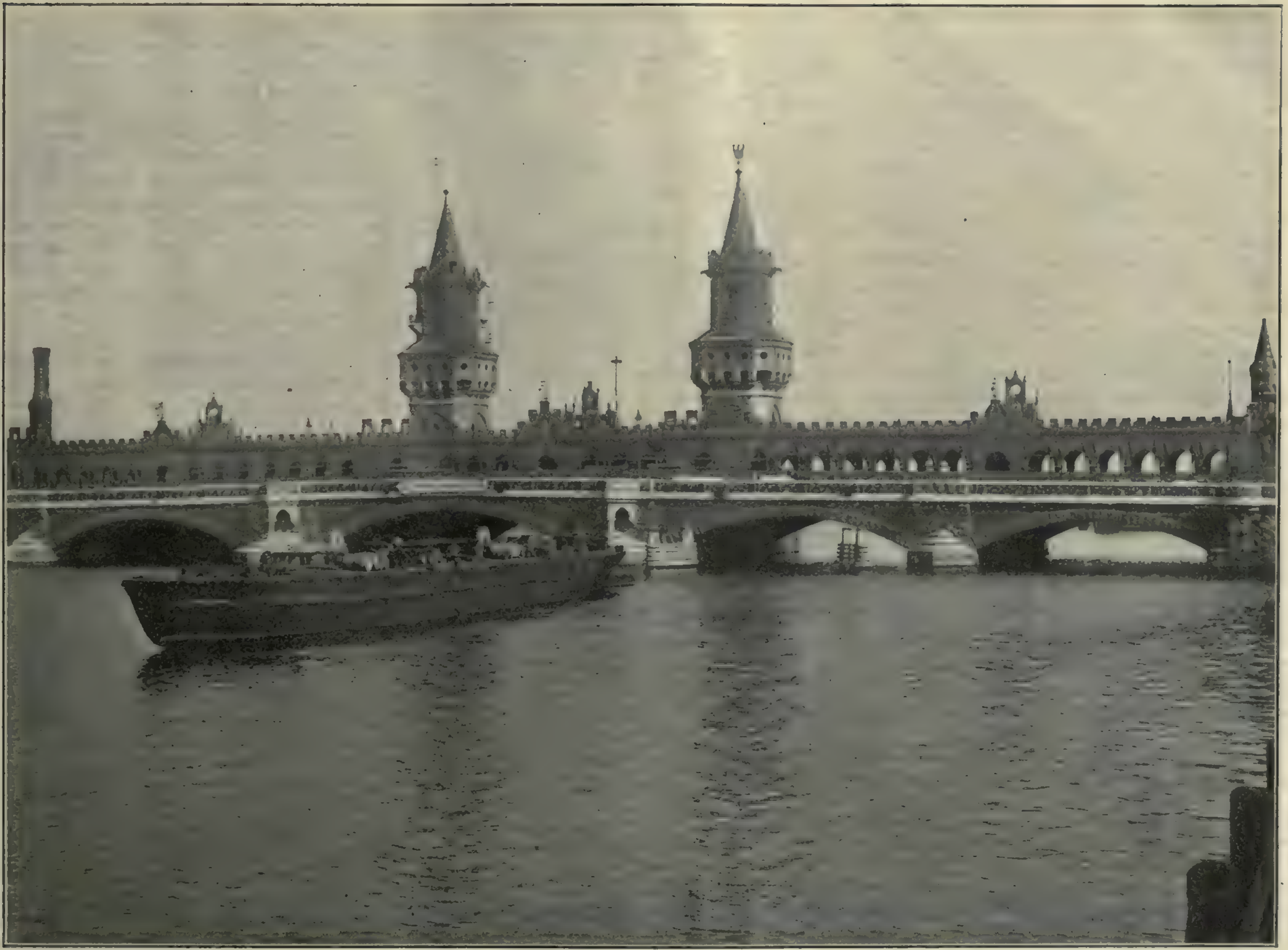
*Extracts from a paper in the "Technograph" by W. C. Lemen, Topographer, U. S. Engineer's Office, St. Paul, Minn.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXVI, BERLIN, THE OBERBAUM BRIDGE.

This is the latest constructed bridge in this city. It is of granite and red brick, and is designed for the elevated railway as well as for vehicles and pedestrians. The towers marking the channel on one side only hardly appear logical.

Relative importance of different features.—The relative importance of the different features of this survey should perhaps be touched upon. Exact elevations are of primary importance, especially on all stadia lines. Water will seek its level regardless of whether the engineer says it ought or ought not go over such and such a divide; therefore every loop hole of the basin must be accurately tested. For this reason the modifications in the usual method of carrying elevations in stadia work, described further on, were made. While a main line of levels was carried from one reservoir to another, there are established bench marks at Pokegama and Leech Lake Dams, whose relative heights to the water in the reservoirs and flowage lines of reservoirs are known; their height above sea level has been determined only by a long line of ordinary levels.

Second in importance is the location of all section and quarter section corners which bear any relation to the overflowed lands. Horizontal position, while necessary within reasonable limits, need not be precise, since a location relative to the section corners is desirable. Lastly, all topographical features should be taken, especially kind of timber, soil, cultivation, and any facts which may aid in estimating any damage by overflow.

Levels.—A double duplicate line of ordinary levels was run from one reservoir to another, upon which all topography elevations are based. Elevations were carried about the lakes by water levels. The closures on this line were well within the usual limit of 0.05 ft. $\sqrt{\text{dist. in miles}}$.

In this work an original method of duplicating a line while running in one direction was used. A 12-foot, self-reading rod, graduated to hundredths of a foot, was used, being read to nearest half hundredth. The rod was first read direct on the turning point, then reversed end for end and read from the top down. Thus two lines were carried along, which should remain exactly 12 feet apart. All accidental errors were eliminated. Notes for one line were kept on the left hand page and for the other on the right hand page. A level party usually consisted of an observer, a recorder, and two rodmen. In heavy cutting an extra man was added.

Section corners.—The location of these corners calls for some long stadia lines and forms a considerable part of the field work. A great deal of patience, perseverance, a knowledge of woodcraft and a quick eye are needed in discovering what now remains of these corners. The land survey of this country was made between 1869 and 1875. The original corner stakes are sometimes found in the swamps still in fair preservation.

Geographical position.—The azimuth and horizontal positions are carried by tertiary triangulation supplemented by a chained traverse line. The targets for all triangulation points were peeled poles with red and white flags for finders. A transit, reading directly to 20 seconds and by estimation to 10 seconds, set over the holes of the poles, was used in reading angles, four readings of the angles being made. The limit for the error of closure of triangles is 30 seconds though this limit is rarely reached, an average closure being about 10 seconds. Sides of triangles range from 500 feet to 3 miles in length.

On base lines, which are put in about every 6 miles or when work progresses from one township to another, closures of 1 in 500 in length and 1 minute in azimuth, after correcting for westing, are required. In all chaining a 300-foot steel tape is used. Fifteen pounds tension is put on the tape with a small spring balance. Corrections for difference in elevation of base stations, where necessary, and for difference of temperature are made on the base lines.

Azimuth observations are made upon Polaris along one side of the triangulation, preferably on the base line. A new azimuth is obtained for each township. These observations are made at any convenient time, and the azimuth of Polaris deduced from a table found in "Manual of Instruction" issued by the Commissioner of the General Land Office in 1890.

Permanent marks are left in pairs about every two miles at the triangulation points. A known azimuth is therefore always available at almost any point in the system for future work. These marks consist of a limestone slab about 4 x 14 x 18 inches with a copper bolt leaded in it, buried about 3 feet in the ground, surmounted by a 4-inch iron pipe 4 feet long. On top of the pipe is a removable iron cap fastened by brass burrs so a reading on the copper bolt is obtainable. The foot of the pipe is split and flared out to about 8 inches in diameter. This prevents any one pulling it up, and keeps it from being heaved by the frost. The cap bears letters and figures indicating the bench mark's use, date and number. Its elevation is also known.

Topography.—The three main features to be obtained are the shore line, the flowage line of the reservoir, and the contour 4 feet above this flowage line. This additional 4 feet is taken to give a certain margin of safety and to give an idea of the country immediately adjacent to the reservoir. This limit is sometimes reached upon the immediate shore of the lake or river, but more often is obtained by a gentle slope through swamps and wind falls.

Stadia courses are run following out these particular features. Starting from some triangulation point they are closed on it or some other portion of the system. Long stadia lines are avoided when possible, though some courses are five miles in length. An average line is about two miles. The allowed error of closure on these lines is 5 minutes in azimuth, 1 in 500 in distance, and 0.2 of a foot in elevation regardless of the length of line. Exceptions are made where lines are run through very soft swampy country or of extreme length. Stadia rods are 15 feet long, graduated to feet and tenths. Instrumental manipulations are the same as are used on all stadia work so far as the measurement of distance is concerned.

The ordinary methods of carrying elevations with the vertical circle, which is almost universally associated with stadia work, was not considered sufficiently accurate for the needs of this survey. In following out a contour the elevation of each point must be known as soon as a shot is taken, which is not practical by the ordinary methods. For these reasons the following modifications were made. Instead of a vertical circle, a bubble equal in delicacy to those upon good ordinary levels was placed on the transit and levels were carried with it. The principle of a gradienter screw as a leveling instrument was applied, without the gradienter screw itself, to give sufficient range in elevation to cover the ground. This range of ground is from 8 to 13 feet, though sometimes greater heights have to be reached owing to the character of the high ground.

As long as the difference of elevation is insufficient to take the rod out of the field of the telescope, the carrying of elevations is simply a matter of plain leveling. If, however, the rod is above the height of the instrument, the telescope must be inclined and some method used to measure the angle of inclination or the amount of this inclination in feet at the point taken.

This method may best be explained by an example. Suppose the head rodman has his stake 1,000 feet away and 10 feet above the "height of the instrument," which for convenience in recording is called E. I. When the telescope is level, the middle wire is just 10 feet below the foot of the rod. Assume the telescope reads 1 foot on the rod for 100 feet on the ground. Now elevate the telescope with the tangent screw until the lower wire occupies the position the upper wire did when the telescope was level, which can be done by noting the position of the upper wire with reference to some small object such as a twig, knot on a tree, etc. Now the middle wire has been raised just one interval and the rod being 1,000 feet away this interval is 10 feet at the stake, and the elevation of the forward stake is = E. I. + 10 feet — rod reading (0 in this case). The E. I. is always equal to the elevation of the stadia stake plus the height of instrument above the back sight. This operation may be repeated any number of times, within a certain limit, each operation adding the interval (10 feet in this case) to the E. I. One-half intervals may be read without inclining the telescope by reading the upper or lower wire instead of the middle wire.

In case of a slope downward, the operation is reversed, bringing the upper wire to coincide with the position of the lower one, etc. This method has been called "drop elevations," though a raise is more often used, since there is less range up than down, due to being able to use the full length of rod going down hill. When ten raises have been made an error in the elevation due to the inclined sight, becomes 0.01 foot for every 100 feet; therefore an incline of this amount is avoided. Five raises in the main stadia line are all that is considered good practice; this number is not often required. Another accumulative error occurs where considerable change of focus is necessary in the operations, and change of focus should be avoided if possible. The principal accidental error is inaccurately placing the wires, which accumulates or multiplies when the focus is changed. By reading the elevations both forward and back on the main line, using the plumb bob string for a sight, a duplicate line of levels is carried. This duplication eliminates errors of adjustment, curvature and refraction, which, with shots that are often 1,000 feet long, are considerable. Excellent results are obtained by this method, an average closure of 0.10 being obtained.

A topography party usually consists of an observer, a recorder and four rodmen. Extra men are added in heavy cutting.

The Construction and Dimensions of Chimneys for Boiler Plants.—II.

The stability of brick chimneys.—The principles laid down by the German Academy of Building may be considered as sufficient, provided some allowance is made for the stresses due to high smoke temperatures in some cases. They are as follows: "The calculation of the stability of high structures having a limited base area, as chimneys, unsupported walls and towers, considering them as independent masses of masonry affected only by wind pressure, should provide that at that point where the maximum overturning stress occurs the resultant of this force and the opposing force due to the weight of the masonry above that point must fall within the area of the cross-section at that point and must not come so near the edge of the section that the masonry is liable to crush under the pressure. No account is to be taken of the adhesion of the mortar to the bricks, the joints on the wind pressure side being considered free to open."

Allowable stresses.—The construction of a chimney usually occupies a short space of time compared to that needed for other work, and in service is exposed to the strains due to expansion under heat. On this account the pressure allowable per square foot of section is to be diminished the more rapidly the construction is carried forward. Since a stack 65 feet in height is finished in about 5 or 6 days and one 200 feet high in about 50 days, it is desirable to assume the pressure with reference to the time required in construction, or more simply, with regard to the height. There are, of course, other causes that influence the time of construction, such as the diameter, the weather and the methods employed by the builders, but they are of secondary importance compared with the height. Assuming the temperature of escaping gases to be below 600 degrees Fahr., the following rule is to be recommended: The allowable pressure, p, neglecting the adhesion of mortar, shall nowhere exceed that given by the formula $p = 71 + 0.65 H$, in which H denotes the distance in feet from the top of the chimney to the point in question and p the pounds per square inch. Substituting in this formula we get

H =	75	100	150	200	250	300	400
p =	120	136	169	202	233	266	332

For small chimneys it is not enough to fix a minimum pressure, as trouble may arise from opening joints due to poor mortar on the windward side. This may be provided for by fixing a maximum limit for the tension due to the wind pressure. This limit must be set low because of the uncertainty regarding the quality of the mortar, its adhesion to the bricks and the care with which they were laid. Furthermore, if the mortar should fail, there must be little, if any opening of the joints, as the variations of wind pressure would cause oscillations and further damage. These difficulties would be overcome if the resultant of the forces due to the weight of the masonry and the maximum wind pressure does not fall farther away from the center of gravity of the stack cross-section at the point in question than $\frac{1}{2}R + \frac{1}{4}r$, in which R and r denote radii of the circles inscribed in the inside and outside perimeters of the cross-section, provided these are in the form of a circle or a regular polygon. If the formula is satisfied, the joints can open only half-way round the circumference at most. It is further to be desired that this opening shall be only an infrequent occurrence, therefore a low limit is set to the tension on the windward side as shown in the formula $p = -18.5 + 0.056H$, the negative sign indicating tension. Substituting various values for H in feet we have

H	75	100	150	200	250	300	400 feet
P	— 22.7	— 24.1	— 26.9	— 29.6	— 32.5	— 35.3	— 41

If the value of p does not exceed the limits set in these two equations, the stability of the chimney in its newly-built condition may be considered sufficient. When it has been in use some time the gradual hardening of the mortar increases its strength, but on the other hand there are new stresses to be encountered due to expansion from the heat, increasing with the increase in temperature. It is, therefore, to be understood in applying these formulas not only that brick of good quality and lime mortar strengthened with cement are to be used, but that the temperature shall not rise above 570 degrees, or that in case a higher temperature is to be allowed, the stack shall have a firebrick lining. If this is not done, the values for p in the preceding equations should be diminished, and the same is true if the mortar is made with lime alone. If the stack has an independent lining, the quantities 85.0 and — 21.3 may be substituted for 71.0 and 18.5 in the equations for p, since the time required for building is longer, and the strains due to expansion are less. If lime mortar is to be used, the determination of the proper limit is more difficult, but it will be sufficient if the contractor be required to furnish samples of the mortar, for these to withstand three times the highest allowable joint pressure due to the wind in the same time as is allowed for the completion of the stack. The construction time so fixed is not then to be shortened.

It may be here remarked that the former practice of assuming a fixed value for the allowable pressures gives dimensions that are too small for the small stacks and too large for the large ones. Since the present tendency is toward large central power stations, requiring high stacks, this is the more to be avoided.

The wind pressure is to be considered as that on a plane surface normal to its direction.

Since the accuracy of instruments for measuring the force of the wind leaves much to be desired, estimates of the allowable pressure vary widely. It is generally admitted, however, first, that the pressure is to be considered greater than on other structures in order to allow for the strains arising from expansion due to the heat, and second, the pressure increases with the distance above the ground, because of friction and impediments on the earth's surface. This variation in pressure is not usually considered because of the resulting complication in the calculation, but, as will be shown later, this is not a serious matter. It is the more to be desired that this variation be taken into account since it is the only way that stacks of differing heights may be made of uniform stability, without an excess of masonry in the smaller ones or a dangerous weakening of the upper part of the larger ones.

Let w denote the wind pressure in pounds per square foot. Assume that the pressure ω_x at a height of x feet above the ground level is 0.001 pounds per square foot greater than ω_u, the wind pressure at the ground level, therefore, $\omega_x = \omega_u + 0.001x$. To compare this with the accepted method of assuming a uniform wind pressure as, ω, for the whole height of the stack as in the equation, $\omega = \omega_u + 0.0006H$, where H denotes the total height in feet, it will be apparent that while both expressions may indicate the same total moment at the base of the stack, that for the uniform pressure will give a smaller moment at the cross-sections near the top than that for variable pressures. The latter is no more cumbrous in form, while it certainly agrees more closely with the existing conditions. The values to be assigned to ω_u and ω_s, the wind pressures at the foot of the shaft and on the lower or base portion of the stack, vary according to circumstances. The following are average figures, in pounds per square foot:

Ordinary surroundings, $\omega_u = 25$ lbs.; $\omega_s = 20.$ lbs.
Exposed situations, $\omega_u = 30$ lbs.; $\omega_s = 24.5$ lbs.
On the seacoast, $\omega_u = 35$ lbs.; $\omega_s = 28.6$ lbs.

Here ω_u denotes the pressure at the point where the taper of the shaft proper begins, and ω_s the average pressure between this point and the ground. Owing to the losses by friction near the earth's surface, ω_s is smaller than ω_u. At higher altitudes the velocity of the wind is greater but the density of the atmosphere less, consequently the value of ω_u need seldom be taken as more than the preceding figures. In the case of the ventilation chimneys in the Tüngfrau tunnel, 40 pounds per square foot was used.

Influence of the cross-section on the wind pressure.—Let F denote the area in square feet of the vertical section of the stack taken through the axis. This plane is usually normal to the perpendiculars to two opposite sides when the horizontal cross-section is a polygon. Then cF may be taken as the area to be actually reckoned in calculating the wind pressure, c being a constant factor which varies with the design of the stack in question. For circular chimneys c = 0.667, for octagonal ones 0.71 and for square ones 1.0. The most dangerous direction of the wind for polygonal stacks is that which brings opposite surfaces normal to the wind direction, not because the wind pressure is then greater but because the stresses at the perimeter of the cross-section are then at a maximum.

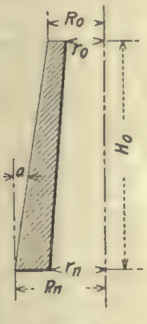


FIGURE 3.

The effect of suction caused by the wind on the leeward side is allowed for in the values assigned to ω and c. According to Figure 3, which shows the half vertical cross-section of the shaft, the breadth of the half section at the height, x, is

$$y = \frac{H_o - x}{H_o} R_n + \frac{x R_o}{H_o}$$

hence the moment of the wind on a small area of height, dx, multiplied by c, the factor for the shaft section, will be

$$c\,(\omega + 0.001\,x)\,y\,x\,dx,$$

and for the whole area, substituting for y,

$$2c\,(\omega_u + 0.001\,x)\left(\frac{H_o - x}{H_o} R_n + \frac{x R_o}{H_o}\right) x\,dx$$

which being integrated between the limits of o and H_o gives the total moment at the base,

$$\tfrac{1}{6}\,c\,H_0^2\left\{2\,\omega_u\,(R_n + 2\,R_o) + 0.001H_o\,(R_n + 3\,R_0)\right\} = M_{sh}$$

in which H_0, R_0 and R_n are in feet, ω_u in pounds per square foot, and M_{sh} in foot-pounds. For a constant wind pressure the second number in the main parenthesis disappears. In order to calculate the wind pressure W_m on each section of the shaft, the distance, x_m, of the middle of the height of each section from the bottom of the shaft must first be found, as well as ω_m, the wind pressure for each section. If m be the number of the section counting from the top, h_m the height of this section, while the total number of sections is n, then will $x_m = \frac{1}{2} h_m + \Sigma\, h_m$ between m + 1 and n + 1, $\omega_m = \omega_u + 0.001x_m$ and $W_m = c\,\omega_m\,h_m\,D_m$ where D_m is the average diameter as given later on. Since ω_x increases with the height, while the diameter decreases at the same time, it is sufficiently exact to assume that the wind pressure, W_m, is exerted at the middle of the section, provided the latter is not too tall. Then the wind moment on the mth section with respect to the base of the shaft will be simply $W_m\, x_m$. By summation of W_m a second expression for the total moment is obtained namely, $M_{sh} = \Sigma\, W_m\, x_m$ between the limits of n and 1. It may be noted that the actual values of M_{sh} derived from these two equations should not differ more than one-half one one per cent., otherwise errors are to be suspected.

In order to calculate the moments M_v for the bottoms of the separate sections the values already obtained are used in the following manner. If v is the number of the base of the section, counting from the top, then $W_v = \Sigma W_m$ for the upper v sections; Σh between n + 1 and v + 1 equals the distance of the bottom of section v from the base of the shaft, and $\Sigma W_m x_m$ equals the sum of the wind moments of the v upper sections with respect to the shaft base. Then $M_v = \Sigma W_m x_m - W_v\, \Sigma h_m$, the total moment of the upper v sections about the shaft base as required. When v = n this equation becomes $M_v = \Sigma\, W_m x_m$, as Σh_m between n + 1 and v + 1 = 0.

These values need only be worked out when it is necessary to ascertain that the weakest joint lies above the base of the shaft. If the sections are of uniform height and increase uniformly in thickness this calculation is unnecessary for heights below 150 feet. If, however, H_0 is greater than 150 or H is less than 150 where the sections are of uneven length, particularly if the lower ones are the shorter, the values of the moments M_v and those for o″ and o′ the stresses in the joints, as given further on, should be worked out until the stresses decrease regularly. The effect of architectural ornaments can be neglected in calculating wind pressure as well as in estimating the weight.

The wind moment and wind pressure on the base depend very much upon the surroundings. In any case the pressure per square foot is considerably lower, as previously shown, because of the friction near the earth's surface. If no distinction in design is made between base and shaft, the shaft running with even batter right down to the foundation, the lower section may be regarded as the base, and considered as being acted upon by the decreased wind pressure ω_s.

Let F_s in square feet denote the area of the vertical section taken through the axis perpendicular to two opposite sides of the polygon forming the horizontal section. Let M_s in foot-pounds be the total wind moment of shaft and base about the bottom of the base, and H_s be the height of the base. Then $W_{sh} = \Sigma_1^n W_m$ the wind pressure on the shaft in pounds. $W_s = c\,\omega_s\,F_s$ the wind pressure on the base in pounds and $M_s = \frac{1}{2} W_s\, H_s + \Sigma_1^n\, W_m\,(x_m + H_s)$, or more conveniently $M_s = M_{sh} + H_s\,(W_{sh} + \frac{1}{2} W_s)$. The wind moment, M_u, about the foundation bottom, where H_u denotes the part of the structure below the ground level, will be

$$M_u = M_{sh} + (H_u + H_s)\,W_{sh} + (H_u + \tfrac{1}{2} H_s)\,W_s.$$

The weight of the different portions.—Let y denote the weight of a cubic foot of brickwork, stonework or concrete, and u the factor of the horizontal section. In order to make a preliminary estimate of the total weight of the shafts the internal offsets may be neglected, as in the following formula, according to Figure 3,

$$G_{sh} = \tfrac{1}{3} y u\, H_o\,[R_n^2 + R_n\, R_o + R_o^2 - (r_n^2 + r_n^2 r_0 + r_o^2)].$$

This formula is a closer approximation when the sections of the shaft are of the same height and the differences in thickness uniform, under such conditions it should be within one-half of one per cent. of the actual weight, but under unfavorable conditions the error may be 8 per cent.

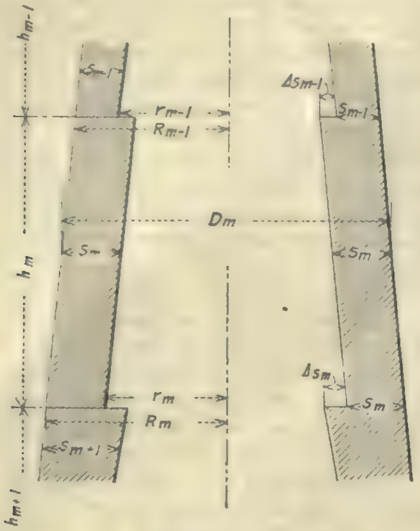


Figure 4.

For the weights of the separate sections, G_m, referring to Figure 4, and taking the mth section from the top

$$G_m = yuh_m s_m (R_{m-1}+r_m).$$

Another formula, more frequently used, but less convenient, is

$$G_m = \tfrac{1}{4} yuh_m (D_m^2 - d_m^2),$$

in which D_m is the diameter of the outer inscribed circle and d_m that of the inner inscribed circle of the horizontal cross-section taken half way up the mth section. These two formulas apply to square, octagonal and round chimneys. The weight, G_v, of the upper v sections may be easily found by the summation of the values of G_m corresponding.

$$G_r = \Sigma_1^u G_m.$$

For $v = n$ another and more exact value for the weight of the shaft is

$$G_{sh} = \Sigma_1^n G_m.$$

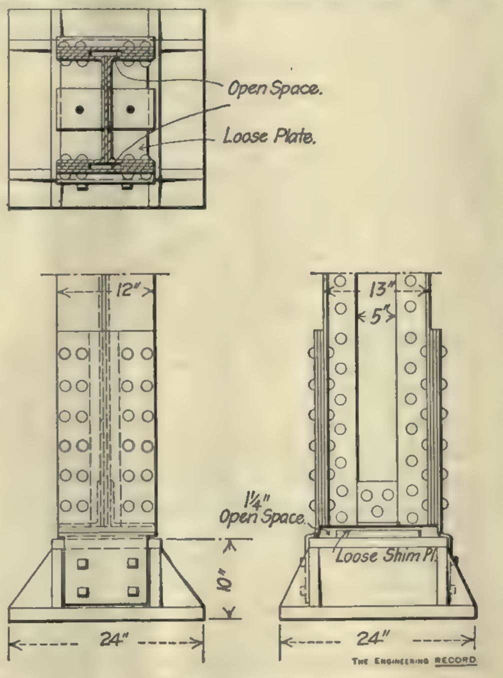
The weight of the base may be found from the equation $G_s = y_s H_s F_s$, in which y_s is the weight of a cubic foot of the base masonry, H_s, the height of the base, usually extending to a little below the ground level, and F_s the average area of the horizontal section. The weight of usual ornamental projections and indentations is neglected, also the footing projection at the bottom, in both the calculations for the weight and for the joint stresses. If the base at the smoke flue and entrance openings is not strengthened, the stresses at this point should be specially worked out in order to avoid undue weakening. The weight of the foundation, which is usually a truncated pyramid of concrete, may be found by estimating its volume in cubic feet and multiplying by the weight of a cubic foot. The stresses at critical joints should be worked out for every construction; these are at the bottom of the lower sections, the bottom of the shaft, the base and the foundation and the section at the smoke flue as discussed above. In order to find the eccentricity, i.e., the distance a between the resultant of the wind pressure and the force due to the weight of the stack at the center of gravity of the vth section, $a = M_v \div G_v$ in which previously found values of M_v and G_s may be substituted. For the bottom of the shaft, $a_n = M_{sh} \div G_{sh}$; for the bottom of the base, $a_s = M_s \div G_s$; and for the bottom of the foundation $a_u = M_u - G_u$. For all these equations a is less than c as stated at the outset, otherwise the pressure is to be considered as too great, and the area should be increased before going farther.

To determine the pressure o_0 in the above critical joints without regard to the wind, let F in square inches denote the area of the joint in question, and G the weight of the masonry above it in pounds. Then $o_0 = G \div F$ in pounds per square inch.

Since the above extracts from Professor Lang's article were put in type, The Engineering Record learns that Mr. W. W. Christie has prepared and copyrighted a translation of the entire paper, giving the formulas in American and metric measures, parts of which will appear in future editions of his work entitled "Chimney Design and Theory."

A Poor Column Seat.

An instance of how badly steel construction can be made and yet be concealed from superficial observation was afforded recently by some columns in an apartment house now being erected in New York. The floorbeams are supported on the side walls and by a center longitudinal row of steel columns seated on cast-iron pedestals in the cellar. Both columns and pedestals are of ordinary design and apparently of suitable dimensions, materials and general construction; the trouble lay in the finish and assembling. The lower sections of the columns are of I-shape cross-section made up of a web plate and four angles, and have no base plate on the bottom end, the bearing on the pedestal being designed to be between the ends of the angles and the horizontal top of the casting. Neither of these surfaces was planed or machined as required by law, and neither of those examined were true or smooth. The column angles and plates had been sheared to approximate length and riveted up with the ends projecting irregularly, and the tops of the pedestals were not even as good as ordinary rough-cast surfaces, because projecting ledges, like chipping strips, on two opposite sides of each had been roughly cut off. In some cases the column web projected below the angles, and in one case it was cut so obliquely that if it received bearing it could only be at one corner, concentrating the load at a single point.



A Poor Column Seat.

Evidently this state of affairs was somewhat objectionable to the builders; possibly from considerations of plumbing the columns sufficiently to permit their erection; and they had ingeniously remedied it by riveting to the sides of the columns jaw plates which engaged the webs of the pedestal and were bolted to them, thus at once covering up two sides of the open joint and giving the appearance of a spliced connection. As the columns were narrower than the pedestals the jaw plates were fillered out from the column and the twenty-four rivets through each plate gave an appearance of strength which was hardly maintained by the connection between the lower end of the plate and the pedestal where the same stress was provided for by four small bolts into or through holes of unknown character in the casting. This connection carried the column entirely free of the top of the pedestal and forced all the column load to be transmitted through the bolts in single shear which could hardly be expected to act together with full simultaneous bearing, so that it is probable that the bolts would be successively sheared off as the load was applied to the column.

The crack between the end of the column and the top of the pedestal was partly filled with loose thin plates, small shims, wedges, etc., but most of them could be explored pretty thoroughly with a long thin piece of steel which had apparently been provided to furnish shims. Some of the jaw plates were riveted to the columns over several thicknesses of fillers of the full width of the column and thick enough to match the sides of the pedestal and allow straight jaw plates. In other cases pairs of narrow fillers were used with an open space between, and as their combined thickness was insufficient, the jaw plates were offset with a double bend to clear the pedestal. It was stated that the architects were unable to have the steelwork shop inspected because it was a case of friendship between the owner and builder, and the former trusted the latter and would not authorize the expense of inspection. When the lower sections of the columns were set the architects employed an engineer to inspect them and on the receipt of his report ordered them all to be removed, and retained him to make complete inspection of the steel work.

Syphons for Water-Works.

The development of ground-water supplies is receiving the same attention in Austria as in other European countries and the technical publications of the kingdom have lately contained a number of interesting papers on the subject. One of them, on syphons, was written by Mr. Heinrich Adolf and appeared recently in the "Zeitschrift" of the Austrian Society of Engineers and Architects. In the introduction the author mentions the drawbacks of a collecting gallery intersecting the water-bearing stratum, and states that there is an increasing preference for a series of wells so placed that when they are drawn upon to their maximum capacity their depression curves are tangent. With such an arrangement the most important technical question is the bringing together of the yield of the different wells. The use of a gravity pipe line assumes its location at a lower grade than the water level at the time of maximum draft, and is open to the same objection as regards cost as the collecting gallery. In order to avoid this expense, syphons are employed, and the following article gives the author's statements concerning their design and construction.

The saving in excavation, x, is shown by Figure 1 to amount to $x = H - h$, where H is the height of the column of water which corresponds to the air pressure, with the vacuum practicable in a pipe line; it may be taken as 20 to 26 feet, according to the care taken in construction. The friction loss in the pipe is h. The inclined line is the hydraulic grade line. The syphon is preferably laid on a rising grade to a single high point, and the equation shows that the most favorable point for the summit is at the well from which the water is taken, for h may thereby be neglected. It is not always desirable to place it there, however, when the air collecting at the summit is removed by an air pipe, for the latter may then become very long. Where the syphon is kept in operation by charging it with water, this objection disappears. The value of h may be considerable with long distances and small pipes, and should be estimated carefully. If x is greater than H-h, the pipe rises above the hydraulic grade line and the flow will stop, by the accumulation of air, for part of the pipe wil then be acting as a channel only. This explains the fact that the discharge of a syphon cannot be increased by lowering the level of the outlet much below that for which it was designed. If the water is taken from the lower well by a gravity pipe line, the regulation of the level is assured, but where the water is pumped from the well some form of signal or automatic regulator is needed.

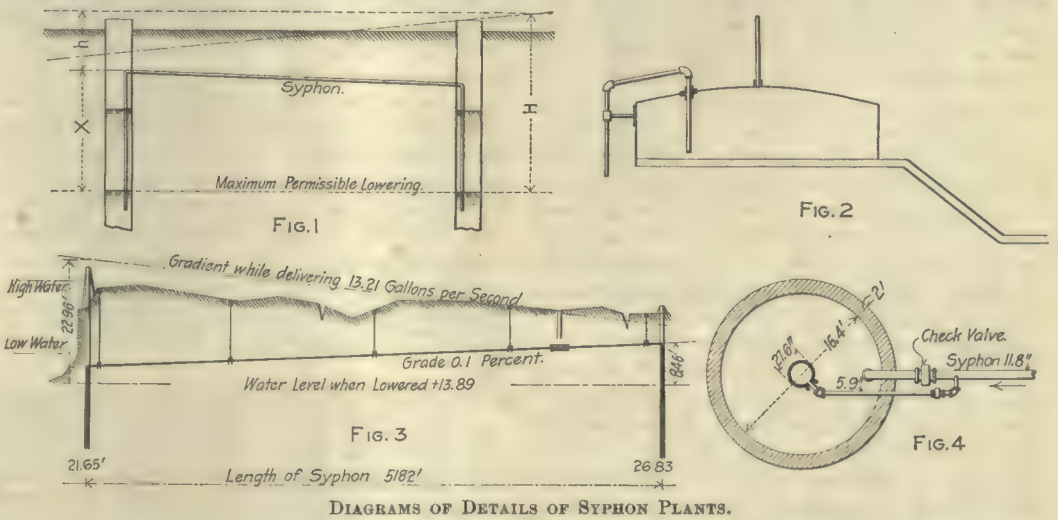
When the diameter and the height x have been correctly chosen and the pipe is tight, the operation of a syphon without branches is simple and entirely reliable. If the syphon serves as a branching collector for the water of a group of wells, certain phenomena occurring in operation must be provided for in advance. The hydraulic gradient of such a system is a branching line, with its slope fixed by the lowering of the water level at the outlet of the syphon and by the loss of head. The supply from each well is as large as the pipe can carry under the given conditions provided each well can furnish that amount of water. If a part of the wells cannot supply this quantity, a complication in the operation arises.

The velocity of flow is determined by the lowering of the surface of the water at the lower end; this causes the delivery from the well of the volume Q through the pipe of cross-section F. If, now, in the equation $v = Q \div F$, a smaller volume, q, enters in place of Q, a reduction in F must result; that is, a part of the cross-section only will be filled. This calculation is not exact because the friction is not considered in the change of section; the fact that the inadequate yield of a well prevents the complete filling of the pipe connected with it, follows at all events from that cause. An increase in the discharge through lowering any one point of a system is impossible because in the entire system the pressure is determined by the permanently high water level of the head or yielding well.

The operation of the leg of a syphon which does not run full must be irregular because bubbles of air entrained in the water will collect in the dry spaces and spoil the vacuum. In this way the outer atmospheric pressure is reduced as respects this leg, and there results a countercurrent or at least a damming of the discharge from the other leg where the pressure is higher. The discharge is thus deranged, the velocity is gradually reduced as the cross-section is more and more nearly filled, and while the two opposing forces remain in equilibrium the water rises in the slow-yielding well in order, when its level again attains the upper hand, to step into its former place on the stage and repeat the performance. The fluctuating water level in the well causes a more rapid chemical change in its walls, if of metal, and a greater inflow of particles of sand. In the syphon leg the changing motion hinders the removal of the air bubbles and finally affects the movement in the main leg of the system. In order to check such countermovements in the branch or side legs, a back-pressure valve is often improperly introduced. The counter-movement mentioned is not strong enough to seat the valve since it has to overcome the discharge still taking place, and the valve, remaining in a floating position, only complicates the phenomena in the pipe. The valve also hinders the complete equalization of the vacuum in the two parts of the pipe. If the air is drawn out above it, it will be closed; if this happens below it, there will still remain in the upper part of the pipe the air which does not reach to the valve. It is not always practicable to attach a suction pipe to both legs, and the simplest plan then is to bore the valve at the top with a small hole. The air carried along by the motion of the water, which otherwise struck the valve, will be advanced in this way.

A further irregularity can arise from essential differences in the lengths of the several branches, occasioned by the resulting different friction losses. In any event it is necessary to refer the drop in the hydraulic grade line caused by the lowering of the water level to the most distant well; that is, in the requirement that x must be less than (H-h), the value of h must be that of the longest arm. Disturbances from this cause need not then be feared. The water level in the distant well will remain higher than that in the others, and the supply will not be fully utilized if the effect of the distance is disregarded in selecting the diameter of the pipe.

All such complications are best met by making the diameter of the pipe correspond with the yield of the well and the length of the pipe, or by introducing throttling valves where the original diameter of the pipe is too great, by which means the operation is still further simplified because of the opportunity the valves afford of shutting off sections of the system for repairs. It is advantageous to keep a long and branched syphon system in steady operation by occasionally removing the air collected at the various high points. If this is possible, the legs can be allowed to slope down toward the main pipe and each can be fitted with an air suction. The ability to restore the vacuum at any time by sucking out the air gives this system a decided advantage over that of filling the syphon with water, and, moreover, obviates the use of foot-valves.



DIAGRAMS OF DETAILS OF SYPHON PLANTS.

Precautions must be taken to prevent the lowering of the water level at the ends of the legs so far as to expose them to the air. The safest way is to have the end reach down below the suction height, particularly at the upper well which is more withdrawn from supervision. If the foot of the pipe is more than about 26 feet deeper than the summit of the syphon, sucking-dry is prevented. This often makes it necessary to sink the well deeper, but it has an advantage over all automatic mechanical devices. In the case of the lower well this measure is expensive if the well has a large diameter in order to serve as a pump well and must be carried down through material containing ground-water. It will answer in such a case to put in a water-level indicator or signal at the pumping station to indicate the lowering of the water.

With syphons it must be possible to limit the draft on the wells to a certain maximum amount. If a great sinking of water level is dangerous to a well, the avoidance of such a condition should not be left to the conscientiousness of the attendant. The supply corresponding to the desired depression is regulated by a valve, an appliance which always requires a correction or calibration more careful than it usually gets. In order to accomplish this result automatically, the author designed an apparatus actuated by a float, which, on account of its simplicity, may be employed without hesitation. The float, Figure 2, is filled with water and ceases to operate as soon as the water surface rises above the summit of the little syphon, so that the inflow into the well can take place without interruption. If the water drops below this summit, the float is emptied and raises a throttling valve in proportion to the increase in lifting force caused by the emptying. The apparatus is connected to the suction pipe of the pump and shuts it off if the engineer overlooks the record of the indicator. It calls for a charging device for the suction pipe in order that the outer pressure on the closing disk, produced by the vacuum, may be stopped and the suction pipe may be again opened without hindrance.

The collection of the water in wells which have slight differences in their surface elevations is simpler than the contrary case. The syphon system will reduce the water elevation in this case to that of the lowest well. With a large drop in the elevation of the water table, the volume of the ground-water in all wells will decrease correspondingly. To remedy this the lowest reservoir may be made water-tight to serve as a reservoir and its casing may even be carried above the ground level. This is sufficient in most cases, as a number of yards additional height may be gained in this way. If insufficient, falls or steps must be introduced, and float valves employed to regulate the maximum flow. In any event the lowest well must then be provided with an overflow apparatus.

The fitting-up of syphon pipes encounters in most cases a certain mistrust, particularly if a line of considerable length is concerned. Since the matter is merely one of good workmanship and proper design, this lack of confidence is not always warranted, and such a system may result in a marked saving in cash. As a practical example of this, a syphon built under the author's supervision may be instanced. It was built to increase the water supply of wire works at Oderberg.

The total supply required by the works was 37 gallons per second, which was formerly drawn from three wells not proportional for this yield and furnishing, moreover, a water unsuited for boiler purposes on account of the iron in it. It was decided to supplement and improve this supply by a pipe line from the Oder River, and proposals for the work were asked from several parties. With the exception of the project subsequently carried out, all proposed a pumping station on the Oder.

While the works required a minimum of 7.4 gallons per second, it was clear that the draft on the new plant might rise to 13.2 gallons. An electric pumping plant pumping the latter amount against a head of 22.96 feet was figured to call for 9 horse-power at the generating station. This would call for an annual expense of 1,500 florins for fuel, amortization and labor, corresponding to a capital outlay of 30,000 florins. The syphon for the same service cost 29,000 florins. Although a pumping plant is more accessible than a syphon buried in the earth, it was claimed that with tight joints the latter was less liable to interruption than the parts of a pumping plant.

The syphon is 5182.4 feet long and 11.8 inches in diameter. It delivers the minimum quantity of 7.4 gallons per second with a velocity of 1.64 feet and a friction loss of 4.27 feet, and 13.2 gallons at a velocity of 2.33 feet and a friction loss of 11.48 feet. The lowest drop of the water level was fixed at 3.28 feet below low water, and the summit of the syphon figured as follows: $x = H - h = 22.96 - 11.48 = 11.48$ feet. It was actually fixed at 8.46 feet above the datum mentioned. The pipe is laid with a rising grade of 0.1 per cent. to a summit at the central well of the works, where the air can be removed by a steam ejector.

As shown in the profile, Figure 3, the natural elevation of the ground-water in the central well is above that of the river at the supply well. The pipe line therefore first begins to operate at the moment when the syphon gradient is established by pumping at the central well. On the pipe line there are five gate valves, near each of which small vertical pipes have been tapped into the main so that each section of the latter can be tested with a pressure pump.

The company made it a condition of the contract that the water from the syphon intended for the boiler supply should be discharged into a separate reservoir and prevented from mixing with the ground-water of the old well. The arrangement of parts sketched in Figure 4 was accordingly adopted. In the center of the well there is a cast-iron pipe 2.3 feet in diameter, with a tight bottom resting on a concrete base and united with the masonry by rings. A 5.9-inch pipe branches from the syphon and is carried into this vertical pipe. Behind the point of branching there is a back-pressure valve in the syphon in order that there may be no backflow from the well into the central pipe when the water surface in the latter is below that in the well. The feed-water for the boilers is drawn directly from the central pipe, and any mixing of the two supplies is thus avoided.

The syphon operated properly from the moment it was put in service, but the supply well, although less than 40 feet from the river, could not deliver the quantity of water the syphon was able to carry. As a test the water level in the central well was sunk to 13.1 feet above datum while that in the supply well was lowered to the foot of the syphon, 4.6 feet below the normal minimum. The supply obtained under these conditions was sufficient to fill but half the section of the pipe. The operation of the syphon was observed by replacing the cast-iron cover of the back-pressure valve with a tight glass plate. In this way all the phenomena in the motion of the water during the sinking or rising of the hydraulic grade line could be observed and also the operation of the valve itself. The latter kept the water back but at first made some trouble in starting the syphon. The air was removed above the valve, which was thus sucked against its seat by the vacuum on one side and pushed against it by the compressed air on the other side, when, by the rise of the water level in the central well, the air in the vertical leg of the syphon was compressed into a smaller volume. This was remedied by boring a 0.4-inch hole in the valve.

The yield of the supply well was increased by laying a collecting conduit 52½ feet long at a depth of 5 feet below the river bed, and the end of the syphon was extended. At the time of writing the syphon had been working with entire success for seven months.

Central Heating Plant, Ellis Island, N. Y.—I.

Ellis Island, in New York Harbor, is a small island in the Upper Bay, which is occupied entirely as the landing station for United States immigrants. For the last few years a new colony of buildings have been under construction there to replace the station which was burned some years ago. The island is altogether isolated, except as to its water supply, which is obtained through a submerged pipe line from the State of New Jersey. Lighting and heating is provided for in a central plant, and the purpose of the present article is to describe the interesting power house and the unusual method of carrying the pipe lines from the central station overhead in the covered ways which interconnect the various buildings, the intention being to study the interesting heating and ventilation in the main buildings independently in a separate article.

An accompanying map will serve to show the relative location of the buildings of the colony. The ferry from New York City reaches the island through a lagoon dividing it into two parts, which are connected together by the ferry house at the end of the lagoon. From the ferry house the covered way passes in opposite directions, one running straight to the power house but connecting with a covered way turning to the right and passing to the kitchen and restaurant and bath and laundry building, which adjoin each other, and finally by a connecting corridor from these to the main building. Similarly in the other direction it runs to a hospital building passing an outbuilding of the hospital on its way.

The power plant is shown in an accompanying plan. It is of the type in which the boiler and engine rooms are placed end to end, and both live steam and the feed mains are of the ring form. It is noteworthy also in the fact that a large pump room was necessary, this located alongside the boiler room and open to the engine room. A steam pressure of 125 pounds is carried on the plant for the electric light engines, but live steam is needed at various other points on the grounds, and for this purpose a reduction in pressure to 70 pounds is provided for. Part of the steam engines are arranged to run non-condensing, and the exhaust is utilized for heating the buildings, and the rest of the engines are operated condensing, a surface condenser with salt water for the cooling medium being used. The exhaust to the condenser passes through a grease extractor, and between the extractor and the condenser the piping is cross-connected with the exhaust from the non-condensing engines, the former pipe having an atmospheric valve for the usual relief, and the latter the customary back-pressure valve for a similar purpose—that is, to give vent when the supply of exhaust steam exceeds the demand for it in the heating system.

The boiler plant consists of water-tube boilers, made by the Oil City, Pa., Boiler Works, and installed under a specification which required an equivalent evaporation of 47,500 pounds of water per hour from and at 212 degrees Fahrenheit and under test, for which a single battery has been selected, an equivalent evaporation of 25 per cent increase at a rate of 11 pounds per pound of combustible. There are eight boilers all told, set in four batteries of two each. They are provided with the Hawley down draft. The smoke connections to the boilers pass underneath them toward the center of the boiler room to a brick smoke stack which divides the plant into two parts of two batteries each. The stack is an octagonal one, and has a constant inside diameter of 7 feet and is 125 feet high. The front part of the space between the two sections of the boiler equipment is utilized for the boiler feed pumps, and this apparatus is thus under the immediate control of the firemen. The foundations for the boiler setting consist of a concrete bed 10 inches thick, laid on the wood caps of the piling, and 10 inches wider than the wall built thereon. The walls up to 10 inches below the ash pit level are of rubble masonry of quarry stone, laid in 2-foot courses in hydraulic cement mortar.

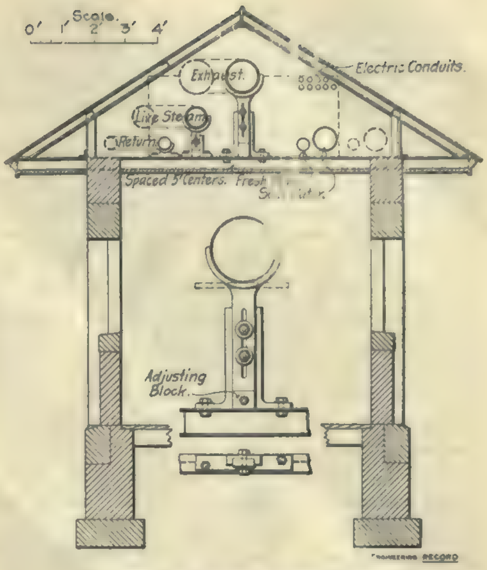
The arrangement of piping in the powerhouse is, as stated, very interesting. Each boiler feeds the ring main by a steel pipe branch 6 inches in diameter, which rises from the steam drum and drops in a long-radius steel bend into the top of the main. On the basis of evaporation given, the velocity through the branch pipes is about 1,850 feet per minute. The diameter of the ring main is 10 inches, or the equivalent in area of three of the boiler branch feeders. The main has a valve at each end of the boiler room, so that the steam can be led in either direction, as may be necessary or desirable, and the header between boiler connections is further subdivided by valves cutting off two pairs and a set of four, the latter fitted with short lengths, which can be replaced with valves to give the same arrangement as the other half.

The ring main feeds opposite ends of a 10-inch main passing through the engine-room, the piping thus forming a complete loop. The ring feeds into this engine-room header through a steam separator in each case, and the main is suspended practically horizontal, 9 feet above the floor, so that the condensation occuring in it is carried along with the current of steam to the separators, except at a point below each boiler connection where there is a drain pipe. A valve cuts off the separator on each side, which allows of readily cutting it out for cleaning or replacement. Each end of the ring main in the boiler room also feeds a branch 6 inches in diameter which supplies a system of piping through pressure reducing valves set for 70 pounds, for use throughout the colony, as well as for the pumps in the boiler room. The pressure reducing valves can likewise be cut out, being provided with a valve on each side, and as either may be used to supply the medium-pressure system no by-passes around them were necessary.

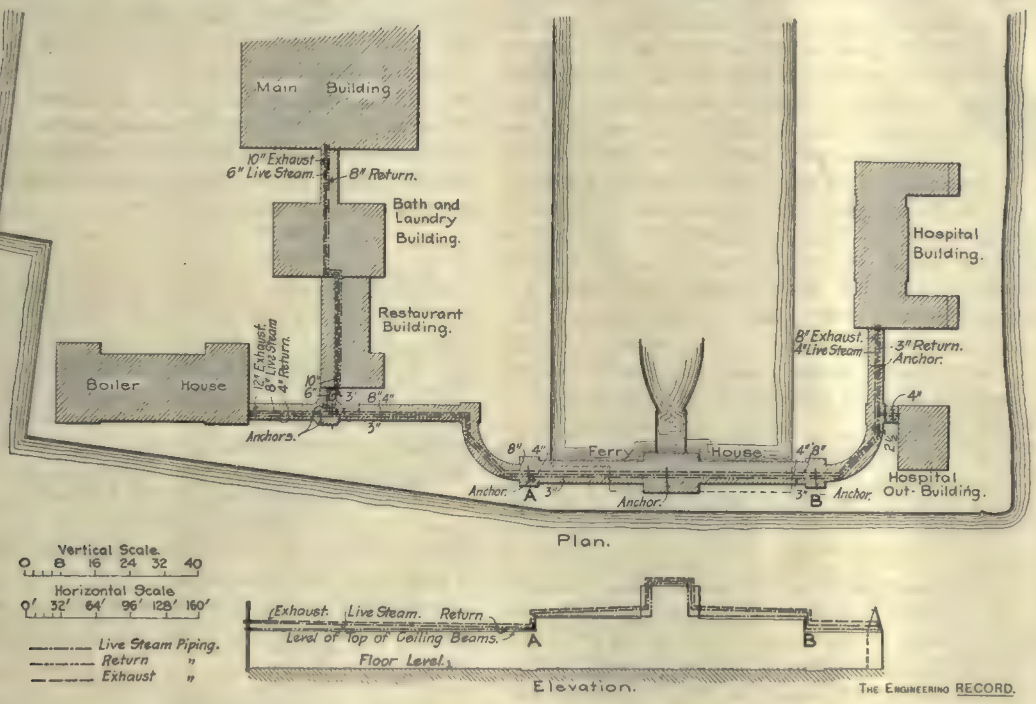
The pump main from this medium-pressure system leaves near the pump room end of the ring main and continues into the middle of the ring main in front of the boilers, this arrangement thus providing for receiving high-pressure live steam, whenever necessary, or making it possible, should the desirability ever occur, of supplying the pumping machinery from a boiler working independently. Piping has also been installed so connected up to the boiler-feed pumps that they may be operated with the high-pressure steam, while the rest of the pumping machinery is connected on the medium-pressure lines. Other than the fact that the medium-pressure main is continuous from the pressure-reducing valve at one end to the high-pressure ring main at the other, as just explained, the rest of the pumps are not connected with a duplicate system of steam mains.

The feed piping is another very interesting feature of the plant, being also a ring system, connected with either or both of the two pumps and arranged to drive through or by a feed-water heater. The pumps, as already stated, are in the center of the boiler room at the firing place, while the feed-water heater is at the inner end of the pump room, close to the exhaust piping, so that the run of the large pipe would be as short as possible. The feed-water suction is concentrated at the pumps, and the feed-water heater is connected to take the pump discharge. The delivery from each pump may pass forward and backward, and then in each case toward either end of the boiler room, the feed piping being virtually a continuous loop extending across the boiler front, passing along one end, running along in the pump room and coming into the boiler room again at the other end, all supported overhead; and the discharge pipe from each pump is connected with the front and back pipes of the loop near the center. The feed-water heater is connected up so that the delivery to any or all of the boilers may be passed through the heater, while the rest is sent direct to the boilers.

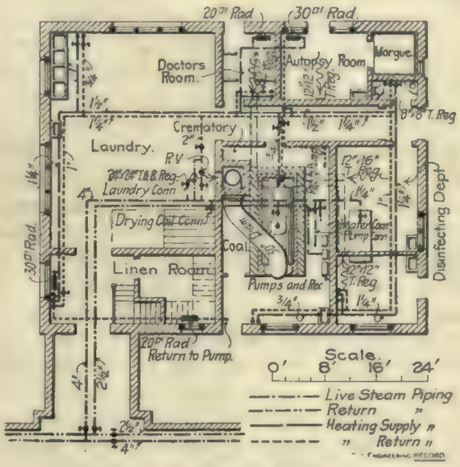
The engine room contains five tandem-compound McEwen engines direct-connected to Thompson-Ryan dynamos, the entire generating plant thus being furnished by the Ridgway Dynamo & Engine Company, of Ridgway, Pa. Two of the units are of 100 kilowatts capacity, employing 170 horse-power engines of 10-inch stroke and 11 and 18-inch cylinders, and 250-volt generators run at 250 revolutions per minute; and the other three are of 75 kilowatts capacity, with 125 horse-power engines of 14 x 9 and 16-inch cylinders and 75 kilowatt dynamos, run at 275 revolutions per minute. The larger units are intended to be run non-condensing, the exhaust steam being utilized for heating while the smaller ones may be operated condensing. This arrangement thus provides for an economical operation of generating units during the warm weather, the engines being both compound and condensing, but also makes it possible in winter to run only a part of the engines non-condensing, should the exhaust supply be sufficient to meet the demands. As already stated, the high-pressure steam main, which is carried along near the inside wall of the engine room, is supplied from opposite ends of the ring main through a steam separator in each case. The exhaust steam main, which is supported parallel with it and a little above, also has a connection at each end, one to the heating main, with the usual back-pressure valve, and the other, through an oil extractor,



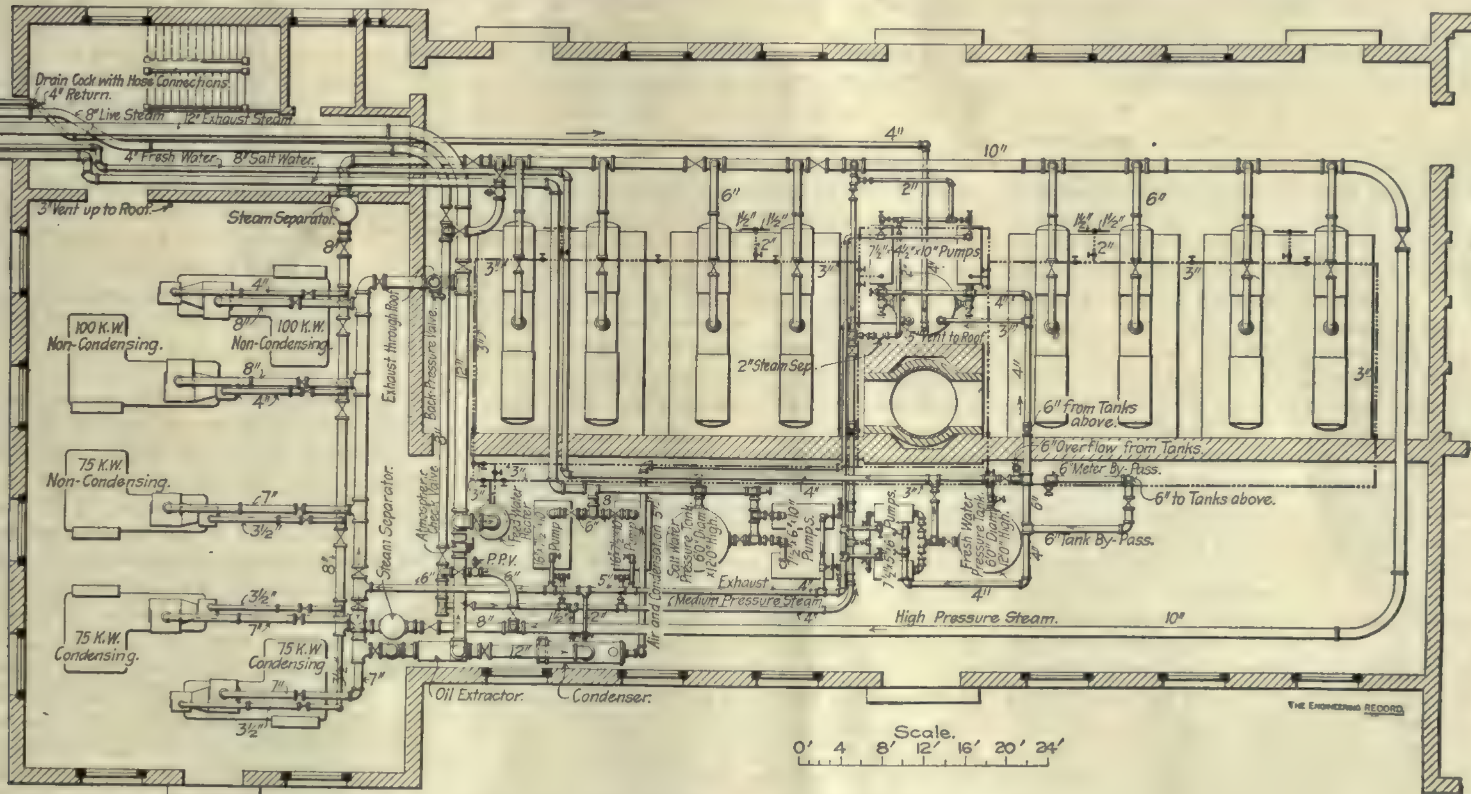
SECTION OF THE COVERED WAY.



MAP OF ELLIS ISLAND, NEW YORK HARBOR.



HOSPITAL OUTBUILDING PLANT.



PLAN OF THE ELLIS ISLAND POWER HOUSE.

to the condenser. The exhaust main from all the pumps in the pump room and the feed pumps is connected into the exhaust main in the engine room, so that it might, if desired, be connected with the condenser.

The feed-water heater, to which the feed pumps deliver, is of the National type, containing about 230 square feet of heating surface and provided with one steam connection. The condenser is a Worthington surface condenser, with 365 square feet condensing surface. It was installed under a guarantee to condense 4,000 pounds of steam per hour with a vacuum of 26 inches of mercury, using salt water, which has to be lifted 12 feet from the harbor. All the piping under the basement floor is carried in concrete trenches with cast-iron floor cover plates. All concrete throughout the power-house consists of 5 parts broken stone of the size of 2-inch cubes, 2 parts sand and 1 part hydraulic cement. The high and medium-pressure piping is covered with Keasbey & Mattison's Specialte covering.

The piping distributed about the island starts with a 12-inch heating main and 4-inch return, an 8-inch medium-pressure main and two water mains, one for fresh water, 4 inches in diameter, for the supply of the whole island, and the other for salt water, 8 inches in diameter, largely for the bath and laundry building. The return water from the heating system is brought back overhead in front of the boilers and dropped into a drip tank between the feed pumps, which draw their supply from it. This tank is 6 feet in diameter and 8 feet high, placed half above and half below the boiler room floor, and resting on a 12-inch bed of concrete, with a packing of 10 inches of concrete around it to a level slightly above the boiler room floor. It also receives the condensation from the condenser and fresh water from the tanks in the loft, the latter pipe fitted with a by-pass around the tank, allowing the feed pumps to take the fresh water directly. The pumps are Worthington, of 7½ x 4½ x 10-inch cylinders.

The water supply to the island comes in a 6-inch pipe, which rises through the pump room, passing through a meter, provided with by-pass, and connected with six tanks in the loft above, each tank 10 x 15 x 6 feet in size. Altogether there is thus a storage capacity of about 40,400 gallons, or about 337,000 pounds of water in the tanks. The tanks are emptied through a 6-inch pipe, which supplies the feed pumps, as explained, and two pumps for the fresh water system of the island, the branch suction to these pumps also receiving water directly from the inflowing water main in a by-pass around the loft tanks at the pump-room ceiling. These pumps are controlled automatically by Mason regulators to maintain a constant pressure on the water system, and they deliver either into the fresh-water main supplying the buildings, or into a pressure tank connected with the main, the tank acting as a large air chamber and as a reservoir to take up the fluctuations in the water demand. The salt water system is similarly connected with two larger pumps, and has besides two 16 x 7½ x 10-inch pumps, which provide for large pumping capacity in time of fire. The two pressure tanks are of the same size, 6 feet in diameter and 12 feet high, resting on rings of 3 x 5-inch angle iron bedded into a concrete foundation. Each tank is furnished with a lever safety valve, a pressure gauge and a glass water gauge. The tanks are constructed with a shell of ⅜-inch steel and inward dished heads of ⅝-inch steel.

The distribution of the heating piping throughout the buildings is shown on the map of the island, and an elevation of the piping through the ferry house is shown underneath it. An interesting point is the location of these pipes overhead, the return pipes being forced there because of the wet condition of the ground. Another interesting point is the auxiliary source of steam production which has been provided in the hospital out-building. In this there is an independent steam boiler, which supplies medium pressure steam into the live steam main for the supply of the hospital building for all purposes, when it becomes desirable or necessary to disconnect from the main plant.

The piping for the covered way leaves the power house through an opening about 6 feet wide, and the various pipes then are spread apart under the roof of the way. In the section shown herewith of this passage the full lines indicate the position of the pipes at the point of leaving the power building, and the dotted lines show the relative position throughout the rest of their run. The heating pipes are laid on adjustable standards fastened to the I-beams supporting the roof. The beams are spaced about 5 feet apart and the standards about 15 feet apart, no two standards, however, on the same beam. On either side at the ferry house the covered way has a wooden roof frame, but the pipes are carried in the same manner. The support also is shown at a large scale. After the alignment of the pipes was fixed a wooden block was fitted underneath the sliding part of the support. The return pipes are not fitted with an adjustable support, provision being made simply to make room for pipe covering and flanges. The pipes are jointed in lengths of about 18 feet with flanges which are extra heavy, and into which the pipes are screwed and then expanded on the inner side; the pipes are turned through the flanges almost flush with the inside of the flange. The joints are made with two thicknesses of copper gaskets, with a mixture of thick red-lead and white-lead paint applied to each gasket.

Where the branch mains feeding the main building leave this line is the first watchman's tower, and here all three of the heating pipes are anchored. The pipes are also anchored at the ferry house, at a point half way between the hospital and the hospital outbuilding and at the towers at A and B. The distance between anchors in the straightway lengths of the piping is 135 feet. Where there is a number of intermediate bends the distance between anchors is greater, being 224 feet in one case. The live steam and exhaust pipes are started as high as possible at the boiler house, and have a slight fall in the direction of the steam flow. At the Tower A, however, they rise vertically about 3 feet and then pitch toward the ferry house, where they rise about 8 feet; from there on there is a continual fall to the hospital. At these points of vertical rise and at the ends of the lines the water is drained from the steam pipes by traps and pumped into the returns by pumps in the various buildings. On account of the possibly comparatively high pressure in the returns the drainage of the exhaust main into the return main is through a return trap connected with the medium-pressure main. So as to reduce the shock of water hammer in this case, the steam is supplied through a reducing valve. H. W. Johns' fire-felt pipe covering is used in the covered way distributing system, and through the ferry house from towers A and B, this is enclosed in snugly fitting galvanized iron pipe as a protection against moisture attacking the covering in any way.

The hospital outbuilding plant includes a horizontal tubular boiler, which is 60 inches in diameter, 12 feet long, contains 112 3-inch tubes and has a grate 54 x 60 inches in size. The boiler setting is built on a concrete foundation 8 inches thick, formed of 4 parts stone, 2 parts gravel, 2 parts sand and 1 part Rosendale cement, by measure. The boiler supplies a direct radiation system for its own building, which includes 340 square feet of direct radiation and 20 square feet of aspirating surface in the top of the main vent flue in that building and steam for a disinfecting apparatus and a laundry, besides feeding the medium-pressure main in the covered way. All condensation in the building is returned to the main return from a receiving tank by pumps installed in duplicate.

The buildings were planned by Messrs Boring & Tilton, of New York, under the supervision of Mr. James Knox Taylor, supervising architect of the Treasury Department, and Mr. William J. Baldwin, of New York, is the consulting mechanical engineer for the plant. The details of the work in the power house, however, were designed under the direction of Mr. Taylor. Messrs. Gaylord & Eitapenc, of Binghamton, N. Y., were contractors for the steam piping in the power house, and Mr. E. Rutzler, of New York, for the piping in the covered way and the apparatus in the hospital building.

(To be continued.)

Cooling Pavements has become necessary in New Orleans, owing to the heat radiated from them. The work has been done on Canal Street, which is 170 feet wide between property lines. There is an 18-foot sidewalk on each side, then a 37-foot asphalt roadway and, in the center, a 60-foot strip paved with concrete 5 inches thick. The heat radiated from this wide street was intense until Commissioner Moulin, of the department of public works, decided to flush the asphalt and concrete at frequent intervals. Such a plan has been proposed for New York tenement house districts but has probably not been put in regular service before in an American city.

Wood Pavements are being laid on Beacon Street, Boston, according to the Bulletin of the Society of Civil Engineers of that city. Long-leaf yellow pine blocks measuring 8 x 4 x 4 inches and treated by the creo-resinate process of the U. S. Wood Preserving Company, New York, are used. A 6-inch Rosendale cement concrete base is laid, covered by a 1-inch cushion course of sand. The blocks are driven together as tightly as possible at every sixth row, the joints are filled with dry sand, and the pavement consolidated with a 5-ton steam roller. The joints are then run full of hot creo-resinate mixture and the surface covered with a quarter of an inch of sand screenings.

The 300,000,000-gallon Weston Aqueduct now under construction by the Metropolitan Water and Sewerage Board, of Boston, was described briefly in The Engineering Record of February 9, 1901. Bids for seven sections of this aqueduct were opened April 30, as reported in detail in The Engineering Record of May 11 and 18. The remaining masonry portions of this aqueduct will be let in three contracts of about equal lengths, the total length to be let at this time being a little over 3½ miles. It is expected to have drawings and specifications ready so that bids may be received during the last week in August or early in September. The sections to be let are located in Wayland and Weston, Mass. These portions of the aqueduct will be built of concrete masonry lined with brickwork on the bottom and sides and will be 12 feet 2 inches high and 13 feet 2 inches wide. The cross-sections will be similar in form to that of the Wachusett aqueduct built in 1896-7. There will be a tunnel, probably through rock, about 500 feet long, on one of these sections. The entire work is to be finished before the close of the summer of 1903. This note is published on the authority of Mr. Frederick P. Stearns, M. Am. Soc. C. E., chief engineer of the Board.

Personal Notes.

Mr. Joseph O. Osgood, M. Am. Soc. C. E., has been appointed chief engineer of the Central Railroad of New Jersey.

Mr. Frank H. Mudge has been appointed resident engineer for the Atchison, Topeka & Santa Fe Railway, at Pueblo, Colo.

Prof. William De Witt Alexander has recently resigned from the Hawaiian Department of Surveys and accepted a place in the United States Coast & Geodetic Survey.

Mr. M. L. Holman, M. Am. Soc. C. E., of St. Louis, has been selected as the third member of the New Orleans Drainage Commission mentioned last week in this column.

Mr. S. Taylor Wilson, who has been in charge of the Engineering Department of Tippett & Wood, general contractors in iron work, Phillipsburg, N. J., for a number of years, has been elected a director and made vice-president of the company.

Mr. Frederic A. Kummer, Jun. Am. Soc. C. E., until recently manager of the Eastern Paving Brick Co., of Catskill, N. Y., has resigned that position to take the office of general manager of the United States Wood Preserving Co., with offices in the Columbia Building, New York City.

Col. Oswald L. Ernst, Corps of Engineers, U. S. A., has been assigned to duty at Chicago, as chief engineer of the Department of the Lakes. Captain Lansing H. Beach, who has been stationed in Washington since 1884, where he has administered with much success for some time the duties of Engineer Commissioner of the District, has been ordered to take charge of the river and harbor works in the vicinity of Detroit, and will be succeeded by Major John Biddle.

Dr. Elon Huntington Hooker has resigned the duties of deputy superintendent of public works of the State of New York to become vice-president of the Development Company of America, which has offices in the Park Row Building, New York. Dr. Hooker studied civil engineering in several American and foreign schools, and his doctor's thesis, "The Suspension of Solids in Flowing Water," was one of the most important papers printed by the American Society of Civil Engineers in 1896. Prior to his State office he was connected with contracting enterprises mainly and was one of the party of contractors which visited Nicaragua a few years ago to investigate canal construction there.

The Reckless Waste of Water in Washington has assumed an additional importance since the decision to filter the supply. The draft now rises at times nearly to 200 gallons per capita daily, and the cost of filtration of all the wasted water such a figure implies is not regarded with equanimity by the frugal taxpayers. Unfortunately there has always been a needless fear of the meter system among Washington newspaper editors, who are not so fully acquainted with its practical operation as they might be. Although exhaustive reports on the purification of the water supply of large cities generally contain a recommendation for restricting waste by the use of meters, the Washington papers continue to oppose such a progressive step. It is probably for this reason that the last annual report of Col. Alexander M. Miller, Corps of Engineers, U. S. A., contains the following alternative proposals: "In the opinion of the local engineer officer in charge of the aqueduct the existing conditions suggest two remedies—either the reduction of the consumption to a reasonable rate, 100 gallons per capita per diem, by the use of meters, or the increase of the present supply to keep up with the present demand by the building of a second conduit from the Great Falls of the Potomac. The necessary surveys of practical routes for this conduit should be taken in hand at once, and an estimate of $8,000 for this work is submitted by the officer in charge." The prevention of the waste is the manifestly proper choice.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Abingdon, Ill.—Bids are wanted Aug. 1 for the machinery, materials and supplies for water-works, as advertised in The Engineering Record.

Cleveland, O.—Bids are wanted July 31 for about 8,700 ft. 2-in. black wrought iron pipe and malleable iron fittings for same, to be delivered and distributed as directed by the engineer in Brookside Park. Chas. P. Salen, Dir. of Pub. Wks.

Brookings, S. D.—Press reports state that bids will be opened Aug. 7 by J. V. Walker, City Clk., for the construction of a water system and the extension of the light system. Loweth & Wolf, of St. Paul, Minn., Engrs.

Boone, Ia.—Bids are wanted July 31 for water main extensions, approximate quantities, 1,760 ft. 8-in. and 1,570 ft. 6-in. cast iron pipe, 7 hydrants, valves, etc. Jesse L. Hull, City Clk. C. E. Russell, Supt. of W. W.

Binghamton, N. Y.—Bids are wanted Aug. 7 for furnishing material and erecting a building over the filter plant adjoining pumping station. John Anderson, Secy. Bd. of Water Commrs.

Pontiac, Mich.—Bids are wanted by the City Clerk until Aug. 1 for the purchase of $50,000 water-works bonds.

Pierce, Neb.—Arnold C. Koenig of Grand Island, Neb., has been angaged to prepare plans and specifications for a system of water-works. L. R. Herbert, Clk.

Monterey, Mex.—The construction of water-works and sewerage is contemplated. Address Juan Espero, Apartado 170, Monterey.

Xenia, O.—Bids are wanted July 30 by the Trustees of the Ohio Soldiers & Sailors Orphans' Home for the erection of a steel water tower and tanks, piping, etc. Orin C. Baker, Financial Officer. General C. L. Young, Supt.

Klamath Falls, Ore.—See "Power Plants, Gas and Electricity."

Jacksonville, Ill.—Charles W. Brown, Public Engr., writes that on Aug. 2 the city will purchase 5,280 ft. of 6-in. cast iron water pipe, with specials and hydrants.

St. Joseph, La.—Mayor W. M. Davidson, writes that it was voted on July 17 to issue $5,000 bonds for water-works extensions.

Arnprior, Ont.—Bids are wanted Aug. 8 for the purchase of $50,000 water-works and $25,000 sewerage bonds. Arthur Burwash, Chmn. Finance Com.

Weatherford, Okla. Ter.—City Clk. John W. Flournoy writes that on July 17 it was voted to construct a water-works at a cost of $15,000.

Marietta, O.—Supt. of Water-Works J. S. H. Torner writes that water-works extensions and improvements, estimated to cost $100,000, are contemplated, but work will probably be only commenced this season.

Lebanon, Pa.—This city, owing to errors in its method of awarding contract for the building of Poplar Run extension of Hammer Creek water supply, is compelled to readvertise and make another award. J. D. Kerr, Secy. Water Bd.

Knox, Ind.—It is stated that on Aug. 15 the Knox Water, Light, Heat & Power Co. will let contracts for furnishing 30 hydrants, 4 miles of pipe, a standpipe 10 ft. in diameter and 100 ft. high, pumps, etc., to cost about $30,000. O. A. Garner, Engr.

East Orange, N. J.—The City Council having declined to pay $800,000 for the Orange Water Co.'s plant, local papers state that contracts will probably soon be let for a municipal water plant.

Greenwood, Miss.—It is stated that bids are wanted Aug. 16 for constructing water-works, sewerage system and electric light plant. R. H. Hicks, Mayor.

Wellsville, O.—Engineers Emil Kuichling, of Rochester, N. Y., and L. E. Chapin, of Canton, O., have both reported in favor of Little Yellow Creek as a source of water supply for this city.

Lewes, Del.—Local press reports state that the following bids were opened July 15 for the construction of water and sewer systems: H. A. Miller, Wilmington, $46,247.85; Hite, Smith & Minshall, of Norfolk, $48,136.87; W. H. Church & Co., Cape May, $42,657.15; Rosser & Castoe, Bellaire, O., $50,024.23; C. W. Johnson, Lewes, $56,783.74.

Bakersfield, Cal.—It is stated that bids are wanted Aug. 5 for furnishing 14 fire hydrants, etc. A. T. Lightner, City Clk.

Wills Point, Tex.—Mayor J. R. Finney writes that the Wills Point Water, Ice & Light Co. propose to construct water-works and an electric light plant; probable cost, $35,000. W. McIntosh, of Houston, Tex., Engr. in charge.

Sarnia, Ont.—Plans for new water-works are said to be under consideration by the Town Council.

Waterbury, Conn.—Bids are wanted Aug. 13 for the stripping of portions of the basin of Wigwam reservior, as advertised in The Engineering Record.

Buckhannon, W. Va.—This place is said to be preparing to put in water works.

Rock Island, Ill.—The water-works committee is stated to have recommenced the construction of an auxiliary pumping station at the reservoir to serve in case of emergency.

Paulding, O.—Mayor Henry E. Spring writes that on July 22 a vote was taken in favor of the issue of bonds for water-works.

Mantua, O.—A. W. Russell, Justice of the Peace, writes that on July 22 a vote was taken in favor of the construction of water-works, at a cost of $16,000.

Saranac Lake, N. Y.—Village Clk. S. A. Miller writes that on July 23 it was voted to issue $50,000 bonds for the improvement of the water system.

Park River, N. D.—Press reports state that City Auditor O. E. Lofthus will receive bids Aug. 12 for the construction of a system of water-works and electric light.

Port Arthur, Ont.—Bids are wanted Aug. 5 for the construction of a timber dam on Current River, also for the construction of about 1,900 ft. of wood stave pipe and certain concrete work in the vicinity of the present electric power-house. J. M. Neelin, Chmn. of the Water Power Committee.

Collinsville, Ill.—The City Council has adopted an ordinance authorizing the enlargement and improvement of the water-works at a probable cost of $30,000. Plans prepared by Owen Ford, St. Louis, Mo.

Des Moines, Ia.—The City Council has adopted the report of the water committee, ordering the Water Company to lay 11,600 ft. of mains this season.

Conneaut, O.—Press reports state that the water-works plant will practically be rebuilt this summer, a new intake pipe and boilers being among the improvements contemplated.

Kansas City, Mo.—An ordinance has been introduced in the Council providing for the issue of $250,000 bonds to increase and improve the water supply.
The Board of Public Works on July 23 voted to spend $6,000 for the purchase of valves for Quindaro, $7,500 for a new boiler at Turkey Creek station and about $56,000 for new water mains.

Mason City, Ia.—G. L. Wilson, of St. Paul, Minn., is stated to have been engaged to investigate the water-works system and report needed improvements.

Haverstraw, N. Y.—The Haverstraw Water Supply Co. has been incorporated with a capital of $130,000. Directors, J. D. Reynolds, of New York City; H. A. V. Post, of Babylon, L. I., and C. C. Wheeler, of Bayonne, N. J.

New Castle, N. B.—Willis Chipman, of Toronto, Ont., writes that he is preparing a report on the proposed water-works, estimated to cost $100,000.

Ft. Wayne, Ind.—The Bacon Air Lift Co., Cincinnati, and the Brass Fdy. & Mch. Co., of Ft. Wayne, are stated to have submitted jointly the only bid received July 11 for the installation of an air compressing plant at the North Side Station; total, $52,875.

Malvern, Ark.—Press reports state that a municipal water-works plant will be established at a cost of $20,000.

Troy, N. Y.—Plans, maps, etc., for the Tomhannock water supply have been completed. The estimated cost is said to be $1,040,000.

Ft. Worth, Tex.—The Finance Committee has approved the proposition to contract with Daniel W. Mead, of Chicago, for a 3,000,000-gal. artesian water supply for $110,000. Contracts for meters will probably soon be let.

Manistee, Mich.—The proposition to issue $125,000 water and light bonds is reported to have carried.

Bartonville, Ill.—The Bartonville Asylum trustees at Peoria are stated to have adopted plans for the erection of a power-house and water-works plant, to cost about $70,000.

Saugerties, N. Y.—Bids are wanted Aug. 7 for constructing a dam and reservoir. H. C. Bogardus, Secy. Bd. Water Commrs.

Loudonsville, O.—A vote is stated to have been taken in favor of water-works.

Shinnston, W. Va.—It is stated that water-works are to be built at a cost of $15,000.

Marshall, Mo.—The water supply of the Marshall Water Co. having fallen short, the city has engaged Hiram and R. H. Phillips to make an examination of the plant and investigate the feasibility of the city putting in a municipal plant.

Oswego Falls, N. Y.—The taxpayers have voted in favor of extending the water mains.

Roanoke, Ala.—Bids are wanted by the Mayor and Board of Aldermen Aug. 1 for constructing a combined water-works and electric lighting system. Appropriation, $35,000. Thos. V. Hall, Consulting Engr., West Point, Miss.

Newcomerstown, O.—A 25-year water-works franchise is stated to have been granted to S. F. Potter, of Greenburg, Pa., and J. H. Beal, of Scio.

Carl Junction, Mo.—City Clk. A. W. McDowell writes that it is proposed to construct water-works at a cost of $10,000, but no definite action has as yet been taken.

New Kensington, Pa.—The present water company proposes expending about $75,000 on its plant, provided the Council grants a new franchise and new water rates.

Ocean Springs, Miss.—A new water-works company is being formed. Temporary officers, Jos. Kotzum, Chmn., and E. W. Illing, Secy.

Tyron, N. C.—P. H. McDonnald, Secy. of the Water-Works Com., writes that the proposition to construct water-works and an electric light plant is being agitated, with a view to the issue of $15,000 bonds for a gravity water supply. Nothing definite has as yet been done.

Lynn, Mass.—Geo. I. Leland writes that the contract for raising Walden Pond dam 20 ft. above its present altitude, with the purpose of ultimately adding another 20 ft., has been awarded to F. E. Shaw, of Providence, R. I., for $306,845. Other bids received were as follows: Frank L. Allen, $357,916; Fred E. Ellis, $332,230; Thomas Hurley, $360,110; Jesse Moulton, $353,365; Lucian A. Taylor, $352,597; John Sheehan, $318,410; C. H. Eglee, $397,475. The storage capacity of the pond will be increased 1,230,518,078 gal.

The contract for the pumping station at Walden Pond has been awarded to Edw. D. Dearborn for the masonry work at $12,335, and to F. G. Kelley for the carpentry work at $4,500.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—Bids are wanted Aug. 6 for building Section 30 of the Neponset Valley sewer in West Roxbury, Newton and Brookline, as advertised in The Engineering Record.

Columbia, Mo.—Bids are wanted Aug. 6 for the construction of sewers in District No. 6, as advertised in The Engineering Record.

Bozeman, Mont.—Bids are wanted Aug. 1 for furnishing all material and labor for constructing a portion of public sewer No. 1 and a portion of district sewer No. 3; approximate quantities, 4,480 ft. 10-in., 5,480 ft. 8-in., and 3,470 ft. 6-in. vitrified sewer pipe, 25 manholes, 5 flush tanks and 6 lamp holes. T. M. Pierce, City Clk. S. H. Crooks, Livingston, Mont.

Troy, N. Y.—Bids are wanted Aug. 1 for the construction of about 1,600 ft. of 4-ft. brick sewer, with manholes, etc., in Ferry St. Jas. M. Riley, Clk. pro tem. of the Bd. of Contract & Supply.

Hamilton, O.—Bids are wanted Aug. 1 for the construction of sanitary sewer and appurtenances in Hanover St. and on Frankfort alley. M. I. Burns, City Clk.

Union City, Ind.—Bids are wanted Aug. 5 for furnishing material and constructing a sewer in the alley between Columbia & Howard Sts. C. S. Pierce, Mayor.

Conneaut, O.—Bids are wanted July 30 for furnishing material and constructing a sanitary pipe sewer in Main St., approximately 3,000 ft. in length. Geo. B. Pike, City Engr. J. L. Risley, Clk.

Buffalo, N. Y.—Bids are wanted Aug. 1 for the construction of a 12-in. tile sewer in Howell St., a 15-in. tile sewer in Rudolph St. and a 30 and 27-in. brick sewer in Randle St. R. G. Parsons, Secy Bd. of Pub. Wks.

Hartford, Conn.—A resolution to lay a 24-in. tile sewer in Albany Ave. has been referred to the Board of Street Commissioners for the preliminary assessment.

Arnprior, Ont.—See "Water."

Syracuse, N. Y.—City Engineer Sweet has submitted following estimates to Board of Contract & Supply: Intercepting sewer, Hiawatha St., $200,000; intercepting sewer, Extension Elmwood, $63,750; intercepting sewer, Harbor Brook, $12,500; improvement Onondaga Creek, $78,750; erection of purification plant, $150,000.

Saratoga Springs, N. Y.—F. A. Barbour of Boston, Mass., is preparing plans to be submitted about Aug. 15, for a sewage disposal plant. J. S. Mott, Village Engr.

Burlington, Ia.—Sewers aggregating 2,700 ft. in length and 8 to 18-in. in diameter have been ordered built by the City Council. Emmet Steece, City Engr.

Trenton, N. J.—A system of sewers for the 12th Ward is being designed by Rudolph Hering of New York City, from data furnished by City Engr. C. C. Haven.

Canon City, Colo.—City Engr. L. C. Hall writes that the construction of a complete separate system of sewers is contemplated.

Jersey City, N. J.—Bids are wanted July 30 for the construction of a sewer in Rutgers Ave.; estimate of quantities, 2,870 ft. 18-in. vitrified pipe, 100 cu. yds. rock excavation, etc. Wm. A. Folsom, Clk. pro tem. Bd. of Street & Water Commrs.

New Rochelle, N. Y.—Bids are wanted Aug. 7 for the construction of sewers and appurtenances in numerous streets, roads and avenues. Patrick E. O'Connor, Clk. and Secy. Bd. of Sewer Commrs. Wm. J. Haskins, Ch. Engr. Sewer Dept.

Sherman, Tex.—Bids are wanted Aug. 5 for the construction of a sewerage system estimated to cost $80,000. For copy of contract and specification or other information address the engineer in charge, John W. Maxcy, Houston, Tex., or E. M. Kearney, City Secy.

Monterey, Mex.—See "Water."

Madison, N. J.—The Borough Clk. writes that on July 22 a vote was taken in favor of constructing a system of sewerage.

Sparta, Wis.—Bids are wanted Aug. 5 for 500 ft. of 24-in. and 2,262 ft. of 6-in. sewers, with 6 manholes. Z. K. Jewett, Chmn. Sewer Com.

St. Paul, Minn.—Bids are wanted Aug. 5 for sewers in portions of 3 streets. C. H. Bronson, Clk. Bd. Pub. Wks.

Great Falls, Mont.—Local press reports state that bids received by the City Council July 16 for 3 lateral sewers have been rejected, and that new bids will be received Aug. 2.

Mason City, Ia.—It is stated that bids are wanted Aug. 5 for 1,789 ft. of 10, 12 and 15-in. pipe sewer, 10,419 ft. 8-in. and 346 ft. 10-in laterals. W. P. Fitch, City Clk.

Greenwood, Miss.—See "Water."

Florence, Colo.—City Engineer McFall is said to be preparing plans for a new system of sewers.

Perth Amboy, N. J.—The State Sewerage Commission has received application for the approval of plans for a sewage disposal plant for Perth Amboy.

Washington, D. C.—The District Commissioners have decided to accept the proposal of the Allis-Chalmers Co. of Milwaukee, Wis., at $253,000 for the pumping machinery, boilers and auxiliaries required to equip the sewage pumping station.

Terrell, Tex.—The New Odorless Sewerage Co., of Terrell, has been incorporated with a capital stock of $10,000 to construct and operate a sewerage system at Terrell. Incorporators: Matthew Cartwright, James Muckleroy, J. S. Grinnan and others.

Revere, Mass.—It is stated that bids are wanted by the Sewer Commissioners until July 31 for a pipe sewer in Genessee St.

Altoona, Pa.—The contract for the 7x9 storm sewer in the 4th sewer district, or for so much of the work as an appropriation of about $3,000 will pay for, was awarded to J. H. Miller, July 19. The estimated cost of the sewer, described by the ordinance authorizing its construction, is $24,000.

Edwardsville, Ill.—L. D. Lawnin, Secy. of the N. O. Nelson Mfg. Co., writes that a sewer system is to be built for the suburb of Leclaire, $1,000 to be spent to start with.

Atchison, Kan.—City Engr. Fred Giddings writes that he is preparing estimates of the cost of constructing sewers in South Atchison.

Green River, Wyo.—It is stated that estimates are being prepared for a sewer system.

Dunkirk, N. Y.—Bids are wanted Aug. 6 for a sewer in East Front St.

New York, N. Y.—Bids are wanted Aug. 7 for sewers in portions of 3 streets, Boro. of Bronx; also sewers in portions of 2 streets, Boro. of Queens. Jas. Kane, Commr. of Sewers.

Beloit, Wis.—Bids are wanted Aug. 2 for sewers. Edgar S. Greene, Clk. Bd. Pub. Wks.

Bristol, R. I.—At a recent town meeting the Sewer Committee was authorized to extend the sewer system and $47,000 was voted for this purpose.

Delaware, O.—The bid of Ulrick & Williams, of Springfield, at $59,007 for the construction of a system of sanitary sewers, has been recommended for award.

Beverly, Mass.—Bids are wanted by the Standing Committee on Sewers until Aug. 1 for constructing about 4 miles of sewers. Ernest W. Bowditch, Ch. Engr., 62 Devonshire St., Boston.

Sheboygan, Wis.—Bids are wanted Aug. 5 for 492 lin. ft. 48-in. iron pipe; 1,700 lin. ft. 48-in. brick sewer; 1,640 lin. ft. 10 and 15-in. pipe sewer, and 17 manholes. C. U. Boley, Chmn. Bd. Pub. Wks.

Pueblo, Colo.—City Engr. Wm. Peach writes that he is preparing plans, etc., for a combined sanitary and storm sewer system. The city now has more than 60 miles of sewers, but no storm sewers.

Carthage, Mo.—The Council has passed an ordinance providing for the construction of a sewer in district No. 2. R. Lundy, City Clk.

Windsor, Vt.—The Village Trustees have been authorized to borrow $6,000 bonds to pay for the construction of a new trunk sewer.

Haddonfield, N. J.—The following bids were opened July 15 for the construction of a system of sewerage and sewage disposal: Alexander Potter, New York City, Consulting Engr: *a*, Cost of sewers proper; *b*, cost of sewage disposal; *c*, total; *d*, cost of alternate sewage disposal; *e*, total with alternate sewage disposal plant. For detail bids see accompanying table: A, John Quinlan, South Amboy, N. J., *a* $24,804, *b* $5,886, *c* $30,689, *d* $10,619, *e* $35,423. B, A. Costa, Orange, N. J., *a* $27,454, *b* $5,035, *c* $32,488, *d* $9,305, *e* $36,759. C, John H. Hurley, Trenton, N. J., *a* $27,275, *b* $6,872, *c* $34,146, *d* $9,015, *e* $36,290. D, Herr & Clark, Altoona, Pa., *a* $30,096, *b* $6,323, *c* $36,419, *d* $10,877, *e* $40,973. E, David Peoples, Philadelphia, Pa., *a* $36,559, *b* $9,766, *c* $46,325. F, J. I. Hillpot, Bound Brook, N. J., *a* $42,226, *b* $7,430, *c* $49,656, *d* $8,379, *e* $50,605.

Detail bids for Haddonfield Sewerage System.

Items and Quantities.	A	B	C	D	E	F
8-in Sewer:						
0—6 ft. deep, 555 ft...	$0.30	$0.28	$0.26	$0.40	$0.43	$0.44
6—8 ft. deep, 11,165 ft.	.30	.37	.35	.44	.48	.51
8—10 ft. deep, 11,710 ft.	.38	.43	.40	.50	.60	.83
10—12 ft. deep, 3,235 ft.	.48	.55	.45	.60	.70	.80
12—14 ft. deep, 525 ft..	.60	.68	.59	.75	.80	.99
14—16 ft. deep, 425 ft..	.90	1.25	.90	.95	.90	1.42
16—18 ft. deep, 720 ft..	1.00	1.50	1.05	1.20	1.20	1.76
10-in. sewer:						
6—8 ft. deep, 100 ft....	.45	.47	.45	.50	.59	.74
8—10 ft. deep, 1,060 ft.	.50	.50	.56	.56	.65	.77
10—12 ft. deep, 825 ft..	.60	.67	.65	.66	.80	.93
12—14 ft. deep, 715 ft..	.70	.85	.79	.81	.90	1.13
14—16 ft. deep, 480 ft..	.80	1.00	.90	1.01	1.10	1.50
12-in. sewer:						
6—8 ft. deep, 480 ft....	.50	.65	.54	.60	.64	.80
8—10 ft. deep, 1,100 ft..	.60	.71	.60	.66	.84	.84
10—12 ft. deep, 405 ft..	.70	.80	.75	.76	.90	.98
12—14 ft. deep, 20 ft...	.80	1.25	1.50	.91	1.10	1.20
15-in. sewer:						
0—6 ft. deep, 1,390 ft...	.55	.60	.63	.70	.78	.83
6—8 ft. deep, 1,300 ft...	.65	.07	.70	.76	.98	.96
8—10 ft. deep, 1,565 ft.	.75	.80	.88	.85	1.08	1.12
10—12 ft. deep, 585 ft.	.90	.91	1.00	.95	1.15	1.26
12—14 ft. deep, 650 ft.	1.00	1.00	1.15	1.07	1.30	1.47
14—16 ft. deep, 525 ft.	1.10	1.25	1.23	1.20	1.50	1.72
16—18 ft. deep, 615 ft.	1.40	1.50	1.48	1.40	1.70	2.06
20—22 ft. deep, 250 ft.	2.00	2.00	2.00	2.00	2.25	2.75
Branches:						
On 8-in. pipe, 1,130 ft.	.50	.40	.50	.50	.60	.40
On 10-in. pipe, 125 ft..	.70	.60	.63	.70	.74	.55
On 12-in. pipe, 80 ft...	1.00	.75	.80	.85	.88	.68
On 15-in. pipe, 200 ft..	1.50	1.00	1.25	1.25	1.25	.80
Deep cut connections:						
Class A, 300 ft.........	.45	.40	.45	.35	1.50	.20
Class B, 650 ft.........	.30	.20	.20	.15	1.30	.20
M. H., 0—10 ft. deep, 62	30.00	28.00	36.00	38.00	44.00	60.00
Intersection M. H., 4..	35.00	34.00	40.00	45.00	74.00	65.00
Length of M. H. over 10 ft. deep, 61 ft.......	3.00	3.00	4.00	4.50	5.00	5.00
Drop manholes, 13......	30.00	36.00	45.00	45.00	60.00	67.00
Flush tanks, 27.........	40.00	35.00	45.00	30.00	50.00	70.00
Sewage Disposal.						
Earth excav., 12,000 cu. yds.	.25	.17	.30	.18	.40	.35
Br. mas., 225 cu. yds....	8.00	9.00	9.00	10.00	9.00	8.50
Concrete, 30 cu. yds....	5.00	6.00	5.00	6.50	7.00	7.00
15-in. Vit. pipe, 550 ft..	.50	.55	.50	.65	1.25	.60
10-in. Vit. pipe, 550 ft..	.30	.40	.35	.40	1.00	.35
6-in. Tile, 2,500 ft.......	.15	.07	.20	.15	.50	.21
10 x 15-in. T branches, 8	1.50	2.00	1.50	1.25	2.00	1.70
10 x 6-in. T branches, 30	1.75	2.00	2.30	.70	2.25	1.00
Iron plates, 8............	7.00	2.00	6.00	8.00	20.00	2.00
Alternate Sewage Disposal Plant.						
Earth excav., 1,100 cu. yds.	.30	.17	.28	.20	....	.35
Br. mas., 380 cu. yds...	7.50	9.00	9.00	10.00	....	8.00
Concrete, 45 cu. yds....	5.00	6.00	5.50	6.00	....	7.00
Coke or br. stone, 1,604 cu. yds.	2.50	2.00	2.00	2.80	....	1.80
Gravel, 535 cu. yds.....	1.00	2.00	1.00	1.50	....	1.10
C. I. pipe, 2 tons.......	31.00	35.00	34.00	42.00	....	35.00
15-in. Vit. pipe, 300 ft...	.50	.55	.52	.65	....	.60
12-in. Vit. pipe, 360 ft...	.46	.40	.40	.50	....	.45
10-in. Vit. pipe, 360 ft...	.40	.30	.32	.40	....	.35
6-in. Vit. pipe, 566 ft....	.26	.20	.20	.30	....	.21
5-in. Alternat. syph., 2	500	150	175	130	....	137.50
5-in. Time syphons, 2..	500	125	175	130	....	137.50

Cleveland, O.—Bids are wanted Aug. 1 for the construction of sewers in Nursery, Norwood and Spafford Sts. Chas. P. Salen, Dir. of Pub. Wks.

Binghamton, N. Y.—Separate bids are wanted Aug. 6 for the construction of sewers in Mary St. and in Vestal Ave. I, C. Hull, City Clk.

Mt. Vernon, O.—City Clk. W. A. Hosack writes that the only bid received July 20 for the construction of sewers in Districts Nos. 1 and 2 was from Stoyle & Ralston of Mt. Vernon, at $2,899. The work includes 7,000 ft. of 6 to 18-in. pipe sewers, 8 manholes, 6 catch basins and 2 flush tanks.

Cleveland, O.—The following bids were opened July 16 for constructing the main intercepting sewer Ansel Ave. to Louis St.: John Wagner, Detroit, Mich., $187,530; N. O. Paving & Const. Co., $230,270; Campbell Brothers, $186,075; Beers & Doolittle, $184,520; Clements Brothers, $176,160 (awarded); Reaugh Const. Co., $226,835.

Bids opened July 18 for sewer construction in Doan Brook Valley, from the intersection of Doan St. and Doan Brook to Cedar Ave., were as follows: Clements Brothers, $45,873 (awarded); Campbell Brothers, $48,315; Beers & Doolittle, $51,257; N. O. P. & Const. Co., $53,110; Wm. J. Townsend, $57,536; Reaugh Const. Co., $60,435. Bidders all of Cleveland, except John Wagner.

Woodbury, N. J.—Engr. Wm. Easby, Jr., of Philadelphia, writes that the contract for constructing a sewerage system has been awarded to the American Artificial Stone Pavement & Construction Co., 211 So. 9th St., Philadelphia, at its bid, submitted July 9, which was as follows: Y branches, 1,500 8 x 4-in., 50 cts. each; 250 10 x 4-in., 73 cts.; 70 12 x 4-in., 95 cts.; 30 15 x 4-in., $1.40; 15 18 x 4-in., $1.91; 20, 20 x 4-in., $2.53. Cast iron pipe, 310 ft. of 10-in. laid on top wall, at $2 per ft.; 110 ft. 18-in. in tunnel under tracks of R. R., at $13.20 per ft. Terra-cotta pipe, 1,707 ft. 20-in. 0 to 7 ft. deep, 94 cts.; 650 ft. 20-in. 7 to 9 ft. deep, $1; 225 ft. 18-in. average fill and covering, 7½ ft. at $1.25; 125 ft. 20-in. average fill 3½ ft. at $1 per ft.; 300 ft. 24-in. cut 5 ft. and under at $1.33; 140 ft. 24-in. laid in concrete at $3.13; 157 galvanized iron catch pans for manholes at $5.50 each; drop conections for drop manholes, 11 7 ft. deep and under at $5.50, 7 drop over 7 ft. at $5.50; 8 flush tanks at $80; 10 lampholes, $5; inverted siphon, $1,500; sewage reservoir, $2,980; masonry outfall complete, $700; total, $48,826. For bids on pipe and manholes see accompanying table.

Bid of Amer. Art, Stone Pave. & Con. Co., for pipe and manholes, Woodbury, N. J., Sewers.

Terra-cotta Sewer. Cut, in ft.	8-in., length in ft.	8-in., price.	10-in., length in ft.	10-in., price.	12-in., length in ft.	12-in., price.	15-in., length in ft.	15-in., price.	18-in., length in ft.	18-in., price.	Manholes. Depth, in ft.	Plain Number.	Plain Price.	Single Junct'n Number.	Single Junct'n Price.	Double Junct'n Number.	Double Junct'n Price.
0 to 7	29,387	$.32	2,655	$.42	....	....	.....	.....	1,110	$.69-.74	0 to 7	60	$30	25	$35	5	$40
7 to 9	11,725	.32	495	.42	....	....	50	$.69	120	.87	7 to 9	13	30	10	35	4	40
9 to 11	3,419	.42	1,390	.55	375	$.75	125	.74	100	.87	9 to 11	4	30	8	40	3	45
11 to 13	2,000	.51	1,780	.68	450	.75	385	.85	150	.99	11 to 13	1	32	3	40	2	50
13 to 15	475	.63	171	.75	420	.90	1,400	.97	100	1.10	13 to 15	3	35	6	45	..	55
15 to 17	365	1.10	291	1.20	325	1.25	315	1.50	100	1.30	15 to 17	2	40	2	45	1	60
17 to 19	380	1.25	388	1.30	350	1.25	.....	.....	150	1.50	17 to 19	1	50	..	50	..	...
19 to 21	140	1.75	350	1.30	....	....	....	.....	345	1.90	21 to 23	1	50	1	60	2	60
21 to 23	......	....	338	1.50	....	....	....	.....	100	2.25	....	..	...	..	...	..	...
23 to 25	......	....	40	2.00	....	....	....	.....	.....	....	....	..	...	..	...	..	...

Stonington, Ill.—Engineer-in-Charge J. W. Dappert of Taylorville, Ill., writes that contracts for drainage in three districts were awarded July 9, 10 and 11, respectively, as follows: *a* Union District No. 1, which includes 22,380 ft. of 14 to 24-in. vitrified salt-glazed tile, 28,400 ft. 7 to 12-in. field drain tile; *b*, District No. 1, Town of Mosquito, which includes 16,940 ft. 14 to 24-in. vitrified salt-glazed tile, and 19,200 ft. 6 to 12-in. field drain tile: *c*, District No. 2, Town of Stonington, which includes 25,800 14 to 27-in. vitrified salt-glazed drain tile and 24,100 ft. 12-in. field drain tile: To White Hall Sewer Pipe Co., of White Hall, Ill., for large tile, *a*, $3,675; *b*, $3,523; *c*, $8,896: To Stoneware Pipe Co., East Alton, Ill., for large tile, *a*, $2,303; *b*, $399; *c*, $2,150: To Baldridge Bros. & Co., Stonington, small tile, *a*, $1,576; *b*, $968; *c*, $1,326: To Hilt & Ware, Blue Mound, Ill., unloading and hauling tile, *a*, $758; *b*, $1,180; *c*, $1,613: To I. D. Koger, Harvel, Ill., laying tile, trenching, etc., *a*, $3,868: To J. W. Debrun, Assumption, Ill., laying tile, refilling, etc., *b*, $1,938: To John Connolly, Stonington, trenching, laying tile, etc., *c*, $3,824.

BRIDGES.

Troy, N. Y.—Bids are wanted Aug. 1 for furnishing f. o. b. cars in Troy one steel bridge weighing 3,000 lbs., for the Quackenkill pipe line. John Phelan, Commr. of Pub. Wks.

Cleveland, O.—The County Commissioners will receive bids Aug. 14 for a bridge to have 1 span of 160 ft. and be built across Cuyahoga River. Plans prepared by the Osborn Engineering Co., Cleveland. J. C. Dorn, Clk. of Bd. of Co. Commrs.

Hartford, Conn.—The Court of Common Council on July 18 raised a joint special committee to act with the Conn. River Bridge Commission in locating the west approach of the proposed East Hartford bridge.

Oneonta, N. Y.—Village Clk. H. D. McLacery writes that if ordered by the State Board of Railroad Commissioners a bridge will be built across the D. & H. tracks on Main St. Estimated cost, $80,000.

Cincinnati, O.—City Engineer Stanley on July 16 transmitted to the Board of Public Service a resolution declaring it necessary to construct an elevated road and footway and viaduct across Delta Ave. to connect Grandin and Edwards roads, estimated to cost $175,000.

Winchester, Ind.—Press reports state that the Board of County Commissioners will on Aug. 5 receive bids for the stonework for two bridges. Address the County Auditor.

Terre Haute, Ind.—Press reports state that the County Commissioners will receive bids Aug. 9 for the construction of a bridge according to plans prepared by Howe & Starbuck.

Avondale, Pa.—Bids are wanted until July 31 by the County Commissioners at West Chester, Pa., for a steel plate-girder bridge, clear span abutments 65 ft., roadway 20 ft., 5-ft. sidewalks on either side. David E. Chambers, Co. Commr.

West Chester, Pa.—Bids are wanted July 31 for excavating and masonry work for an iron bridge in Franklin Township and for a bridge in Avondale; also for excavating for and building a stone arch bridge in East Bradford Township. David E. Chambers, County Commr.

Vicksburg, Miss.—The Vicksburg National Military Park Commissioners have been authorized by the War Department to contract for four bridges required on the inside roadway. These bridges to be viaducts as recommended by Engineer E. E. Betts. Wm. T. Rigby, Park Commr.

Hopedale, Mass.—C. M. Day, Secy. of the Road Commissioners, writes that plans and specifications are now in the hands of contractors for a steel trestle bridge about 800 ft. long, to be built over the Grafton & Upton R. R. tracks.

San Jose, Cal.—Bids are wanted Aug. 6 for the construction of a steel or stone bridge on Saratoga turnpike. Henry A. Pfister, Clk. of the County Bd. of Supervisors.

Boston, Mass.—Bids are wanted July 29 for rebuilding a part of the wooden draw pier of Broadway bridge over Fort Point channel. Wm. Jackson, City Engr.

Buffalo, N. Y.—Bids are wanted Aug. 1 for the construction of a bridge on Stevenson St. over Cazenoria Creek. R. G. Parsons, Secy. Bd. of Pub. Wks.

Meadville, Miss.—Bridge bonds, amounting to $32,000, are to be issued by the County Board of Supervisors for the purpose of constructing 4 bridges.

Austin, Minn.—Local press reports state that bids are wanted for constructing a steel bridge, 24 ft. wide, at Water St., which will replace present structure.

Findlay, O.—Local press reports state that plans are being prepared for stone abutments for Cory St. bridge, and bids for constructing same will soon be asked.

Davenport, Wash.—The business men are about to petition the County Commissioners to construct a bridge across Spokane river, between Lincoln and Stephens Counties.

Tacoma, Wash.—An ordinance has been passed by the Council appropriating $4,000 for the construction of a bridge across Puyallup river, on the tide flats.

Reading, Pa.—The city and the Philadelphia & Reading Ry. Co. have agreed to construct, jointly, a bridge across the Lebanon Valley R. R. at Front St.

Nashville, Tenn.—The Nashville Bridge & Construction Co. has filed articles of incorporation. Capital stock, $10,000. Incorporators, John D. Anderson, Robert D. Goodlett, Watkins Crockett and others.

Absecon, N. J.—Bids are wanted by the County Board of Chosen Freeholders until Aug. 14 for taking out the iron bridge at Absecon, putting in tide gates and filling in road to grade. M. L. Jackson, Chmn. Bridge Com., Hammonton.

Erie, Pa.—City Engineer Briggs estimates the cost of constructing an overhead crossing at East Ave. and the Buffalo road at $23,000.

Connersville, Ind.—Bids are wanted Aug. 5 for constructing 3 steel county bridges. H. M. Broaddus, Co. Aud.

Perth Amboy, N. J.—The contract for constructing a steel bridge near Perth Amboy has been awarded to Jos. H. Cutley, of Jersey City, for $11,949.

Carrollton, Mo.—Press reports state that the contract for constructing 4 bridges will be let Aug. 6. Silas Ballard, Bridge Commr.

Colorado Springs, Colo.—As soon as plans and specifications can be prepared a steel bridge will be constructed across Clear Creek at Miner St.

White Sulphur Springs, Mont.—It is stated that bids are wanted Sept. 3 for constructing a highway bridge across Smith River. Geo. W. Harden, Clk. Co. Commrs.

Ellsworth Falls, Me.—It is stated that bids are wanted Aug. 3 for constructing a bridge on granite foundation at Ellsworth Falls. It is to have one span 67 ft. and 2 spans 55 ft. each. G. B. Stuart, Chmn. Bridge Com., Ellsworth.

Sherbrooke, Que.—The City Council has decided to ask for bids for the immediate construction of a steel bridge to replace present Wolfe St. structure, which has been condemned.

Durand, Wis.—A steel bridge is to be constructed across Chippewa River, to replace present structure, at a probable cost of $28,000.

Buffalo, N. Y.—The Grade Crossing Commission is considering plans for the proposed viaduct to carry Louisiana St. over the tracks of the New York Central; Lake Shore and Erie Railroads, estimated cost $250,000.

Montrose, Pa.—It is stated that bids are wanted by the County Commissioners until July 30 for building the masonry for 4 bridges.

Philadelphia, Pa.—Press reports state that President Cassatt, of the Pennsylvania R. R., has approved plans for the construction of stone arch bridges and viaducts which will cost in the aggregate $10,000,000.

San Mateo, Cal.—The citizens have voted in favor of issuing $27,500 bonds for constructing 4 concrete arch bridges, to replace present wooden structures crossing San Mateo creek.

Greensburg, Ind.—Bids are wanted Aug. 5 for constructing a stone arch bridge across Salt Creek on Newpoint and Clarksburg road. Coleman T. Pleak, Co. Aud.

PAVING AND ROADMAKING.

Troy, N. Y.—Bids are wanted Aug. 1 for paving Ferry St. (about 6,000 sq. yds.) with granite blocks, with cemented joints upon a gravel and sand foundation; also for paving Spring Ave. (about 3,000 sq. yds.) with brick on 6-in. concrete foundation. Jas. M. Riley, Clk. pro tem. of the Bd. of Contract and Supply.

Washington, D. C.—Bids are wanted Aug. 10 for laying cement sidewalks, as advertised in The Engineering Record.

Evanston, Ill.—Separate bids are wanted Aug. 1 for grading and paving Elm Ave., Central, Harrison and Hartzell Sts. A 3-year guarantee will be required on each contract. Frank W. Gerould, Pres. pro tem. of the Bd. of Local Imp.

Homestead, Pa.—City Engr. Wm. A. P. Wilson writes that bids are wanted Aug. 5 for brick paving estimated to cost $5,000.

Atlanta, Ga.—Bids are wanted Aug. 5 for repaving Whitehall St. with sheet asphalt, approximately 15,250 sq. yds. R. M. Clayton, City Engr.

Crafton, Pa.—Separate bids are wanted July 30 for grading, curbing and paving 5 streets. Thos. C. Stephens, Boro. Clk.

Valparaiso, Ind.—Bids are wanted by the Board of County Commrs., John Bornholt, Chmn, until Aug. 10 for building certain roads in Liberty Township. M. J. Stinchfield, Co. Aud.

Cleveland, O.—Bids are wanted Aug. 14 for grading, draining, curbing and paving with asphalt on 6-in. concrete foundation two streets. Chas. P. Salen, Dir. of Pub. Wks.

Wilmington, O.—Bids are wanted Aug. 15 and 16, respectively, for the construction of road improvements, Nos. 97 and 98, by grading and graveling or macadamizing, building necessary bridges and culverts, said roads are located in Green and Vernon townships. J. A. Brown, Engr.

Muscatine, Ia.—The contract for paving in Improvement District No. 19 has been awarded to Fuller Bros., Muscatine, as follows: Excavation, 20 cts.; street curb, 16 cts.; alley curb, 38 cts.; brick paving, Buffalo brick, $1.06½; total, $29,280.

Newport News, Va.—A vote will be taken on the issue of $100,000 bonds for street paving.

Indianapolis, Ind.—Final action has been taken by the Board of Public Works for asphalt pavement on New York St., at an estimated cost of $12,500.

Atlantic City, N. J.—The Council has passed second reading an ordinance providing for the expenditure of $98,000 for street paving.

Brookville, Pa.—C. B. Hastings has received a contract, amounting to about $11,000, for brick paving on certain streets at $1.54 2-3 per sq. yd.

Fowler, Ind.—Bids are wanted July 29 for grading, curbing and paving with brick or block on Washington Ave. Frank Carter, Town Clk.

Mayville, Ia.—It is stated that the issue of $30,000 paving bonds has been authorized by vote.

Newark, N. J.—Contracts for paving 8 streets are stated to have been awarded to the Barber Asphalt Paving Co. at $1.80 per yd.

Worcester, Mass.—The Street Committee has under consideration an order for the paving of Main St. with granite block at an estimated cost of $24,000.

Maryville, Mo.—The City Council has passed resolutions calling for the paving of 41 blocks of streets with vitrified brick.

Birmingham, Ala.—Ordinances have been introduced in the Council for street improvements estimated to cost $240,000.

White Plains, N. Y.—At an election held July 16 a vote was taken in favor of issuing $75,000 bonds for road improvements.

Groton, Conn.—This town has voted to expend $4,500 for road improvements.

Cincinnati, O.—The Board of Public Service has decided to improve Eggleston Ave. with granite from Court St. to Pearl. Local press reports state that the improvement will cost about $100,000.

Lowell, Mass.—The Aldermen have voted in favor of a loan of $55,000 for smooth paving on portions of Broadway and Suffolk St.

Connecticut.—The towns of Windsor Locks, Milford, Clinton, Manchester, Orange, Seymour, So. Manchester, West Haven, West Hartford and East Hartford have voted to expend $9,000 each for good roads.

Syracuse, N. Y.—Bids are wanted July 29 for furnishing material and repaving with sheet asphalt on a portion of James St. Jos. H. Saunders, City Clk.

Pittsburg, Pa.—Bids are wanted Aug. 5 for the permanent improvement of Steubenville Pike. W. E. Thompson, Co. Compt.

Cincinnati, O.—Bids are wanted Aug. 6 for brick pavement on portions of Wingate Alley and Sedam St. Geo. F. Holmes, Clk. Bd. Pub. Service.

Bids are also wanted Aug. 23 for brick pavement, 40 ft. wide, on a portion of Gilbert Ave.

Coraopolis, Pa.—An ordinance has been passed authorizing the issue of $25,000 bonds for street improvements. H. J. Wheeler, Burgess.

Peru, Ill.—C. M. Rickard, of La Salle, Ill., is preparing estimates and specifications for about 1¼ miles of brick pavement.

Marion, O.—Bids are wanted Aug. 17 for 3,736 sq. yds. brick or block pavement on a portion of Olney Ave. D. M. Odaffer, City Clk.

Washington, N. J.—Boro. Clk. A. J. Craft writes that certain streets are to be macadamized at an estimated cost of $21,000. The township contract, for which bids were opened July 16, has been awarded to Jas. C. Stanley, of Little Falls, N. J., at $11,245. Bids for the Borough contract will be opened Aug. 10.

Austn, Tex.—The City Council has passed an ordinance setting aside 40 per cent. of the street fund for the purpose of constructing permanent roadways on the main thoroughfares of the city.

New Haven, Conn.—The Paving Committee has voted to have Church St. between Elm and Chapel Sts. paved with Trinidad Lake pitch asphalt.

Council Bluffs, Ia.—Bids are wanted Aug. 5 for 35,000 sq. yds. brick paving. N. C. Phillips, City Clk.

Tampa, Fla.—It is stated that bids are wanted Aug. 15 for 18,999 yds. of brick paving, with granite curbing. W. B. Henderson, Pres. Bd. Pub. Wks.

Wapakoneta, O.—Bids will be opened Aug. 2 for paving Auglaize St., the approximate estimate of work is as follows: 8,786 sq. yds. brick paving, 8,786 sq. yds. gravel concrete foundation and cushion, 5,269 cu. yds. excavation, 3,618 ft. straight curb, 377 ft. circular curb, 10 ft. radius, 3,256 ft. 6 to 15-in. sewer pipe, 75 6x2 to 16x15 T's, 15 catch basins, etc. Sam Craig, Engr. Chas. E. Fisher, Village Clk.

Moline, Ill.—The Council has passed an ordinance to pave 19th St. with asphalt at a total estimated cost of $16,161.

Newark, N. J.—Bids are wanted Aug. 1 for paving with sheet asphalt or brick on concrete, as follows: So. 9th St., 6,400 sq. yds. paving, 1,300 lin. ft. 20x4 in., new curb, etc.; Fourth St., 4,600 sq. yds. paving, 700 lin. ft. 20x4-in. new curb, etc.; Second St., 7,500 sq. yds. paving, 1,200 lin. ft. 16x4-in. new curb; So. 10th St., 10,600 sq. yds. paving, 1,000 lin. ft. 20x4-in. new curb, etc.; Clayton St., 1,500 sq. yds. paving, 600 lin. ft. 16x4-in. curb, etc. J. Crowell Mundy, Gen. Supt. of Works.

New York, N. Y.—The following bids for asphalt block paving were opened July 23 by Jas. P. Keating, Commr. of Highways; A, Abbott-Gamble Const. Co., 41 Park Row; B, Hastings Pavement Co., 25 Broad St.:

Items.	W. 88th St.			Edgecombe Ave.			E. 141st St.		
		A	B		A	B		A	B
Asphalt block, sq. yds.	6,740	$2.46	$2.56	21,600	$2.55	$2.48	6,625	$2.74	$2.67
Stones relaid, sq. yds.	40	.45	.45	.....	.....	.....	.....	.....	.....
Concrete, cu. yds.	1,155	7.20	6.84	3,375	7.20	6.84	1,070	7.20	6.84
New curb, lin. ft.	1,775	.95	1.06	500	.90	1.00	1,900	.98	1.00
Old curb, lin. ft.	300	.40	.55	500	.45	.55	2,000	.45	.50
Water manholes	4	25.00	25.00	.....	.....	.....	.....	.....	.....
Sewer manholes	18	25.00	25.00	.....	.....	.....	.....	.....	.....
Old curb, lin. ft.*	.....	.....	.....	8,000	.45	.45	.....	.....	.....

*Reset without redressing.

Denver, Colo.—B. M. Hughes, Jr., Secy. of the Bd. of Pub. Wks., writes that the contract for paving Broadway in District No. 1 with asphaltum has been awarded to the Colorado Paving Co. of Denver, at $1.98 per sq. yd.; total, $85,989. The contract for paving Grand Ave. with macadam has been awarded to the Bermudez Blake Const. Co., Denver, at 75 cts. per sq. yd.; total, $42,627.

East Newark, N. J.—Bids are wanted Aug. 14 for paving a portion of Central Ave., approximate estimate of work as follows; 5,450 sq. yds. asphalt pavement on 6-in. concrete foundation, 1,500 lin. ft. new 4 x 20-in. curb set on concrete, 1,600 lin. ft. old curb reset on concrete, 60 lin. ft. 4 x 20-in. headers on concrete and manhole heads readjusted. Bids will also be received at the same time for paving a portion of Searing Ave., approximate estimate of work, 1,500 sq. yds. brick paving on 6-in. concrete, 700 lin. ft. new 4 x 20-in. curb set on concrete, etc. Edward Kenny, Mayor. C. Melville Borrie, 757 Broad St., Newark, Boro. Engr.

New York, N. Y.—The following bids for paving West Farms Road, Boro. of Bronx, with granite block, flagging sidewalks, placing fences and planting trees were opened July 23 by Jas. P. Keating, Commr. of Highways:

Bidders.	Earth excav., 25,500 cu. yds.	Rock excav., 17,300 cu. yds.	Filling, 37,000 cu. yds.	Drain pipe, 100 lin. ft.	Dry rubble masonry, 3,000 cu. yds.	New curb, 12,375 lin. ft.	New flags, 48,050 sq. ft.	Bridge stone, 7,275 sq. ft.	Lumber, 5 M. ft.	Granite block, 31,900 sq. yds.	Trees, 350.
Leeson & Brown, 217 W. 125th St.	$.35	$1.43	$.01	$1.00	$1.60	$.60	$.22	$.55	$20.00	$1.84	$1.00
Michael Fitzgerald, 312 W. 141st St.	.50	1.35	.10	.01	1.50	.70	.20	.40	30.00	1.97	2.50
John McQuade, 1298 Lex. Ave.	1.55	1.55	.....	1.50	1.00	.55	.20	.45	25.00	1.00	3.00
F. V. Smith Contr'g Co., 411 Lenox Ave.	35	1.10	.....	1.00	1.40	.63	.22	.50	.....	1.84	3.00
D. W. Moran, 686 Tremont Ave.	.16	1.25	.45	1.00	2.00	.65	.21	.45	35.00	1.74	2.50
Norton & Dalton, 215 W. 125th St.	.40	1.20	.05	1.00	1.50	.68	.26	.60	25.00	1.75	2.00
Jos. Leopold, 18 Broadway	.01	1.50	.60	1.00	1.50	.70	.01	.01	30.00	1.79	1.00
Williams & Gerstle, 1st Ave. and 44th St.	.42	1.43	.02	1.50	1.46	.64	.22	.38	21.00	1.80	1.75

New York, N. Y.—Bids were opened July 16 by Jas. P. Keating for repaving with asphalt on present pavement as foundation, and the Barber Asphalt Paving Co. was the lowest bidder for the largest three contracts, as follows: $37,392, University Pl.; $16,649, Lexington Ave.; $21,245, E. 57th St. The University Place paving involves 7,900 sq. yds. of asphalt, including binder, 7,920 sq. yds stone pavt. relaid, 2,060 ft. new curb and 360 ft. old curb; the prices bid were $3.79, 55 cts., $1.05 and 49 cts., respectively. The Lexington Ave., letting includes 3,650 sq. yds. asphalt, 2,950 sq. yds. stone pavt. relaid, 100 cu. yds. concrete, 1,150 ft. new curb, and 25 ft. old curb; the prices bid were $3.52, 55 cts., $6.75, $1.05 and 49 cts., respectively. The 57th St. work includes 5,840 sq. yds. asphalt pavt., 5,880 sq. yds. stone pavt. relaid, 2,510 ft. new curb and 120 ft. old curb; the prices were $2.65, 47 cts., $1.05 and 49 cts., respectively.

Aurora, Ill.—Public Engr. Myron G. Stolp writes that the following bids were opened July 15 for 34,008 sq. yds. asphalt paving, 16,640 lin. ft. of 6-in. combined curb and gutter, and 3 blocks of brick paving, asphalt pavement to have 6-in. concrete base, 1½-in. binder and 2-in. wearing surface:

Bidders.	Asph. pave.			Curb and gutter.	
	Broken stone concrete.	Gravel concrete.	Block pave.	Br. stone con.	Gravel con.
Jos. J. Duffy, Chicago	$1.73	$1.73	$2.05	$.47½	$.45
Ayers Asphalt Co., Zanesville, O.	1.79	1.78	1.50	.44	.42
Western Paving Co., Indianapolis, Ind.	1.76	1.73	1.61	.49	.47
Barber Asphalt Co., Chicago	1.99	1.99	1.99	.49	.46
R. F. Conway Co., Chicago	1.74	1.74	2.00	.50	.50

Omaha, Neb.—Local press reports state that the Board of Public Works has awarded contracts for 222,000 yds. of paving, the property owners in each district to elect the kind of paving and curbing to be laid at the prices quoted by the successful bidders. The Western Paving & Supply Co. was the lowest bidder on asphalt in a majority of the districts at the average of $1.59 per yd., minimum $1.47. Charles E. Fanning lowest on brick at an average of $1.75 for new paving and $1.30 for repaving; the prices on vitrified block by the same bidder ranged about 10 cts. lower. Hugh Murphy, stone block at an average of $2.20 for new and $1.65 for repaving. John M. McGowan was the lowest on artificial stone curbing at 34 cts. George R. Crandall bid 57 cts. for the combination curb and gutter, the Commercial Land Co. 65 cts. for Colorado and Bedford sandstone curbing, and J. E. Riley 61 cts. for Berea sandstone.

Albany, N. Y.—State road contracts are reported to have been awarded as follows: To Thos. H. Karr, of Troy, Troy & Brunswick road, section two, 3 miles long, for $25,800, and Hoag's Corners road, 3 miles, for $9,450; to E. & J. E. Martin, of Utica, Waterford road, section one, 1½ miles, for $10,700; also section two of same road, 5 miles long, for $32,900; to Chambers & Casey, Rochester, Fairport road No. 60, 3.03 miles, for $32,400; to Whitmore, Rauber & Vicinus, of Rochester, Pittsford road No. 61, 1.30 miles, for $13,200; to Henry Richards, of Dover, for Chenango River road, 1.76 miles, for $14,800.

Brooklyn, N. Y.—The following bids were opened July 23 by Jas. P. Keating, Commr. of Highways, N. Y. City, for granite-block pavement on a sand foundation for Park Ave.:

Items and Quantities.	Jas. P. Graham.	Newman & Co.	Dennis Norton.
Granite block, 13,290 sq. yds.	$2.95	$2.40	$2.48
Old stone relaid, 300 sq. yds.	.25	1.00	.30
Granite bridge stone, 608 sq. ft.	.70	.90	.65
Bluestone bridge stone, 370 sq. ft.	.60	.60	.45
Old blue bridge stone, 3,300 sq. ft.	.25	.40	.15
New curb, 8,630 lin. ft.	.84	2.00	.83
Old curb, 1,200 lin. ft.	.30	.40	.38
Flagging relaid, 19,500 lin. ft.	.05	.02	.05

Allegheny, Pa.—Ordinances for regrading and paving 75 streets have been passed finally by the Council.

The contract for improving River Ave. has been awarded to the North Side Sand & Coal Co. for $31,875. The work includes 8,000 cu. yds. of excavating, 11,000 sq. yds. Ligonier block stone, 7,000 ft. curbing and 4,000 sq. yds. of brick paving.

POWER PLANTS, GAS AND ELECTRICITY.

Sharpsburg, Pa.—Bids are wanted July 30 for installing electric light machinery and furnishing arc lamps, transformers, etc., separate bids will be received at the same time for furnishing material and labor and reconstructing the pole lines and circuits in the Boro. A. H. S. Black, Boro. Clk.

Wilmington, Del.—The People's Railway Co. (R. W. Crook, Mgr.) has awarded the contract for the extension of power house to Patk. Fahey at $14,000.

Meadville, Pa.—City Clk. A. C. Pardee writes that Col. S. B. Dick and A. M. Fuller are interested in the proposition to construct a water power plant at the Bernuston dam.

Bowling Green, O.—The Council is stated to have granted an electric light franchise to the Bowling Green Electric Light & Power Co.

Brookings, S. D.—See "Water."

Klamath Falls, Ore.—The Klamath River & Electric Power Co. of Klamath Falls, has been incorporated with a capital of $350,000 by J. F. Goeller, C. C. Maltby and E. J. Boyd. The company proposes to take water for the power and irrigation purposes from Klamath River one mile above the town of Keno.

Mansfield, Mass.—The citizens are reported to have voted to establish an electric light plant.

Ludlow, Ky.—The Union Light, Heat & Power Co. is reported to have absorbed the Kentucky Electric Co., which has franchises for lighting Ludlow, West Covington, Central Covington and Latonia. Some improvements are contemplated. Directors: Jas. C. Ernst, E. Darrow and others.

San Francisco, Cal.—The Yosemite Commissioners are reported to have authorized Engineer Corey to prepare plans and specifications for the establishment of an electric light plant in the valley to cost $30,000.

Dunkirk, N. Y.—The Council is stated to have granted A. W. Cummings a franchise to furnish heat and power in the city.

Cleburne, Tex.—See "Electric Railways."

Roulette, Pa.—A charter has been granted the Roulette Gas Co. of Roulette, with a capital of $10,000.

Redding, Cal.—Engr.-in-Charge John B. Rogers, Crocker Bldg., San Francisco, writes that the contract for canal construction in connection with the proposed $450,000 power plant of the Shasta Electric Light & Power Co. has been awarded to C. A. Warren & Co., 232 Montgomery St., San Francisco. Contracts for hydraulic and electric equipment not yet let.

Red Wing, Minn.—City Clk. C. E. Harrison writes that the Red Wing Gas & Electric Co. of Red Wing has received a 5-year contract for lighting the city, their bid being as follows: 20 1,200-c. p. arc lamps, all night every night, $1,760 per year; 20 1,200-c. p. arc lamps, midnight, every night, $1,320 per year; 82 16-c. p. incandescent lights, moonlight, midnight, $1,230 per year.

Roanoke, Ala.—See "Water."

Warren, O.—An ordinance is stated to have been introduced in Council granting T. H. Gillmer a franchise for a steam heating plant.

Cincinnati, O.—The only bid received July 19 for lighting the streets, lanes, lands, squares and public places with electricity for a period of 10 years from June 1, 1902, was from Cincinnati Gas & Electric Co., Cincinnati, $72 per lamp per year, conduit lighting; $60 per lamp per year, overhead lighting.

Birmingham, Ala.—A press report states that the Birmingham Ry. Light & Power Co. will expend about $2,000,000 in improvements.

Tyron, N. C.—See "Water."

Logan, Utah.—The Logan Power Co. filed articles of incorporation with the Secretary of this State; capital $250,000. The company was incorporated in Colorado, with principal offices at Ouray, Colo., but intends doing business in Utah. Eldon P. Bacon, of Logan, is resident agent.

St. Albans, Vt.—A syndicate, composed of John F. Kelly, of Pittsfield, Mass.; H. C. Gray, of Greenwich, N. Y., and others, is stated to have purchased a controlling interest in the St. Albans Electric Light & Power Co., and it is reported that the power plant in St. Albans will be abandoned and that electricity for lighting and power will be brought in from Sheldon, Vt.

Montreal, Que.—Bids are wanted by the Royal Electric Co. until July 31 for the erection of a new electric sub-station. H. H. Henshaw, Pres., 94 Queen St., Montreal.

Park River, N. D.—See "Water."

Woodstock, Va.—The General Electric Co. of Baltimore is stated to have received the contract for an electric plant for the lighting of the town. The contract calls for 40 incandescent and 10 arc lights. The town is also to be wired for 1,200 incandescent lights.

Huntington, W. Va.—Bids are wanted Aug. 15 for erecting a building to be used for a power house and electric light plant at the West Virginia Asylum for Incurables at Huntington. Col. C. E. Rudesill, Pres. Bd., Charleston, W. Va.

Auburn, Neb.—The Auburn Mutual Lighting & Power Co. has been organized here, with a capital of $30,000. It is stated that work on the plant will begin at once. Edw. H. Dort, Pres. Robt. C. Boyd, Treas.

Florence, Colo.—It is stated that the Arkansas Valley Electric Co. of Florence will expend about $5,000 in improving its plant.

Bowling Green, O.—The Bowling Green Electric Light & Power Co. is stated to have received the contract for lighting the city for 10 years at $7 per month for each arc light.

Grantsburg, Wis.—The citizens are stated to have voted to grant a franchise to the Grantsburg Electric Light & Power Co. Work will begin at once on a dam to be constructed by the company across Wood River.

Wills Point, Tex.—See "Water."

Chillicothe, Ill.—Bids are wanted Aug. 15 for lighting the city by electricity or otherwise for a period of 2 or more years from Oct. 1, 1901. D. E. Kinsella, City Clk.

Lewes, Del.—Local press reports state that the following bids were opened July 15 for the construction of an electric light plant: W. M. Sheehan & Co., 136 Liberty St., New York, $12,856; J. F. Buchanan & Co., of Philadelphia, Pa., $13,950; W. H. Church & Co., Cape May, N. J., $13,325; Garrett, Miller & Co., Wilmington, $14,101; J. J. Jacoby, $13,038.

Greenwood, Miss.—See "Water."

Pasadena, Cal.—Wm. R. Staats writes that the California Power Co. proposes to build a power plant on Kern River. H. H. Sinclair, of Redlands, Cal., Engr. in charge.

Manistee, Mich.—See "Water."

Bucyrus, O.—The gas franchise is about to expire and the city will receive propositions for a new franchise from outside parties. Address President, Bucyrus Board of Trade. An incandescent plant could be run profitably in connection with gas plant.

Richmond, S. I., N. Y.—The New York & Staten Island Electric Co. has been awarded the contract for furnishing and operating electric lamps in Richmond borough from July 15 to Dec. 31 by Henry S. Kearny, Commr. of Public Bldgs., Ltg. & Supplies, N. Y. City. The tender is as follows: For 460 arc lamps or more, 30 cts. per night; for less than 460 arc lamps, 33 cts.; for 3,462 incandescent lamps, $22 per year each; for less than 3,462 lamps, $25 per yr. each; for current, 15 cts. per kw. hour.

Albany, Ga.—The Council is reported to have rejected the only bid recently received for the electric light plant. New bids will be asked. S. P. Brown, Mayor. Moore & McCrary, Engrs., Atlanta.

ELECTRIC RAILWAYS.

Marysville, O.—The Council is stated to have granted a franchise to the Union Electric Ry. Co.

Pontiac, Mich.—Wm. H. Osmun, of Pontiac, is reported interested in the construction of a belt line around the city.

Springfield, Ill.—The Supervisors of Sagamon County are stated to have granted a franchise to W. H. Price.

Baraboo, Wis.—The Sauk County Power & Traction Co. has petitioned the Council for an electric railway franchise.

Natchez, Miss.—The Bluff City Ry. Co. of Natchez is stated to have been incorporated; capital, $112,000. Incorporators: J. N. Carpenter, Geo. M. Brown and R. F. Learned.

Lima, O.—The Commissioners of Allen County are stated to have granted a franchise to the Lima, Lewiston & Bellefontaine Electric Ry. Co. to construct a line from Lima to the Auglaize County line, along Bellefontaine pike.

Batavia, N. Y.—It is stated that the Genesee & Orleans R. R. Co. has received a franchise to construct an electric railway from Batavia to Oak Orchard, a distance of 27 miles.

Richmond, Ind.—The Eastern Indiana Traction Co. has been incorporated with a capital of $10,000 to construct an electric road from Richmond to Portland, a distance of 60 miles. Directors: Peter Schwab, Hamilton, O.; Henry P. Lane, Franklin, O.; Wm. H. Puls, West Carrollton, O., and others.

Manistee, Mich.—Col. E. W. Muenscher, Ch. Engr., has just completed preliminary surveys for the extension of the Manistee, Filer City & Eastlake Electric Ry., from Orchard Beach to Bear Lake, a distance of 15 miles. Geo. S. Hart, Pres., Manistee.

Parkersburg, W. Va.—The Parkersburg & Marietta Electric Ry. Co. will receive bids July 31 (not Aug. 1, as previously stated) for grading, masonry and trestles on about 12 miles of electric railway from Parkersburg to Williamstown. The work will consist of about 60,000 cu. yds. of excavating, 2,600 lin. ft. of piling, 332,000 ft. B. M. of lumber in trestles, and 500 cu. yds. of masonry. C. H. Shattuck, Pres. J. Madison Jackson, Ch. Engr.

San Bernardino, Cal.—The Supervisors are stated to have granted to A. C. Denman, Jr., representing the San Bernardino Valley Traction Co., a franchise along Colton Ave. to Colton.

Rockville, Conn.—A charter is stated to have been granted to the Rockville, Broad Brook & East Windsor Ry. Co. Incorporators: E. W. Burd and W. M. Lasbury, of Broad Brook, and C. E. Harwood of Rockville.

Batavia, N. Y.—It is stated that the Buffalo & Williamsville Electric Ry. Co. will petition the Village Trustees for a franchise to extend its line through Batavia to Rochester. C. A. Blocher, Ch. Engr., Williamsville, N. Y.

Fairport, N. Y.—The Village Trustees are stated to have granted a franchise to Andrew H. Bown representing the Monroe County Belt Line Co.

Muncie, Ind.—The Council is stated to have granted a franchise to the Muncie & New Castle Traction Co.

Cleburne, Tex.—R. W. Wortham, representing the Interstate Engineering & Construction Co. has petitioned the Council for a franchise for an electric railway and lighting plant.

Cleveland, O.—The Cleveland & South Lorain Traction Co. of Cleveland has been incorporated with a capital of $500,000 to construct an electric railway from Lakewood to Lorain through Cuyahoga and Lorain counties. Incorporators: Chas. W. Wells, Edwin H. Richards and others.

Herkimer, N. Y.—The Mohawk Valley Traction Co. has been incorporated, with a capital of $80,000, to construct and operate an electric railroad 8 miles long in Herkimer and Little Falls. Directors: J. Judson Gilbert, Little Falls; Henry Churchill, Herkimer, and others.

Salt Lake City, Utah.—Local press reports state that the Salt Lake City R. R. Co. will expend about $250,000 in improvements to include an extension of the suburban system, the purchase of new equipment for the extended lines and an enlargement of the mechanical plant. W. P. Read, Supt., Salt Lake City.

Dallas, Tex.—The Dallas Consolidated Electric St. Ry. Co. of Dallas has filed an amendment to its charter increasing its capital from $1,000,000 to $2,000,000 for the purpose of enlarging its plant.

Millersville, Pa.—A charter has been granted to the Lancaster & York Furnace St. Ry. Co. for the construction of a line from Millersville to York Furnace; capital, $200,000. Fredk. Schoff, Pres.

Piqua, O.—The Dayton, Covington & Piqua Traction Co. having made application to define and establish a street railroad route along Covington Ave. and Wood St., the City Clk., M. G. Smith, will on Aug. 8 receive bids for same.

Rome, N. Y.—The Utica Suburban Ry. Co. has petitioned the Council for a franchise.

Birmingham, Ala.—See "Power Plants, Gas and Electricity."

Windsor Locks, Conn.—The Windsor Locks St. Ry. Co. is stated to have been formed with a capital of $100,000 to construct an electric railway from Windsor Locks to Windsor, a distance of about 7 miles. Incorporators: Henry A. Huntington, Horace H. Ellsworth and others.

London, O.—The County Commissioners are stated to have granted the Findlay & Southern Ry. Co. a right of way through the northern part of Madison County.

Walla Walla, Wash.—O. R. Ballou is stated to have petitioned the Council for a franchise.

Batavia, N. Y.—The State Railway Commissioners are stated to have granted Chas. E. Hart, of Albion, a franchise to construct a trolley line from Batavia to Point Breeze on Lake Ontario.

Wapakoneta, O.—The Western Ohio Ry Co. is reported to have secured right of way for a line between Wapakoneta and Sidney.

Auburn, Ind.—The County Commissioners are stated to have granted a franchise to F. L. Welsheimer, representing the Garrett, Auburn & Northern Ry. Co.

RAILROADS

Nashville, Tenn.—The Nashville & Middle Tennessee Railroad, of Davidson County, has been incorporated with a capital of $1,200,000. Incorporators: W. R. Cole, Jos. H. Thompson, G. N. Tillman and others.

Arlington, Ga.—The Georgia, Florida & Alabama R. R. Co. is stated to have awarded to J. H. Davidson of Thomasville and B. H. Hardaway of Columbus, the contracts for extending its road from Arlington to Columbus, a distance of about 60 miles.

Lebanon, Pa.—The Pennsylvania R. R. Co., having obtained control of the Cornwall & Lebanon R. R., running from Conewago on the main line of the P. R. R. to Lebanon, will improve this branch; and it is probable that it will extend its line from Lebanon to Reading, where it will connect with its Schuylkill Valley Branch. W. H. Brown, Ch. Engr., Philadelphia.

Durango, Colo.—The Colorado & Gulf Ry. Co. has been incorporated with a capital of $100,000 by Chas. E. McConnell, Chas. E. Herr and others, all of Durango, Colo., to operate in the counties of La Plata, Colo., San Juan, Socorro and Grant counties, New Mexico, and Apache and Graham counties, in Arizona.

Chicago, Ill.—The Spring Valley & Northern R. R. Co. has been incorporated with a capital of $100,000 to construct a railroad from Hall Township, Bureau County, Ill., in a northerly direction through the counties of Bureau, Lee and Ogle to Stillman Valley in Ogle County, Ill. Incorporators: Frank P. Blair, Robt. J. Cary, Mitchell D. Follansbee and others, all of Chicago. Principal office to be in Chicago.

Albuquerque, N. M.—The Albuquerque Eastern Ry. Co. is reported incorporated with a capital of $1,500,000 to construct a railroad 40 miles long from Albuquerque to the San Pedro coal fields.

Pittsburg, Pa.—Contracts for work on the Wabash R. R. are reported to have been awarded as follows: The tunnel, which is known as section No. 4, with sections 5, 8 and 9, were let to Wm. Kennefick, of Kansas City, for about $750,000, and sections 6 and 7 to Moran & Co., of Pittsburg, for about $100,000.

Troy, N. Y.—The State Railroad Commission is stated to have granted the Troy, Rensselaer & Pittsfield R. R. Co. permission to construct a line from Troy to Rensselaer, Sandlake and Pittsfield, Mass.

Santa Fe, N. M.—The Santa Fe Central Ry. Co. is reported incorporated with a capital of $2,250,000 to construct a railroad 120 miles long from Santa Fe to Pinos Wells, to connect the Denver & Rio Grande and Rock Island systems.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Springfield, Ill.—The Board of Commissioners for the erection of a state arsenal, armory and museum will receive competitive plans for same until Aug. 1. Jas. A. Rose, Secy. of State. Probable cost, $150,000.

Lafayette, O.—Bids are wanted Aug. 1 for the erection of a church, according to plans prepared by Leech & Leech, of Lima, O. C. A. Graham, Clk. of the Board.

Pomeroy, O.—Bids are wanted Aug. 5 for heating the court house by hot water or steam. C. A. Roberts, Auditor.

Bedford, N. Y.—Bids are wanted Aug. 7 for the construction, plumbing, electric wiring and fixtures, heating and ventilating of a hospital building at the State Reformatory for Women, Bedford. Jas. Wood, Prest. Bd. of Mgrs.

Kansas City, Kan.—Andrew Carnegie is stated to have offered this city $75,000 for a public library.

Philadelphia, Pa.—The Governor has signed the bill appropriating $4,000,000 to complete the capitol.

Charlotte, Mich.—The plans of C. Allen, of Jackson, are stated to have been accepted for $25,000 edifice for the M. E. congregation.

Worcester, Mass.—Fuller & Delano, 452 Main St., are stated to be preparing plans for a new building for the City Hospital to cost about $75,000.

Erie, Pa.—The First United Presbyterian Society is stated to have accepted the plans of Constable Bros. for a $25,000 church.

Denver, Colo.—The plans of F. E. Edbrooke, Opera House Blk., are stated to have been accepted for a new county hospital, to cost about $50,000.

Muskegon, Mich.—Smith & Burke, of Muskegon, are stated to have received the contract for erecting the Muskegon county almshouse for $28,900.

Grand Island, Neb.—An election will be held Aug. 7 to vote on the issue of $100,000 bonds for a courthouse for Hall County. C. H. Menck, Co. Clk.

Athens, Ga.—A fire station is about to be built by the city under the supervision of J. W. Barnett, City Engr.

La Crosse, Wis.—Schick & Roth, of La Crosse, have prepared plans for a $15,000 church to be built by the English Lutherans on Ferry St. and West Ave.

New Orleans, La.—F. A. Nouillet is stated to have received the contract to erect the police jail for $112,800.

Portsmouth, O.—Andrew Carnegie is stated to have offered this city $50,000 for a public library.

Peoria, Ill.—John O'Neill & Sons, of Peoria, are stated to have received the contract for installing the heating and lighting plants at the Asylum for $59,066.

Rome, N. Y.—Bids are wanted Aug. 7 for enlarging barn, constructing fire escapes on the Boys' and on the Girls' buildings, and for heating the Boys' building and Principal's residence at the Central N. Y. Institution for Deaf-Mutes. W. J. Kingsley, Pres. Bd. Trus.

Augusta, Ark.—The Commissioners of Woodruff County are reported to have decided to erect a court house and jail in Augusta and also a court house and jail in Cotton Plant, and appropriated $40,000 for the buildings.

Mansfield O.—Dept. Clk. C. L. McClellan writes that Frank L. Packard of Columbus, O., has prepared plans for proposed improvements to the Richland County court house, estimated to cost $50,000.

Winchester, Va.—The plans of C. B. Keferstein, of Washington, D. C., are stated to have been accepted for the Winchester Memorial Hospital, to cost about $14,000.

Cripple Creek, Colo.—The Teller County Commissioners are reported to be considering the erection of a court house to cost about $60,000.

Mayersville, Miss.—The Supervisors of Issaquena Co. will issue $12,000 bonds on Aug. 5 for purposes of building jail, sheriff and clerk's office.

Highland, Cal.—Directors of the Southern California Hospital for Insane at Highland are stated to have accepted the plans of T. H. Goff, of San Bernardino, for a new wing; cost, $40,000.

Philippi, W. Va.—Plans and specifications are wanted by the County Court until Aug. 19 for a court house and jail at Philippi. Granville E. Taft, Clk.

Trenton, N. J.—Bids are wanted Aug. 6 for the construction of a fire engine house on W. Hanover St. C. Edw. Murray, City Clk. Wm. A. Poland, 11 W. State St., Architect.

Mansfield, O.—Bids are wanted Aug. 21 for furnishing materials required in the construction of the superstructure of workshop "C" at the Ohio State Reformatory, including structural steel and iron, cement, brick, etc. Chas. H. Workman, Secy. Bd. of Mgrs.

Utica, N. Y.—Bids are wanted Aug. 1 for the purchase of $165,000 bonds for erecting and furnishing the new public library. J. A. Cantwell, City Clk.

Ware, Mass.—Bids are wanted July 30 for erecting an almshouse, also for heating and plumbing same. J. T. Casey, Chmn. of Com.; Seymour & Newell, Archts., Springfield.

Elizabeth, N. J.—The Committee of Freeholders which has supervision of the Union County court house, to cost $250,000, has awarded to Ackerman & Ross, Turner & Milian, Williams & Campbell, all of New York, N. Y., 1st, 2d and 3d prizes respectively for plans.

Richmond, Va.—The Committee on Public Institutions is stated to have adopted a resolution calling for the building of a new penitentiary at a cost not exceeding $500,000.

Canyon City, Ore.—It is stated that bids are wanted July 31 for repairs to the court house. R. R. McHaley, Clk. Co. Court.

Somerville, N. J.—Local press reports state that bids are wanted by the Armory Committee until Aug. 12 for erecting an armory on Grove St.

Hopkinton, Mass.—It is stated that bids are wanted July 29 for erecting a brick town hall, to cost about $20,000. D. J. O'Brien, Clk.

BUSINESS BUILDINGS.

Port Huron, Mich.—It is stated that a new building will be erected for the First Natl. Exchange Bank, opposite its present structure.

Hot Springs, Ark.—It is reported that a $200,000 fire-proof structure is to replace the present Avenue Hotel.

Pittsburg, Pa.—The Wabash R. R. Co. is reported to have purchased a site on 5th Ave. and Ferry St. for the erection of a depot to cost about $1,000,000. Joseph Ramsey, Jr., Gen. Mgr., St. Louis, Mo.

Freeport, N. Y.—Wm. Taeterow, proprietor of the Woodcleft Inn, is stated to have purchased a site on Grove St., 175 x 250 ft., and will erect thereon a 200-room hotel.

New York, N. Y.—Plans have been filed for a 12-story apartment hotel, to be erected at Madison Ave. and 29th St. by Maitland G. Graves; cost about $750,000. Architect, Henry Allen Jacobs, 1133 Bway.

Lansing, Mich.—It is stated that plans have been completed for the new union depot at Lansing to be built jointly by the Michigan Central R. R. A. Torrey, Ch. Engr., Detroit, and Pere Marquette R. R. G. H. Kimball, Ch. Engr., Detroit.

Berkeley, Cal.—Stone & Smith are stated to have prepared plans for a 2-story brick building, 80 x 135 ft., to be erected on Shattuck Ave. and Addison St., to cost about $25,000.

Binghamton, N. Y.—The Nineteen Hundred Washer Co. is to erect a 3-story brick addition to its factory, to measure 90 x 120 ft. R. F. Bieber, Treas.

San Antonio, Tex.—Bids are wanted Aug. 10 for the construction of a passenger depot, in San Antonio, for the Galveston, Harrisburg & San Antonio Ry. Co. E. B. Cushing, Engr. Maint. of Way, Southern Pacific Co., Houston, Tex.

Chicago, Ill.—Local press reports state that Butler Bros., of 236 Adams St., and the Western Cold Storage Co. will erect buildings at West Water, Lake and Randolph Sts., at a cost of about $1,000,000.

Denver, Colo.—F. E. Edbrooke, Opera House Blk., has prepared plans for a 3-story brick office building for Bennett & Myers, to cost $35,000.

Dawson Springs, Ky.—The Dawson Springs Hotel Co. has been incorporated with a capital of $25,000 to erect a hotel here. Incorporators: W. I. Hamby, Geo. M. Price and J. E. Hayes.

Grand Rapids, Mich.—The Michigan Barrel Co. is to erect a 3-story building, 100x225 ft., to replace factory recently burned.

Mt. Clemens, Mich.—Kilby & Co., of Cleveland, O., are stated to have received the contract for building a 600-ton sugar beet plant, for the Macomb Sugar Co., for $567,000.

Waco, Tex.—The Anheuser Bush Brewing Association is reported to have purchased a site here for the erection of a brewery and a hotel.

Buffalo, N. Y.—The plans of Green & Wicks, 110 Franklin St., are stated to have been accepted for a Y. M. C. A. building, to cost about $325,000.

Colorado Springs, Colo.—Col. W. H. Bacon is reported as having plans prepared for a 2-story brick block on Pike's Peak and Cascade Aves., to cost $40,000.

Boston, Mass.—It is stated that a 6-story warehouse is to be erected on Beach and South Sts., to be leased by the American Oak Leather Co.

Philadelphia, Pa.—It is stated that a hall, to cost $55,000, is to be erected by the parishioners of the R. C. Church of St. John the Baptist, at Manayunk.

Muncie, Ind.—Swift & Co., 188 Madison St., Chicago, Ill., are stated to have received the contract for erecting the union depot here for $35,000.

Sioux Falls, S. D.—It is stated that a Masonic Temple is to be erected here to cost about $25,000. D. L. McKinney, Chmn. Bldg. Com.

St. Louis, Mo.—Weber & Groves, 509 Olive St., are stated to have been selected to prepare plans for an 8-story building to be erected at the entrance of the Eads bridge, for the Norvell-Shapleigh Hardware Co., to cost about $250,000.

Wilmington, Del.—The contract for erecting the Pullman Palace Car Company's shops at Wilmington is stated to have been awarded to R. & S. Sollitt, 140 Dearborn St., Chicago, Ill.; estimated cost of the work reported to be about $190,000.

Durango, Mex.—Alfred Giles, Monterey, Mex., has prepared plans for a $100,000 bank and office building for the Bank of Durango.

Everett, Wash.—The contract for constructing a round house and machine shop for the Great Northern R. R. in this city is stated to have been awarded to Geo. McKenzie of Spokane. Contract price about $75,000.

New York, N. Y.—Plans have been filed with the Building Dept. by Architects De Lemos & Cordes for a 9-story fireproof brick, limestone and terra cotta building, to be erected on Bway. and 34th St. for the R. H. Macy Co.

DWELLINGS.

Chicago, Ill.—Harvy Wright, 226 La Salle St., is stated to have prepared plans for an apartment house to be erected on Drexel Boulevard and 44th St. for John B. Mallers, to cost $150,000.

Wilson & Marshall, 218 La Salle St., are stated to have prepared plans for a 4-story brick apartment house to be erected on Cottage Grove Ave. and 39th St., to cost $100,000.

Boston, Mass.—Jas. T. Kelly, 57 Mt. Vernon St., has prepared plans for 3 dwellings, 4 stories each, of stone and brick, to be erected on Bay State Road and Ashby St.; estimated cost, $60,000. Owner, Warren D. Vinal.

SCHOOLS.

Boston, Mass.—Separate bids are wanted July 29 for building addition to Bigelow School, for furnishing and installing heating and ventilating plant and for furnishing and installing electric works in said addition; also for plumbing system in Ira Allen school. Wm. F. Merritt, Chmn. Com. on New Bldgs., School Com.

Mt. Pleasant, Mich.—Bids are wanted July 30 for the construction of a brick training school to be built at Mt. Pleasant in accordance with plans prepared by Geo. L. Harvey, of Port Huron. Delos Falls, Supt. of Public Instruction, Lansing, Mich.

Jefferson City, Mo.—The plans of Miller & Opel, of Jefferson City, are stated to have been accepted for a dormitory for the Lincoln Institute.

Mandan, N. D.—Bids are wanted Aug. 19 for erecting a reform school. C. A. Heegaard, Secy. Bd.

Shawnee, O.—It is stated that bids are wanted by the County Commissioners at New Lexington until Aug. 1 for erecting a school at Shawnee.

Syracuse, N. Y.—Bids are wanted July 29 for erecting the truant school. Robt. H. Jones, Clk. Bd. Contract & Supply.

Greenfield, Mass.—Bids are wanted Aug. 10 for erecting an 8-room brick school at Davis and Pleasant Sts. Jos. W. Stephens, Chmn. Com.

Stockton, Cal.—Plans will soon be wanted by the Board of Education for a $100,000 high school.

Washington, D. C.—Bids are wanted Aug. 17 for the construction of a 12-room school at Lincoln Ave. and Prospect St. N. E. Lansing H. Beach, Commr.

Delaware O.—Bids are wanted Aug. 16 for the erection of a school in Orange Township. W. F. Sackett, Clk. of Bd.

Allegheny, Pa.—Bids are wanted Aug. 29 for a heating plant for the High School and Annex. G. W. Gerwig, Secy., Rm. 13 High School Bldg. F. J. Osterling, Archt., Times Buldg., Pittsburg.

Waterbury, Conn.—Bids are wanted July 29 for ventilating, heating, mason work, carpenter work, plumbing, electrical and other work for the Walsh and Russell schools; separate bids to be made for each building and for each class of work. J. J. Fitzgerald, Clk. Bd. Educ.

Lorain, O.—Bids are wanted Aug. 1 for $55,000 school bonds. Bids are also asked until Aug. 7 for the construction of a 10-room school; separate bids to be made for stonework, ironwork, ventilating and heating. E. E. Hopkins, Clk, Bd. Educ.

Ypsilanti, Mich.—The State Board of Education will receive bids until July 30 for the construction of a heating plant for the training school of the State Normal College. Delos Fall, Secy.

Jamesville, S. D.—Bids are wanted Aug. 10 for the construction of a school in District No. 44. J. E. Huber, District Clk.

Redding, Cal.—Local press reports state that plans and specifications will be received by the Board of Supervisors until Aug. 3 (readvertisement) for the Shasta County High School, cost not to exceed $30,000, including ventilating and heating system.

Grove City, Pa.—It is stated that a girls' dormitory to cost about $35,000 will be erected at the Grove City College.

Cape Girardeau, Mo.—Legg & Friz, 715 Locust St., St. Louis, are stated to be preparing plans for a science hall for the State Normal School here, to cost $48,000.

Saginaw, Mich.—Cooper & Jackson of Saginaw have prepared plans for a $14,000 addition to the West Side High School.

Harman, Colo.—R. Roeshlaub, King Blk., Denver, has prepared plans for a $20,000 brick school.

Denton, Tex.—The citizens are stated to have voted to issue $12,500 bonds to repair Central School.

Athens, Ga.—G. L. Norrman, Equitable Bldg., Atlanta, is stated to be preparing plans for a $25,000 school hall at Rock College, a part of the State Normal School.

Sioux Falls, S. D.—The State Board of Regents met here July 18 and are stated to have awarded to N. P. Fransen & Co. of St. Paul, Minn., the contract for erecting the normal and industrial school at Aberdeen, for $24,300, and to J. T. Detwiler & Co. of Des Moines, Ia., the contract for the new science hall at the State University at Vermillion, for $31,985.

New Haven, Conn.—The plans of Brown & Von Beren, Exchange Bldg., are stated to have been accepted for the high school, to cost about $250,000. Bids will be received at once.

New York, N. Y.—The following bids were opened July 22 by the Comr. on Bldgs., Bd. of Educ., for sanitary work at the Wadleigh High School: Jas. Harley & Co., 288 Flatbush Ave., Brooklyn, $20,965 (awarded contract); Jere J. Deady, $23,456; Jas. Fay, $22,498; Ed. J. Renehan, $22,040; John Spence, $29,669; John J. McGrath, $21,900.

Cincinnati, O.—A permit is stated to have been issued for the erection of the new St. Xavier's Parochial School, on Sycamore and 5th Sts.; cost, $50,000.

Chicago, Ill.—It is stated that $75,000 has been given to the University of Chicago by A. C. Bartlett, to be added to the $125,000 originally given by him, to be used in the construction of a gymnasium; work on the building will soon commence.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids are wanted July 30 for the final disposition of all garbage, refuse, etc., collected in the Boroughs of Manhattan and Bronx. P. E. Nagle, Commr. of Street Cleaning.

Dubuque, Ia.—This city has let the contract for street sprinkling for balance of year as follows: District No. 1, to M. Clancy at $9 per day; Districts 2, 3, 4 and 5, to Becker Bros., at $40 per day. City to furnish water.

Meadville, Pa.—The following bids were opened July 17 for the construction of a garbage crematory plant: Davis Garbage Furnace Co., Lancaster, Pa., 4 propositions, $7,600 to $4,800, and building $4,200; Dixon Garbage Crematory Co., Toledo, O., $5,106, no building; Bridgeport Boiler Works Co., $7,400, building $2,500 or $5,000, with steel instead of brick stack deduct $800.

GOVERNMENT WORK.

Brunswick, Ga.—Bids are wanted Aug. 29 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Custom House and Post Office at Brunswick, as advertised in The Engineering Record.

Philadelphia, Pa.—Bids are wanted at the U. S. Engineer Office until Aug. 26 for constructing stone buttresses and depositing rip-rap stone for protecting timber bulkhead in Delaware River, as advertised in The Engineering Record.

Elgin, Ill.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 21 for furnishing heating apparatus complete in place for the U. S. Postoffice at Elgin, as advertised in The Engineering Record.

Ft. Yellowstone, Wyo.—Bids are wanted Aug. 21 for erecting an engine house at Ft. Yellowstone. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Philadelphia, Pa.—The lowest bid received July 13 for the erection of three buildings at the Frankford Arsenal is stated to have been from Cramp & Co., Philadelphia, at $83,447.

Annapolis, Md.—Press reports state that the Charles McCaul Co. of Philadelphia has received the contract for erecting the marine barracks at Annapolis on its bid of $119,850.

Oswego, N. Y.—Major Thomas W. Symons, Corps of Engrs., U. S. A., has recommended an appropriation for Oswego Harbor of $215,000, of which $25,000 is for rock excavation, $150,000 for strengthening sub-structures, $10,000 for reducing the 1884 breach from 150 to 75 ft., and for other purposes $30,000.

Fall River, Mass.—Major George W. Goethals, Corps of Engrs., U. S. A., in his annual report for the Newport district, recommends the appropriation of $38,000 for the completion of projected plans for the improvement of the harbor of Fall River.

Governor's Island, N. Y. Harbor.—Press reports state that Secretary Root has approved plans fo the enlargement of Governor's Island, $200,000 to be expended immediately.

Ft. Leavenworth, Kan.—Press reports state that $1,000,000 will be expended as follows for improvements at Ft. Leavenworth: Infantry battalion barracks, $400,000; battalion of engineers barracks, $100,000; officers' quarters, $320,000; administration building, $60,000; and the remainder for grading the parade ground, putting in sewerage, etc.

Norfolk, Va.—The following bids were opened July 22 at the Treasury Dept., Washington, D. C., for alterations and repairs at the U. S. Custom House, Norfolk: B. B. Copp, $15,000; Williamson Bros., $14,500; E. Hart, $13,975; J. F. Oliver, $13,445. Bidders all of New York City.

Havana, Cuba.—E. J. Balbin, Ch. Engr. Lighthouse Bd., writes that the contract for furnishing the material and constructing two lighthouses has been awarded to Emilio Del Monte and Arthur E. Lee of Havana at $51,020 for the Jutias Cay lighthouse and $46,207 for Punta Goberandora lighthouse.

Washington, D. C.—The following bids were opened recently for induced draft steam boilers in the Treasury Dept. building: Wilbur Manchester, Newport, $17,990; Lucas Burbridge, Newport, $16,930; Congress Con. Co., Chicago, $18,850; J. F. Oliver, New York City, $12,849; Ambrose B. Stannard, New York City, $13,936; H. G. Bulman, New Bedford, Mass., $16,300; G. W. Corbett, Washington, D. C., $16,900.

Albany, N. Y.—The following bids were opened July 17 at the Treasury Dept., Washington, D. C., for the installation of an electric elevator in the U. S. Custom House, Albany: *a*, tandem gear; *b*, single gear: Sprague Elevator Co., New York City, *a* $5,050, *b*, $4,720; Otis Elevator Co., New York City, *a*, $5,450, *b* $5,230; Elithorpe Elevator Co., Chicago, Ill., *a* $4,850, *b* $4,370; Winslow Elevator Co., Chicago, Ill., *b* $5,200; Marine Engine & Machine Co., New York City, *a* $5,200, *b* $4,970; Elektron Mfg. Co., Springfield, Mass., *b* $3,880; Gardner Elevator Co., Detroit, Mich., *b* $5,385.

MISCELLANEOUS.

Burlington, Ont.—Bids are wanted Aug. 9 for the renewal of the superstructure of west end of south pier and sheet piling channel side of piers at Burlington Channel. H. A. Gray, Confederation Life Bldg., Toronto, Resident Engr. Fred Gelmas, Secy. Dept. of Pub. Works, Ottawa.

New York, N. Y.—The contract for constructing Pier No. 12, East River, has been awarded to W. H. Jenks, 130 Water St., at $25,715.

Newtown, L. I., N. Y.—The Board of Public Improvements has approved the amended map of the Second Ward of the Boro. of Queens, showing the proposed canal connecting Flushing Canal and Newtown Creek. The canal will be about 10 miles in length.

Boston, Mass.—The following bids have been received by Supt. of Streets Wheeler for filling and slope paving and fence on Alford St., Charlestown district, made necessary by the new bridge over the Mystic River: William L. Miller, Boston, $23,679 (awarded); Jones & Meehan, $46,992; Barnes & Ruffin, $27,885.80; Coleman Brothers, $41,308.

St. Paul, Minn.—The State Drainage Board is stated to have appointed Geo. Ralph, of Crookston, Minn., engineer of the commission. Petitions have been received from several counties asking for a share of the $25,000 available this year.

Memphis, Tenn.—Harry N. Pharr, Ch. Engr. St. Francis Levee Board, writes that the following bids were opened July 6 for the construction of 1,167,100 yds. of levee work:

Bidders.	Sec. 1, 176,700. cts.	Sec. 2, 295,500. cts	Sec. 3, 277,400. cts.	Sec. 4, 285,000. cts.	Sec. 5, 132,500. cts.
M. J. Roach, Memphis.....	16.24	16.24	16.24	16.24	16.24
G. H. Lawrence, Friars Pt., Miss.	12.816	.....	.....	.....	.....
T. M. Jacks, Helena, Ark.	10	14	14	14	10
P. H. Rodgers, Riley, I. T.	11.70	.....	.....	.....	10.40
J. G. Sessions, Greenville, Miss.	.....	16.98	.....	15.70	.....
Bush Bros., Grenada, Miss.	10.90	17.85	16.73	15.25	11.125

The contract for the total work was awarded to M. J. Roach.

NEW INDUSTRIAL PLANTS.

The New Castle, Pa., Stamping Co. has been organized with a capital of $100,000 to make stamped enamel ware. Two buildings, 100x300 ft. each, and a 200-H.-P. power plant will be required.

The Eastern Mfg. Co., Huntsville, Ala., will erect a 2-story, 200x80 ft. building, to be equipped with 200 looms, bleaching, dyeing and finishing machinery. The plant will be driven by electric motors of about 150 H.-P., the electricity being generated from the power plant of the Lowe Mfg. Co. Contracts for generators and motors have not been let.

John Rosenfeld's Sons, 202 Sansome St., San Francisco, Cal., write that the Eureka Portland Cement Co., in which they are largely interested, is figuring on building a plant having a daily capacity of 500 bbls.

The Washington Match Co., 101 New York Block, Seattle, Wash., has been incorporated with a capital of $1,200,000. The first building to be erected will be 4 stories, 200 ft. square, and the power plant will consist of two 100-H.-P. boilers and two 60-H.-P. engines, which have not yet been contracted for.

The Pullman Co., Chicago, writes that the plans for the reconstruction of its shops at Wilmington, Del., comprise seven buildings having a floor surface of 184,000 sq. ft. The present power plant, consisting of four 100-H.-P. boilers and a 250-H.-P. engine, will be used and a direct-connected engine and dynamo added for electric lighting. A furnace will be erected in the blacksmith shop and a 100-H.-P. boiler connected to it, utilizing the waste gas from the furnaces. The iron machine shop and mill will be direct driven from the large engine. The buffing and brass finishing, steam-fitting, upholstery, glass and minor departments will be driven by electric motors, and the shop plant will be lighted by electricity.

The Main Furniture Co., Hagerstown, Md., whose factory was recently burned, will erect a 50x100 ft. factory, a 15x30 ft. office building and an engine house. The power plant required will include a 75-H.-P. engine and a 100-H.-P. boiler or a 30 to 40-H.-P. alternating-current motor.

Henry Stanyon, president of the Stanyon-Miller Engineering Co., 701-702 Empire Bldg., Pittsburg, Pa., represents a syndicate which proposes building, probably in Louisville, Ky., a large plant, consisting of open-hearth furnaces, blooming, rod, wire and nail mills, besides other necessary buildings.

Samuel S. Fretz, 22 and 24 N. Fourth St., Philadelphia, Pa., will erect a 5-story, 60x540 ft., umbrella factory, with two 20x40 ft. wings. The power plant will have a capacity of about 125 H.-P. for electric lighting and 125 H.-P. for motors.

The Western Machine Tool Works, Grand Rapids, Mich., will erect a 50x100-ft. machine shop and an engine and boiler house 45 ft. square at Holland, Mich.

Bids, with plans, specifications and blue-prints, are wanted by the Palestine, Tex., Coal & Mining Co. for erecting a 500-bbl., also a 1,000-bbl. daily capacity salt-making plant.

Bids are wanted by the F. S. Royster Guano Co., Norfolk, Va., for erecting two cottonseed-oil mills, one at Tarboro, N. C., the other at Columbia, S. C.

White Bros., Graham, N. C., will erect a 3-story, 170x60 ft. mill and install two 18 ft. by 66 in. boilers for 125 lbs. pressure, a 150 or 200-H.-P. Corliss engine and rope drive.

C. B. Chapman, 109 S. Fairchild St., Madison, Wis., expects to erect a wood-working plant in Virginia.

The Enfield, N. C., Knitting Mills will install double the present number of knitting machines, and will be in the market for shafting, pulleys and belting.

The Vose & Sons' Piano Co., 40 Waltham St., Boston, Mass., will build a 6-story, 360x60 ft., factory, and expects to install a 200-H.-P. engine.

The Co-operative Foundry, Fifth and Congress Sts., Detroit, Mich., is building 35x80-ft. machine and pattern shops, a 50x145-ft. foundry and core room and a cleaning room 50 ft. square. Seven 10 and 15-ton steel cranes, a 20 and a 40-ton cupola and a 60-H.-P. engine and boiler will be installed.

BUSINESS NOTES.

The Bernards Light, Heat and Power Co., Bernardsville, N. J., has been incorporated with a capital of $100,000 to generate electricity. The incorporators are: Grant B. Schley, C. Ledyard Blair and John A. Dryden.

The Greenpoint factory of the Abendroth & Root Mfg. Co., 99 John St., New York, has been burned, throwing out of employment over 250 men. The company estimates the loss at from $150,000 to $200,000.

The Purdy & Henderson Co. has been incorporated in New Jersey with a capital of $50,000 to conduct the business of civil engineers, architects, constructors and builders and to manufacture iron and steel structures. The incorporators are Corydon T. Purdy, Upper Montclair; Lightner Henderson, New York City, and Charles T. Bergen, Newark.

The Mohawk Cement Co. has been incorporated with a capital stock of $350,000 by J. H. Kugler, Paul W. Ryder and Edward S. Chambless; the principal office is given as 1 Montgomery St., Jersey City.

On July 15 the plant of the Martins Creek Portland Cement Co., formerly the Wm. Krause & Sons' Cement Co., was started in full operation. George W. Rhoydhouse is president, and D. Charles Murtha is secretary. Cable, Thorn & Co., who are the company's sole agents, report that they are selling the cement as fast as the company can ship it.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
July 29.	Philadelphia, Pa	July 20
July 30.	Tower and tank Xenia, O	July 27
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Progress on the Subway Construction Work.

The work on the Rapid Transit subway construction has now been in progress about ten months, and the tearing up and occupation of streets, practically the entire length of Manhattan Island attest in a very emphatic manner the extent to which work has been prosecuted under the various sub-contracts. It is not meant by this observation that the disturbance of streets is any more than is necessarily to be expected in view of the amount of working progress or that it is conducted without due consideration of adjoining business and other interests; but even a layman, if he takes the pains to observe only a portion of the subway work now being carried on, he cannot fail to be impressed with the general distribution of steel girders, open trenches, drilling and blasting, cable transfer of excavated material, erection of steel work and, in short, all classes of operations necessary for the ultimate attainment of the Rapid Transit subway, of which the people of New York have heard so much during the past fifteen years and seen nothing whatever until the upheaval and occupation of streets have demonstrated the near coming of the subway railroad. The celerity with which the work has broken out and been prosecuted with such vigor at so many points indicates conclusively that a good deal of quiet but effective organization and administration has been completed and carried on.

The length of the work in a north and south direction is not much, if any, under a dozen miles, and over the greater part of that distance there are two lines of it with many points of great complication. Such portions of the line as the City Hall loop, the Park Avenue tunnel, the connections at Forty-second Street, the Fifty-ninth Street work and numerous other special features, to say nothing of an infinitude of details of perplexing character, have required an amount of careful and exact study in the development of plans that can never be appreciated by the lay portion of the public. Indeed, the difficulties attending the development of suitable plans and the subsequent execution of the work were considered to be practically insuperable even by some engineers. In suits at law brought by those opposing the enterprise by every legitimate means in their power, there was not lacking engineering evidence of a high professional character to the effect that many of the operations involved in construction would be attended by essentially insuperable obstacles. Yet the every day work, so to speak, of the sub-contractors consists in overcoming these so-called insuperable obstacles; in fact, this is done in apparently the most routine manner.

Incidentally, this aspect of the subway work is an object lesson of the most striking kind to the ultra-conservative portion of the public and of the profession, to the effect that there is generally more danger of underestimating than overestimating capacity for progression, at least in engineering methods and appliances. The amount and character of the work accomplished during the past few months would have been considered impracticable, if not impossible, a few years ago.

The extraordinary progress, for so it is, thus far attained is of course due to the distribution of the work to be performed which permits attacks at a comparatively great number of points in accordance with the well-recognized general principle of efficient practical engineering operations. This distributed attack shortens immensely the time required for the completion of the subway, because it makes that time practically identical with that required to finish but a small portion. A large number of forces and appliances operate concurrently and thus simultaneously complete a correspondingly large number of short sections of the line, the aggregate of which makes the whole. Judging from what has been done and from the present rate of progress, it would appear certain that the subway will be open for traffic in advance of the contract requirements.

This prompt execution of the work at a great number of points along the city streets doubtless produces much inconvenience and no little disturbance to business interests and to residents adjacent to the various working sections, but such disadvantages are temporary only and will be of much shorter duration than with less vigorous operations; they are inevitable, but they will exist for a short time only and will be followed by abundantly compensating conditions. There probably never has been so great a public work performed in any city of the world so well organized and where the rate of progress has been so great. Any one who had an opportunity to observe the work done on the underground railroad in Paris cannot fail to be struck by the violent contrast between the slow methods employed there and those which characterize the Rapid Transit subway construction in New York City.

Obviously, organizations and appliances, to be effective, must be employed, and the chief engineers of the Rapid Transit Commission and of the Rapid Transit Subway Construction Company have certainly displayed administrative ability and energy of the highest order in creating and conducting an organization of their work which has already made such progress as to assure entire completion of it well within their estimates of time. It may be said that the greater part of the work is not yet completed and that there is still opportunity enough to disclose unforeseen difficulties in such portions of the work, for instance, as the tunnel under the Harlem River. As a matter of fact, however, the actual beginnings of such great works are by far the most difficult portions. In the first place, they test the capacity and efficiency of the organizations employed and in the next place, they subject methods and appliances to the crucial test of actual performance. Although there is still more work to be done than has yet been executed, there are few or no difficulties to be encountered as great as those which have already been overcome, except possibly in the Harlem River tunnel construction, and there is little reason for any serious apprehension even there. Subaqueous construction in the well-known Harlem River silt needs extremely careful consideration and resort to effective methods and appliances, which doubtless will be given to it in this case.

There are probably not many who realize the diversity in the classes of work included in this great piece of construction. Much of it is below sub-surface water level and yet it must be kept dry; unusual quantities of steel are required as well as of cement, ordinary and glazed brick, an extraordinary amount of machinery employed in structural operations, to say nothing of the great mass of excavation in earth and rock throughout all the lines on Manhattan Island, and the tearing up and restoration of street surfaces. The reconstruction, removal and replacement of sewers, gas and water pipes and electric conduits make a heavy item of cost in addition to the actual work of construction and were formerly made much of by the opponents of the enterprise.

In reflecting upon the disturbed condition of the streets it is satisfactory to realize that the wisdom of the expert engineer commission which strongly recommended the adoption of Elm Street instead of Broadway has been appreciated by the Rapid Transit Commission, although that recommendation was at the time rejected by the Rapid Transit Commission as then constituted.

A Census Lesson Concerning Municipal Engineering.

The Director of the Twelfth Census recently issued a bulletin on urban population in 1900, by Mr. William C. Hunt, which affords some indirect lessons concerning the important place municipal engineering must soon acquire in public affairs as a result of the operation of well-defined natural laws. The census returns show that 37.3 per cent. of the entire population of the country is now living in incorporated communities of 4,000 population or over or in New England towns of like population which do not contain any incorporated places within their limits. In other words more than a third of the people of the United States are dependent upon the municipal engineer in a large degree for healthy homes, attractive surroundings and facilities for commerce. Of course, he cannot furnish the money for these advantages, but he can furnish the plans for its proper expenditure and ought to have sufficient tact and linguistic ability to convince others of the importance of his proposals.

Moreover, the importance of municipal engineering is steadily growing. It is impossible to compare the urban population at each decade for communities of less than 8,000 people. Using that limit, however, the figures are as follows:

Census Year.	Total Population.	Urban Population.	Percentage of Urban to Total.	No. of Places.
1790	3,929,214	131,472	3.4	6
1800	5,308,483	210,873	4.0	6
1810	7,239,881	356,920	4.9	11
1820	9,638,453	475,135	4.9	13
1830	12,866,020	864,509	6.7	26
1840	17,069,453	1,453,994	8.5	44
1850	23,191,876	2,897,586	12.5	85
1860	31,443,321	5,072,256	16.1	141
1870	38,558,371	8,071,875	20.9	226
1880	50,155,783	11,318,547	22.6	286
1890	62,622,250	18,272,503	29.2	447
1900	75,468,039	24,992,199	33.1	545

These figures show with a certainty that cannot be gainsaid the importance of municipal problems at the present time, an importance which is by no means recognized properly as yet. The effects of wholesome water and good sewerage on public health are fairly well understood by taxpayers, but the value of good pavements, efficient street sprinkling, a well-managed system of garbage-collection and disposal and other features of municipal engineering, is not appreciated. As a matter of fact it is painfully evident that only the engineers directly engaged in such undertakings recognize their difficult features, which demand wide experience and practical familiarity with like work for their proper consideration. Road-making and maintenance, grading and paving streets, draining swamps, the plumbing in buildings, masonry construction, the disposal of garbage, are subjects which cannot be taught to classes with the same precision as surveying, stresses and strains, bridge-building and the like, where mathematics affords a semblance of certainty to results which physical laws render liable to much uncertainty. For this reason municipal engineering has been necessarily taught with less enthusiasm than the more mathematical or mechanical subjects, and its importance has been overlooked by most graduates. Even instrutors have not always been broad enough to see its importance, and it was only a few years ago that the head of a large engineering school naively introduced an article containing some trite facts concerning sanitary engineering with the statement that he had thought the subject of little importance until he had investigated it shortly before.

As a matter of fact the municipal engineer needs a broader training than any other specialist, for he has to be a man of affairs, keen business ability, great tact, skilful in spoken and written argument, and endowed with the patience of Job, if he is to be truly successful. Unlike the railroad and bridge engineers, working for private corporations and usually with able men over them, he must be the leader of technically uninformed men who serve temporarily as the local legislators and executive officers. It requires tact and patience to succeed. It requires human sympathies to see through the political deals to real causes underlying them all. And with all this human element there is demanded great diligence in professional investigation, for in no branch of engineering is so much to be learned from experience and personal inspection as in city work. In spite of the word politics and the uncertainties of political office, the rapidly growing importance of municipal engineering must soon attract many a young man who has a heart rather than a calculating machine under his fifth rib, and The Engineering Record has a strong belief that the result of this young blood will bring about in the present generation the raising of the engineering profession to a position of distinguished eminence. The result must come from an improvement in the status of the public engineering offices, and that improvement will not become marked until the incumbents of such offices in many cities have the professional ability, tact and persuasive powers to make the value of their services fully apparent to both the taxpayers and the professional politicians.

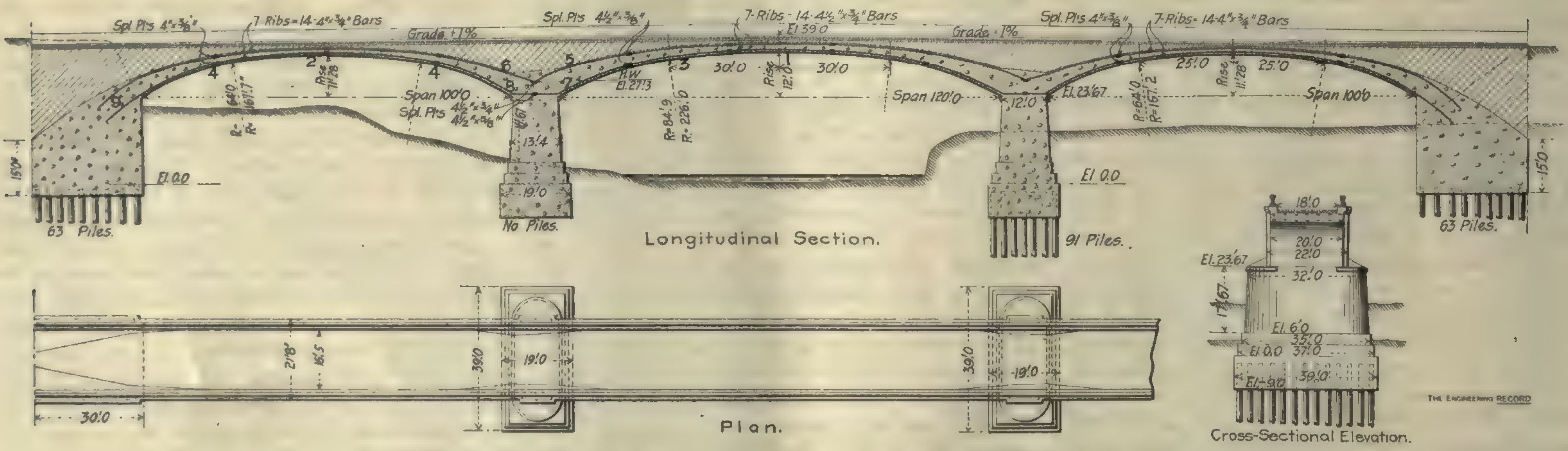
Concrete-Steel Bridges in Porto Rico.

By Edwin Thacher, M. Am. Soc. C. E.

On December 4, 1899, the writer entered into a contract with Capt. W. V. Judson, Corps of Engineers, U. S. A., President of the Board of Public Works, to build two concrete-steel bridges, Thacher patent, on the Island of Porto Rico. Both are located on the military road leading from San Juan to Ponce, one over the Jacaguas River at Juana Diaz, and the other over the Guayo River between Juana Diaz and Ponce.

The Jacaguas River bridge has three spans; the center span has a length of 120 feet and a rise of 12 feet, and each of the end spans has a length of 100 feet and a rise of 11.28 feet. It has total length of 404 feet, a clear width of 18 feet, and the grade at the center is 39 feet above the bed of the river. Work was commenced in February, 1900, and the bridge was completed and opened to traffic on March 7, 1901. The centering of the west span was lowered after two months; the deflection was 5/16 inch, which gradually increased to ¾ inch in sixty days, after which no further deflection took place. The centering of the center span was lowered after forty days; it deflected ⅝ inch, which increased to about ⅞ inch in one month. The centering of the east span was lowered after 30 days, deflected ¾ inch, which increased to about 1⅛ inches in two months. A few days before completion, this bridge was tested by the Board of Public Works as follows: 107 bags filled with sand and from thirty to sixty men, giving a total weight of from 21.5 tons to 23.5 tons, were concentrated at the center and intermediate points of the east 100-foot span, and at the center of the 120-foot span; the deflections under this load were about 0.012 for the 100 foot span and 0.015 for the 120-foot span. These results were considered fully satisfactory by the Board of Public Works and they did not think it necessary to proceed further. After these tests were completed the writer made a test by loading all the spans with bull carts, as many as could be crowded on the bridge two abreast, the carts being heavily loaded with stone, the bags of sand also being piled against the parapets and left on the center span. The deflections under this load were as follows: west span, 0.006; east span, 0.004, center span, 0.016, which were considered satisfactory. The above loads though not so severe as might be desired, were nevertheless several times greater than can be produced by any prospective traffic, and it was not considered desirable to incur the expense of increased loads.

Concrete-Steel Bridge Over the Guayo River near Juana Diaz, Porto Rico.



GENERAL FEATURES OF JACAGUAS RIVER CONCRETE-STEEL BRIDGE.

The Guayo River bridge has three spans each 70 feet in the clear. The center span has a rise of 7.5 feet and each of the end spans a rise of 7.0 feet. It has a total length of 270 feet, a clear width of 18 feet and the grade is about 20 feet above the bed of the river. Work was commenced July 20, 1900, and the bridge was completed on February 9, 1901. The centering was lowered after two and one-half months. No measurable deflection took place when the centers were lowered, nor up to the time the writer left the Island two months later. This bridge was not tested by the Board of Public Works by loading with bags of sand, but was tested by the writer with loaded carts, on the same day and in the same manner as at the Jacaguas bridge, but no measurable deflection took place.

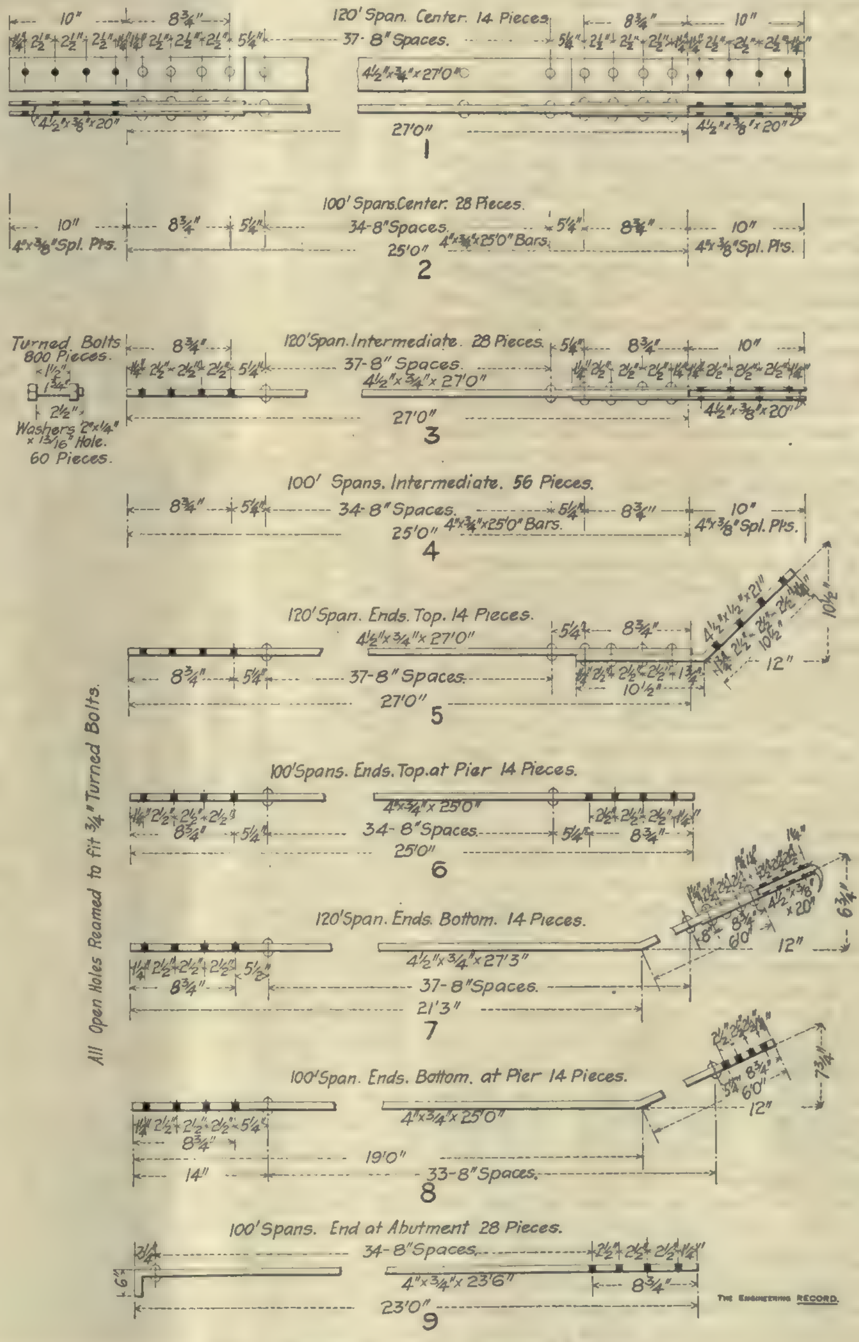
Pile foundations were used throughout except in the east pier of the Jacquas bridge, where it was not found practicable to drive piles. When the excavation had been completed a very compact material, gravel and clay, interspersed with small bowlders, was encountered, into which a drill could not be sledged exceeding 1½ feet. In view of this the Board of Public Works instructed the contractor to proceed with the concreting, and make no attempt to drive piles. With the exception of the east abutment of the Jacaguas bridge, where the excavation was very deep and through clay throughout, all excavations were made through about equal volumes of boulders and clay. The boulders were of all sizes from one cubic yard to only a few cubic inches, and as a rule became smaller as the excavation progressed, and when they were completed piles were driven without any great difficulty to a depth of from 12 to 22 feet. The piles were driven until the pentration did not exceed ¾ inch under the blow of a 2,240-pound hammer falling 25 feet.

The cofferdams were in some cases 3-inch tongue-and-groove plank set on end and driven down as the excavation progressed, and in other cases a curbing of 2-inch plank laid horizontally was used, but the former was found to give less trouble and to be much superior in every way. As none of the foundations were in water at any ordinary stage, it was not expected that any great amount of pumping would be required. The foundations for the abutments at Guayo were nearly dry, but all other foundations for both bridges gave a 6-inch centrifugal pump all the work it could do, and in three cases failed to keep the water down, a few feet of concrete being laid under water.

At both bridges the ribs of the centering were supported on pile bents in the channel spans, the piles being driven to refusal with a 2,240-pound hammer, and sustaining a maximum load of 30 tons at Jacaguas, and much less than this at Guayo. The ribs for the other spans were supported on timber bents, the sills of which rested on a bed of concrete in pits excavated from 2 to 6 feet in depth, depending on the nature of the ground. The ribs were spaced 6.5 feet on centers and covered with 2 x 4-inch lagging set on edge. Sand boxes 10 inches diameter and 12 inches high, with from 6 to 8 inches of sand, were used at all points of support. Sand boxes are very convenient for leveling up and lowering centering, and the writer assumed until recently they were nearly incompressible, but now feels that it is not safe to trust them without a good wedge on each side of them. At Jacaguas it was observed that the centering settled under the weight of concrete much more than was anticipated, and after much delay the greater part of this settlement was traced to the sand boxes, some of them going down 1½ inches or more. The plugs fitted as tightly as would work. Soon after the settlement of sand boxes was discovered, the writer directed the foreman in charge of centering to make an experiment. A sand box was packed carefully, the plug inserted and two men set at work with sledges, the plug was sledged down about 3 inches, and the foreman reported that he could have sent it to the bottom if he had kept on long enough.

The machinery used in the construction of the bridges consisted of two 6-inch centrifugal pumps, one 3-inch pulsometer, one pump with a 2-inch suction for raising water, one pile-driver with 2,240-pound hammer, one pile-driver engine, one Champion stone crusher and two portable 25-horse-power engines for running the pumps and stone crusher.

All concrete was mixed by hand and deposited in place with wheelbarrows. At Jacaguas the crusher and mixing platforms were located near the west pier about 20 feet below the grade of the roadway. Some of the hauls were quite lengthy and on heavy grades, but, everything considered, no cheaper way of handling the material could be found. Broken stone, crushed boulders, was used in all concrete. At Guayo gravel obtained from bed of river near bridge site was used for all concrete; this as well as sand could be delivered at one end of bridge at about the same cost as at the other, mixing platforms were therefore located at each end of bridge, and for the wheelbarrow work the haul was much shorter and the grades much lighter than at Jacaguas.



120' Span. Center. 14 Pieces.
37-8" Spaces.
4½"x¾"x27'0"
4½"x⅜"x20"
27'0"
1
100' Spans. Center. 28 Pieces.
34-8" Spaces.
4"x⅜" Spl. Pls.
4"x¾"x25'0" Bars.
25'0"
2
Turned Bolts 800 Pieces.
Washers 2"x¼" x 13/16" Hole. 60 Pieces.
120' Span. Intermediate. 28 Pieces.
37-8" Spaces.
4½"x¾"x27'0"
4½"x⅜"x20"
27'0"
3
100' Spans. Intermediate. 56 Pieces.
34-8" Spaces.
4"x¾"x25'0" Bars.
4"x⅜" Spl. Pls.
25'0"
4
120' Span. Ends. Top. 14 Pieces.
4½"x¾"x27'0"
4½"x½"x21"
37-8" Spaces.
27'0"
5
All Open Holes Reamed to fit ¾" Turned Bolts.
100' Spans. Ends. Top. at Pier 14 Pieces.
4"x¾"x25'0"
34-8" Spaces.
25'0"
6
120' Span. Ends. Bottom. 14 Pieces.
4½"x¾"x27'3"
4½"x⅜"x20"
37-8" Spaces.
21'3"
7
100' Span. Ends. Bottom. at Pier 14 Pieces.
4"x¾"x25'0"
19'0"
33-8" Spaces.
8
100' Spans. End at Abutment 28 Pieces.
34-8" Spaces.
4"x¾"x23'6"
23'0"
9
The Engineering Record.

Bill of Steel Material, Jacaguas Bridge.

All materials used for concrete were tested by the Board of Public Works in San Juan. Alsens Portland cement was used throughout the work and the tests made gave satisfactory results. The sand was obtained from banks near the bridge sites, and although it was not as good as could be desired, there was no better within any reasonable hauling distance, or so far as the writer knows on the Island. Tests were made on briquettes, after being kept one day in air and six days in water, sets of six, giving the following tensile strengths per square inch:

Cement.	Sand.	Kind of Sand.	Strength, lbs.
1 part	2 parts	Jacaguas, 24% sediment.	208 to 240
1 "	2 "	Guayo, 27% "	208 to 256
1 "	2 "	" 29% "	215 to 249

Tests made with washed sand gave about 50 pounds per square inch greater strength than with unwashed sand.

The tests on sand used in the work, washed and unwashed, were not completed until quite a large part of the concrete work at Jacaguas had been done, but all sand was washed thereafter. This was done by shoveling the sand into a trough through which was running a 2-inch stream of water with sufficient head to carry off the sand and deposit it in a box at the end of trough, the water containing sediment overflowing the box, and the sand being drawn off at bottom. Sand screened from the Guayo gravel gave only 6.5 per cent. of sediment, the sand screened through a 64-mesh sieve constituting from 16 per cent. to 33 per cent. of the volume. For the piers and abutments coarse gravel carrying the minimum of sand was used, bank sand being added to give the proper proportions to the mixture. For the arches a finer gravel carrying the proper proportion of sand without the addition of bank sand was used. The broken stone used at Jacaguas was of good quality. Bowlders found in the excavations and in the bed of river of such size as a man could handle were used for crushing. The part that would pass through a 1¼-inch ring, including stone dust, was used for the arches, the remainder that would pass through a 2-inch ring was used for all other parts of the work. Tests made by the Board of Public Works on briquettes composed of 1 part cement and 2 parts screenings from the arch stone that would pass through a 64-mesh sieve, seven-day tests, in sets of five, gave the following tensile strengths:

Screenings containing 28% dust, mean 372 lbs., max. 433 lbs.

Screenings containing 22% dust, mean 405 lbs., max. 422 lbs.

Screenings containing 30% dust, mean 392 lbs., max. 430 lbs.

Screenings containing 0% dust, mean 412 lbs., max. 444 lbs.

Screenings containing 100% dust, mean 297 lbs., max. 304 lbs.

The screenings of No. 2, containing 22 per cent. of dust, were from stone that had passed through the crusher twice. Tests on five briquettes composed of 1 part cement and 2 parts of clean standard sand, crushed quartz, gave a mean strength of 321 pounds and tests on five briquettes of neat cement gave a mean strength of 558 pounds. It will be seen that mortar made with screenings containing from 22 to 30 per cent. of fine stone dust has nearly the same strength as when made with screenings containig no dust, and has 12 per cent. greater strength than when clean sharp standard sand is used; also that mortar made with fine stone dust in place of sand is only about 7 per cent. weaker than when made with clean standard sand, and much stronger than when made with any sand to be found in Porto Rico, washed or unwashed. These tests only confirm what has been said by several writers before, that when fine screenings are taken out of crushed rock and replaced by sand it is to the detriment of the concrete. The crushed rock that passed through a 1¼-inch screen at Jacaguas contained about 20 per cent. of screenings that would pass through a 64-mesh sieve and classed as sand; sufficient bank sand was added to make the specified mixture.

The cement used on the work was imported from Germany direct; the lumber, piles, steel, machinery and tools were mostly imported from the United States. All material was landed at Ponce Playa and hauled to the Guayo and Jacaguas bridges, eight and ten miles respectively, by ox carts, the only available means of transportation. Every effort was made to hire or buy some wagons for hauling the piles, long timbers and steel bars, but without success. The piles were balanced on a cart and hauled one at a time, the 30-foot steel bars and long timbers were also hauled at great disadvantage. Mule teams and wagons are used by the army, but cannot be hired, and the native will not use them, ox carts with yoke attached to the horns being good enough and fast enough for him.

The specifications called for piles 30 feet long with 10-inch top. This is a common western specification, but such piles could not be found in or about New York, 6-inch top being the standard. Out of many thousand of piles in the Erie Basin, 112 pieces only were found, which by cutting down from 50-foot lengths would give from 8 to 9-inch top. As some piles were required promptly, these were accepted by the Board of Public Works and shipped by steamer from New York. The balance of the piles, 10-inch top, as well as most of the lumber, was shipped by schooner from Jacksonville. The lumber and piles were contracted for in February to be shipped in 30 days, but owing to the difficulty of the shipper in chartering a schooner, they did not reach their destination until June 5, thereby delaying the work quite materially. The day following the landing of the cargo, the crew of the schooner mutinied, and the captain was forced to kill one of the sailors; the subsequent proceedings ran up quite a bill of costs which the mayor of Ponce with his usual generosity kindly offered to let the bridge contractor pay.

Native labor was employed throughout, the foreman only being Americans or Europeans. As the natives could not understand a word of English, and the foremen with but two exceptions could not talk Spanish, the situation was somewhat trying. The laborers as a rule were willing enough to work, but they were barefooted, which was a disadvantage in some kinds of work. They also subsisted on a very slender diet, but have much greater endurance than could be expected under such conditions, in that tropical climate.

The wages of labor are low on the island. The prices paid per day of ten hours by the contractor, which were somewhat higher than paid by the plantations and other employers in the vicinity, were as follows: Common labor, 45 cents; concrete men and watchmen, 60 cents; carpenters, $1.20; masons, $1.50; ox carts with driver, $1.80. American foremen were paid their expenses to and from the island and wages considerably higher than they had been working for in the United States. Everything considered, the work was done no cheaper than the same class of work can be done for in the United States with the prevailing high-priced labor.

The contract prices were $59,438 for the Jacaguas bridge and $25,683 for the Guayo bridge, a total of $85,121 for both bridges, which were included in one contract. Work was commenced under the military government, and completed under the civil government of Porto Rico. All officers of both governments, including the customs officials, treated the contractor with the utmost courtesy and fairness, from the commencement of the work until its completion, which was not only highly appreciated, but in striking contrast to the treatment accorded Americans in general by the native municipal and legal authorities. The bridges were commenced at a time of great distress. The hurricane of August, 1899, had devastated the island, labor was unemployed, and people were dying of starvation on every hand. The work gave much-needed employment to a large number of men who were treated fairly and paid promptly, and no doubt was the means of saving some lives from starvation. In any American community this would have been appreciated, and the contractor felt that he was entitled to at least fair treatment, which he did receive from a few of the best and most progressive citizens of Juana Diaz, but the mayor and city council went out of their way to annoy him, discredit his work and injure him in every way possible, notwithstanding which he was fully sustained by the Governor and Board of Public Works.

One of the greatest difficulties with which a contractor must contend in Porto Rico is the suddenness of changes in the conditions of the weather and the rivers, giving no time for preparation. The writer has left the office under a clear sky for a five minutes walk to the bridge and been obliged to take shelter from a violent shower before he reached destination, and on one occasion was standing on the bank of the Guayo River, where there was not a drop of water to be seen, the bed of the river having been dry for a month, and within ten minutes the river was too high to ford.

The arch concrete at Jacaguas was laid in three longitudinal sections, the center section having a width of 9 feet and the outside sections a width of 5.5 feet each. At Guayo the arches were built in two longitudinal sections of about equal width. On October 16 the contractor met with a serious misfortune at the Jacaguas bridge which resulted in the loss of the center and south sections of the center arch, and delayed the completion of the bridge fully two months. The contractor assumed all responsibility for the disaster, and replaced the sections as promptly as possible, and without expense to the government. The facts on which the cause of the trouble must be based are as follows:

The specifications called for monolithic sections, but at the time these two sections were put in, violent rains were of daily occurrence, and to proceed with the work it became necessary to provide some way by which concreting could be discontinued at any time on short notice. The contractor proposed, and the government engineer in charge approved, depositing the concrete in layers, the layers dividing on the neutral line of the arch, work being suspended at any time by finishing against transverse bulkheads. Parts of three days were consumed in putting in the center section. The writer is satisfied that the method pursued was bad; the work should not have been attempted in rainy weather. Up to the time of relieving the centering the layers had failed to unite, there being about 1 inch of soft concrete between them, this may and probably would have hardened in time. The frequent rains may have injured the exposed surface of the bottom layer which subsequent grouting failed to restore, and the excessive settlement of the sand boxes previously noted may have had something to do with the failure of the layers to unite into one solid body; in any event whatever the cause they failed to unite. The writer is satisfied further that this cause alone would not have been fatal to the sections, as each half, other conditions being favorable, was sufficient to sustain the load.

The immediate cause of the failure was a large mass of bad concrete in the east half of the center section, this extended entirely across the section and had a length of about 20 feet. This mass was discovered before the centering had been greately relieved, and was first supposed to be a shell, but on investigation with a chisel the deeper it was entered the worse it got and as soon as the centering was fully relieved it dropped out, wrecking the center section and subjecting the side sections to an average load of not less than 880 pounds per square foot in excess of their own weight, or about six times the calculated load. The north section, being a monolith of good concrete, sustained this great load without injury, deflecting greatly, but returning to its original position when relieved, offering the strongest possible proof both as to its strength and elasticity. The concrete in the south section was good, at least it contained no large masses of soft concrete, but it was not a monolith and the layers of which it was composed had not united into one solid body, and although it would probably have safely withstood the load for which it was calculated it was not in a condition to stand the great weight and shock imposed by the center section and was wrecked with it. The end spans of 100 feet each, from which the centering had been removed, were, after the loss of two sections of the center span, left in a very trying position, subjecting them to a test much more severe than they can ever be called upon to sustain again, and which it is believed no stone or purely concrete bridge would have stood, but fortunately these spans were not injured. The west span never gave any evidence of having sustained a shock from first to last, but the east span did, and it was feared for some time that this span had been injured, as cracks could be discovered in the soffit west of the center, but it was found by subsequent thorough investigation that these cracks were caused by shells and did not extend beyond the mortar face. The writer now believes that a mortar face on the soffit of an arch, or on concrete work in general, is bad practice and that plastering is much worse. The mortar face is almost always mixed in too large batches and gets too far in advance of the concrete backing, frequently drying out or taking initial set, and failing to adhere perfectly to the concrete, causing shells of greater or less extent, which with the unskilled labor and under the tropical heat of Porto Rico can hardly be avoided, and which with the skilled labor and more moderate temperature of the United States are by no means unknown. Concrete deposited in smooth molds and afterward floated with mortar only sufficient to fill the pores gave much the best satisfaction when used. Some soft concrete was discovered in the east span, but no large masses of it; this was removed as far as possible and replaced by good concrete. The west span which behaved so admirably under extraordinary conditions was not examined so carefully, but is believed to contain very little if any bad concrete. The damage was practically confined to the two sections of the center span; these were replaced with concrete mixed and deposited with great care. They are monoliths, and unquestionably in good condition. Every section of the arches with the exception of the center section of the west span is now a monolith. This section has never shown any signs of weakness, the layers were not washed by rains, and as the centering was not removed until after two months, the layers have probably firmly united.

It is not customary for a contractor to criticise his own work, neither is it an altogether pleasant undertaking, but it is a fact that considerable soft concrete was found in the Jacaguas bridge, and a large body of it in the center section of the center arch, and the important question is how it came there. The writer did not have direct charge of the work, but he visited the work nearly every day, and supposed he knew about how it was being conducted, so will not undertake to shirk any responsibility that belongs to him. The concreting was in charge of men who had had considerable experience in that kind of work, and the government had two and sometimes three inspecting engineers assigned to the work, so there was no lack of supervision, at least so far as numbers were concerned, and the Board of Public Works certainly took every usual precaution to insure good work. The contractor was anxious to do good work, and if there was any shortage of cement in any batch of concrete it was without his knowledge or consent. Although the writer does not know, and will not undertake to explain, why all concrete was not good he has given the subject careful thought and will state some facts on which theories may be based. The cement was without doubt of good quality, but like all foreign cements used by the writer it was lumpy. The lumps were soft and could be easily crushed between the fingers, but hand mixing and some machine mixers will not reduce them to the original powder. The mixer used at Topeka would do this, as no vestage of a lump could be found in the mortar or concrete that came from the machine. At Little Rock the continuous mixer used would not remove all of them, and the writer, who was engineer of the work, required the contractor to regrind the cement in a flour mill on the work. At Jacaguas where all concrete was mixed by hand in batches containing one barrel of cement, the sand was spread on the mixing board, and the cement spread over the sand, the lumps being mashed with a shovel before proceeding further. This may not have been thoroughly done in all cases, as a workman will not do it properly unless constantly watched, and even foremen get careless when urgent demands are made on them for more concrete, so it is quite probable that some of the concrete suffered not from lack of cement, but from lack of thorough reduction of the lumps and their incorporation in the mortar.

Sand was obtained from pits in the vicinity and had to be selected with care. The sand used was of very dark color, the color being about the same as the deposit of loam, sand and clay found on the surface, which had to be removed to reach the sand selected. It is possible that some of this surface material which could not be detected by its color found its way into the sand pile, and was used in the concrete. This appears to the writer as the most probable cause of the large body of bad concrete found in the center section of the center arch. The sand ordinarily used was improved by washing, but some very good concrete was made with unwashed sand. The mixing was probably neither better nor worse than the general run of hand mixed concrete.

The concrete at Guayo was good. It was thoroughly mixed and well rammed, the only exception to this ever discovered was in a contracted space in one of the abutments too narrow to admit an ordinary rammer, and which appeared to have escaped without any ramming at all, but this did not much exceed 1 cubic foot altogether. This bridge never gave any trouble or uneasiness in any way, and so far as the writer knows has but one defect, which he hopes to have remedied in due time. It has been stated that this bridge never gave any deflection when the centering was removed, when the test load was applied, or at any other time; in fact, it was too stiff. The reason for this is supposed to be that the spandrels combined with the deep solid concrete parapets were stiffer than the arches proper, and this opinion is strengthened by the fact that the spandrels have separated from the arches at center in three places. Many similar cases are on record, but this is the first case on work with which the writer has been connected. It is evident that this does not weaken the bridge, but mars its beauty, and should be considered in design. The moral drawn by the writer from his experience in Porto Rico may be expressed as follows: Be sure of your sand. Mix all concrete for important work with a good mixing machine, and build all arch concrete in monoliths having the full depth of the arch, the monoliths being either longitudinal or transverse, it does not matter much which.

Extracts from Specifications.

Conditions of Calculation.—Modulus of elasticity of concrete, 1,400,000 lbs.; modulus of elasticity of steel, 28,000,000 lbs.; maximum stress per square inch on steel, 10,000 lbs.; maximum compression per square inch on concrete, 500 lbs.; maximum shear per square inch on concrete, 100 lbs.; maximum tension per square inch on concrete, 50 lbs. The above to be exclusive of temperature stresses. The steel ribs under a stress not exceeding their elastic limit, must be capable of taking the entire bending moment of the arch, without aid from the concrete and have a flange area of not less than one one-hundred-and-fiftieth part of the total area of the arch at crown.

Portland Cement Concrete.—The concrete shall be composed of clean hard broken stone, or gravel with irregular surface, clean sharp sand, and cement, mixed in the proportions hereafter specified. Whenever the amount of work to be done is sufficient to justify it, approved mixing machines shall be used. The ingredients shall be placed in the machine in a dry state, and in the volumes specified and be thoroughly mixed, after which clean water shall be added and the mixing continued until the wet mixture is thorough and the mass uniform. No more water shall be used than the concrete will bear without quaking in ramming. The mixing must be made as rapidly as possible and the batch deposited in the work without delay. If the mixing is done by hand, the cement and sand shall first be thoroughly mixed dry in the proportions specified. The stone previously drenched with water shall then be deposited on this mixture. Clean water shall be added and the mass be thoroughly mixed and turned over until each stone is covered with mortar, and the batch shall be deposited without delay, and be thoroughly rammed until all voids are filled. The grades of concrete to be used are as follows: For the arches between skewbacks, one part Portland cement, two parts sand, and four parts broken stone or gravel, that will pass through a one and one-quarter inch ring. For the piers, one part Portland cement, three parts sand and six parts broken stone that will pass through a two-inch ring. For the foundations, abutments and spandrels, one part Portland cement, four parts sand, and eight parts broken stone or gravel, that will pass through a two-inch ring.

Concrete Facing.—Concrete facing will be used and shall be composed of one part Portland cement, and two and one-half parts sand, and shall have a thickness of at least one inch on all arch soffits, arch faces, abutments, piers, spandrels or other exposed surfaces. There must be no definite plane or surface of demarkation between the facing and the concrete backing. The facing and backing must be deposited in the same layer, and be well rammed in place at the same time. If the arch faces, quoins or other exposed surfaces are marked to represent masonry, such division marks shall be made by triangular strips two inches wide and one inch deep fastened to the casing in perfectly straight and parallel lines, and all projecting corners will be beveled to correspond.

Connections.—In connecting concrete already set with new concrete the surface shall be cleaned and roughened, and mopped with a mortar composed of one part Portland cement and one part sand, to cement the parts together.

Arches.—The concrete for the arches shall be started simultaneously from both ends of the arch, and be built in longitudinal sections wide enough to inclose at least two steel ribs, and of sufficient width to constitute a day's work. The concrete shall be deposited in layers, each layer being well rammed in place before the previously deposited layer has had time to partially set. The work shall proceed continuously day and night if necessary to complete each longitudinal section. These sections while being built shall be held in place by substantial timber forms, normal to the centering and parallel to each other, and these forms shall be removed when the section has set sufficiently to admit of it. The sections shall be connected as specified above and also by steel clamps or rib connections built into the concrete.

Steel Ribs.—Steel ribs shall be imbedded in the concrete of the arch. They shall be spaced at equal distances apart, and be of the number shown on plans. Each rib shall consist of two flat bars of the sizes marked on plans. The bars shall be in lengths of about 30 ft. thoroughly spliced together, and extending into the abutments as shown. Through the center of each bar shall be driven a line of rivets spaced 8 inches c. to c. with heads projecting about ⅞ inches from each face of bar, except through splice plates where ordinary heads will be used. The bars shall be in pairs with their centers placed two inches within the inner and outer lines of the arch respectively as shown. All steel must be free from paint and oil, and all scale and rust must be removed before imbedding in the concrete. The tensile strength, limit of elasticity and ductility shall be determined from a standard test piece cut from the finished material and turned or planed parallel. The area of cross section shall not be less than ½ square inch. The elongation shall be measured after breaking on an original length of 8 inches. Each melt shall be tested for tension and bending. Test pieces from finished material prepared as above described shall have an ultimate strength of from 60,000 to 68,000 lbs. per square inch, an elastic limit of not less than one-half of the ultimate, shall elongate not less than 20% in 8 inches, and show a reduction of area at point of fracture of not less than 40%. It must bend cold 180 degrees around a curve whose diameter is equal to the thickness of piece tested without crack or flaw on convex side of bend. In tension tests the fracture must be entirely silky.

The Discharge in the Chicago Drainage Canal may be increased from 200,000 to 300,000 cubic feet per minute between four o'clock in the afternoon and midnight, according to a recent order of the War Department. During this period the movement of vessels in the Chicago River is believed to be so small that the increase in the velocity of the river due to the additional discharge of the canal will not cause serious trouble.

The Contractors' Power Plants on the New York Rapid Transit Railway.

One of the many problems that the sub-contractors on the different sections of the New York Rapid Transit Railway have had to solve was the method of power generation and distribution along the line of their respective sections. It is necessary to supply power to the hoisting engines at the derricks and cableways, to the rock drills both in open cuts and in tunnels, to the drainage pumps, and to the pneumatic appliances used in erecting the steel framework. These machines are scattered along sections usually over a mile in length, they are constantly being shifted, and in the down-town sections the conditions are such as to practically preclude the use of the customary portable engine and boiler, even if it were not open to objection on economical grounds. In the tunnel sections the use of compressed air for the drills was a foregone conclusion, and though electrically-driven cableways were installed and are being used with satisfactory results, the only system of power generation and transmission that could be generally applied to the apparatus used on the work was compressed air. In the earlier stages of the work a proposition was entertained by the general contractor, Mr. John B. McDonald, of installing a complete system of plants to distribute compressed air to the sub-contractors all along the line, but it was not carried out. The question of supply, being thus left to the sub-contractors themselves, resulted in the installation of eight plants, varying in type and arrangement in accordance with the practice of the contractor and the necessities of the location.

Fourth Avenue and Union Square, Showing Power Plant and Tunnel Excavation.

Elm Street, Showing Power Plant and Tunnel Excavation.

These plants supply eight contractors working on nine portions of the tunnel. The Degnon-McLean Construction Company, who are working on two widely separated sections, obtain power from a separate plant for one and from a plant operated jointly with another contractor for the other. Therefore there are eight sub-contractors using compressed air out of eleven, the length of their sections aggregating 72,100 feet, or 87 per cent. of the whole, 57 per cent. using air exclusively. The remainder is being done by steam power from portable units.

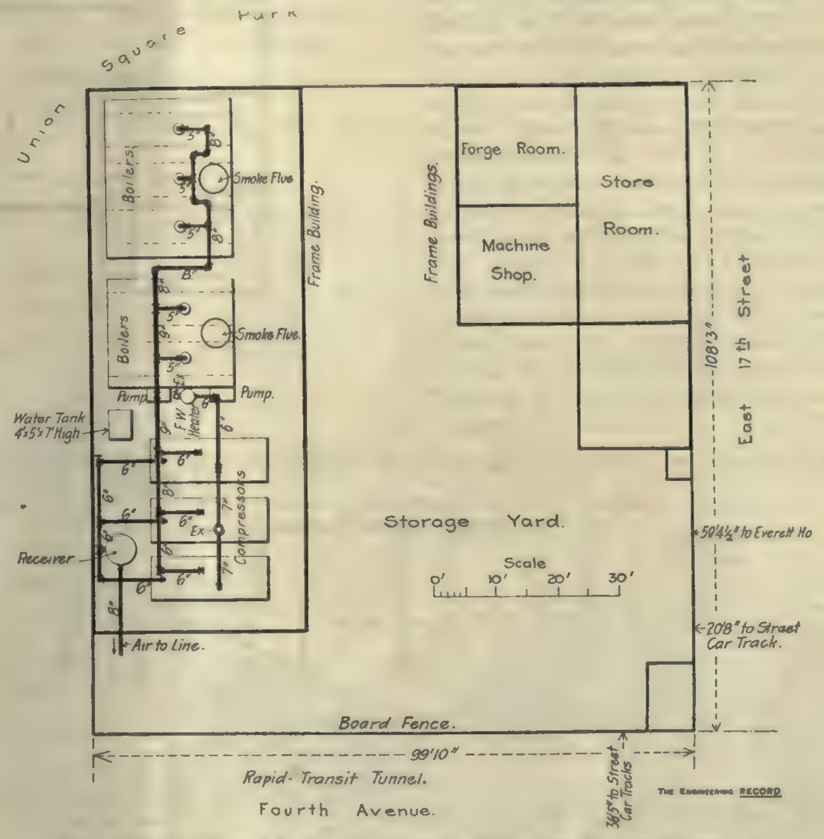
It is the intention of this article to describe in detail the different compressing plants, keeping in view the difficulty of obtaining a practicable location for them near the area to be supplied, the cramped conditions under which they have to operate in the more crowded districts, and the transient nature of the service they are to render.

The reasons for using compressed air, as given by one who has installed it, may be summed up as a saving of the radiation loss in steam pipes, the adaptability of air to the modern drilling, riveting and hoisting machinery, the ability to dispense with a licensed steam engineer on the hoists, and the cost of electrical current as supplied by the local company.

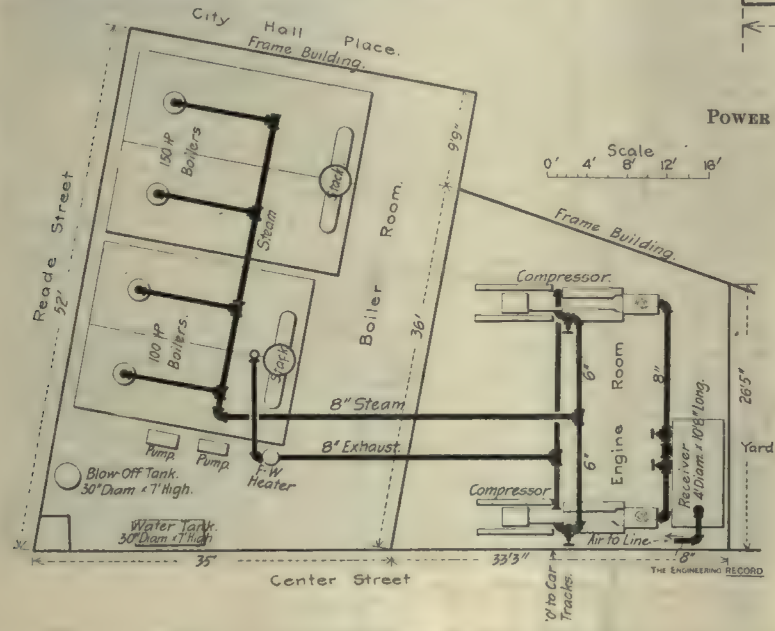
Beginning at the downtown end of the line, and taking up the sections in order, sections 1 and 2, extending from the Post Office loop to the center of Great Jones Street, are being built by the Degnon-McLean Construction Company, for whom Mr. F. D. Fisher is the engineer in charge. They have installed a compressor plant on the triangle of land enclosed by Reade and Center streets and City Hall Place, adjoining the portion of the tunnel on Center Street. The plant is housed in a frame building and is arranged as shown in the drawing. There are two straight-line Ingersoll-Sergeant compressors having steam and air cylinders 24 and 24¼ inches in diameter and 30 inches stroke, driven by two 100 and two 150-horse-power horizontal return tubular boilers. Pea coal is burned, and is supplied by wagons delivering at short intervals, there being practically no room for storage. The boilers are set two in a battery, each battery having a steel stack leading up through the roof. The steam pressure is 100 pounds, the main steam header being 8 inches in diameter and the speed of revolution of each compressor is controlled by an automatic steam and air-pressure regulator. The air cylinder has a piston inlet and a water-jacket supplied from the city mains, the waste cooling water being led to a tank and used for the boiler feed. The exhaust steam passes through a feed-water heater and thence to an exhaust head on the roof. Adjoining the heater are two 6 x 4 x 6-inch Worthington duplex feed pumps, also a steel pressure tank into which the boilers are blown down when necessary and the water allowed to cool before discharging, to avoid admitting steam to the sewer. The capacity of these compressors is 1,225 cubic feet of free air per minute at 80 revolutions and with a terminal air pressure of 100 pounds, the horse-power being about 245.

The air is discharged under about 100 pounds pressure through an 8-inch pipe to a steel-plate receiver, 4 feet in diameter and 12 feet long, placed on trestles 7 feet above the floor. It is provided with a safety valve and has an 8-inch outlet to the street, from which a 6-inch branch is taken to the downtown end of the section and a 5-inch branch, reducing to 4-inch about half way, to the uptown end, there being an auxiliary 4 x 12-foot receiver located at Prince Street. The air is used for all power purposes, there being 12 hoisting engines, 4 concrete mixers, 8 riveting machines, 3 cableways and several pumps in use at the present time. As there is no rock in this section, drills are not needed. In cold weather it was found necessary to reheat the air before using, as was the case with all the contractors working in exposed situations. Several forms of return tubular and malleable-iron heaters were used, but a small fire built around the pipe was sufficient at times. The plant runs practically 16 hours per day, there being two shifts of 8 hours each working on the excavation.

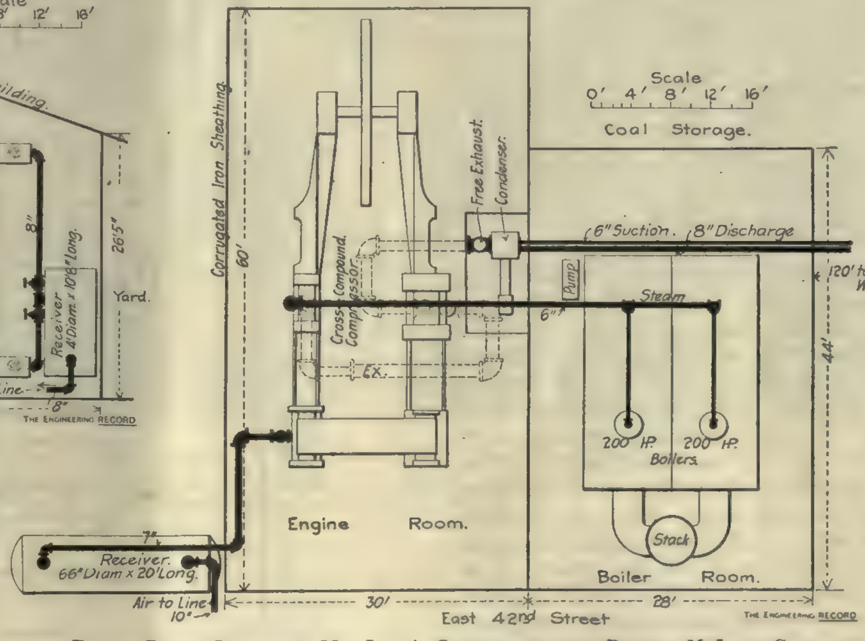
Section No. 3, for which the Holbrook, Cabot & Daly Contracting Company are sub-contractors, and Mr. H. B. Seaman the engineer, extends from Great Jones Street to Thirty-third Street, along Fourth Avenue, and is partly in sand and partly in rock. The compressor plant is located in the northeast corner of Union Square, this being practically the only available area in this crowded district where such a plant could be placed. Permission was obtained from the city authorities to enclose a space about 100 feet square immediately adjoining the tunnel excavation, and in this space a frame building 36 x 86 feet was erected, in which were placed three 24 x 24¼ x 30-inch Ingersoll-Sergeant straight-line compressors, furnished with steam by five horizontal tubular boilers of 100 horsepower each, the arrangement being shown in the drawing with sufficient clearness. The coal used is pea anthracite, delivered by teams from day to day, there being but little storage room available. The boilers are set three and two in a battery, the batteries having a steel stack rising through the roof directly above them, joined to them by an inclined breeching. The pressure carried is 100 pounds. The main steam header is 8 inches in diameter, a 6-inch branch being taken to each compressor. These are identical with those already described in the previous plant and exhaust into a 7-inch main having a free exhaust connection through a relief valve and a 6-inch branch to a Wainwright feed-water heater. There are also two 6 x 4 x 6-inch Worthington duplex feed pumps, which are supplied from a wooden tank into which the waste cooling water from the compressor cylinders is discharged, additional water from the city mains being supplied if necessary. The boiler blow-off is connected to an underground pressure tank. From the air cylinder of each compressor there is a 6-inch connection to the air receiver, which is of steel, 54 inches in diameter and 12 feet long, and is provided with a common 2-inch pop safety valve set at 110 pounds. From the receiver the air passes by an 8-inch main to the supply lines, running about 4,000 feet in either direction, the size of these lines being 5 inches, reducing to 4 inches about half way. Some trouble was caused by breaks at the flanges of the cast tees put in every three or four lengths for branch connections, though the pipe was buried for most of its length. By putting an expansion joint of the ordinary steam pattern every two blocks, this trouble was overcome. Power is supplied to 6 cableways, 10 derricks, 18 rock drills, 10 drainage pumps and 6 pneumatic riveters, part of the work of draining the excavation near the power house being done by a steam syphon. In the colder weather the air was reheated before each hoisting engine or group of drills, which was done by a sheet-iron trough in which a fire was built, surrounding the pipe. A coke-fired cast-iron heater of annular form of about 18 inches external and 10 inches internal diameter and 24 inches high, was also used with good results. The plant runs 24 hours a day, every precaution being taken to render its operation as nearly noiseless as possible, to avoid annoyance to those dwelling in the vicinity.



Power Plant of the Holbrook, Cabot & Daly Contracting Company.

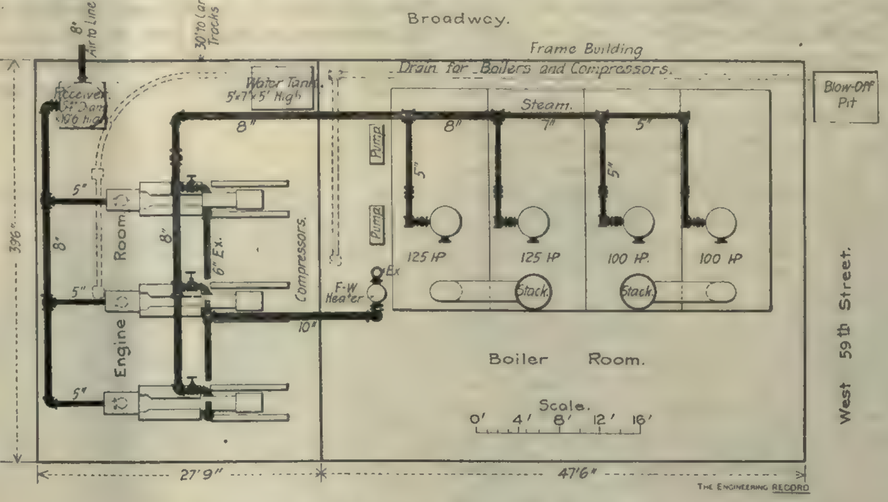


Power Plant of the Degnon-McLean Company.

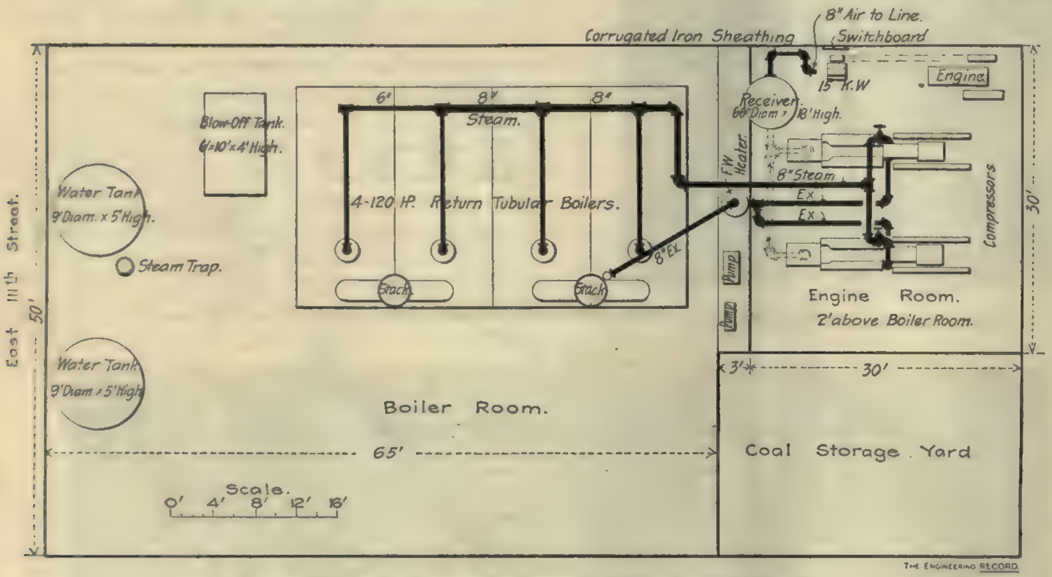


Power Plant Supplying Mr. Ira A. Shaler and the Degnon-McLean Company.

Sections 4 and 5A, extending from Thirty-third Street along Park Avenue to Forty-second Street, west to Broadway and north to Forty-seventh Street, were contracted for by Mr. Ira A. Shaler and the Degnon-McLean Company, respectively. The compressing plant is located at Forty-second Street, near the East River, on a portion of the tract used by Mr. McDonald as a storage yard. This location was chosen because it afforded better facilities for coal supply than any other available site distant from the water front and because of the proximity of condensing water. These advantages were thought to more than counterbalance the outlay for the pipe connection and the losses incident to the air transmission to the junction of the two sections at Park Avenue and Forty-first Street, this distance being some 4,000 feet. The plant was built by Mr. McDonald when the project of a general system of compressed-air supply for the tunnel sub-contractors was under consideration. It was later taken over by Mr. Shaler and the Degnon-McLean Company, and is now operated by them jointly. It comprises a frame building covered with corrugated-iron sheathing, about 60 x 30 feet in plan, containing the compressor, and an addition of about 28 x 44 feet in which are the boilers. The building is on the north side of Forty-second Street, adjoining the street line, and is about 120 feet from the water front, the engine-room floor being some 15 feet above the mean high-tide level. Coal is received at the wharf in barges and is stored in a shed just outside the boiler-room door. The design and construction of the complete plant was undertaken by the Rand Drill Company, and was done under the supervision of Mr. F. C. Weber, their engineer. The general arrangement is shown on the drawing.



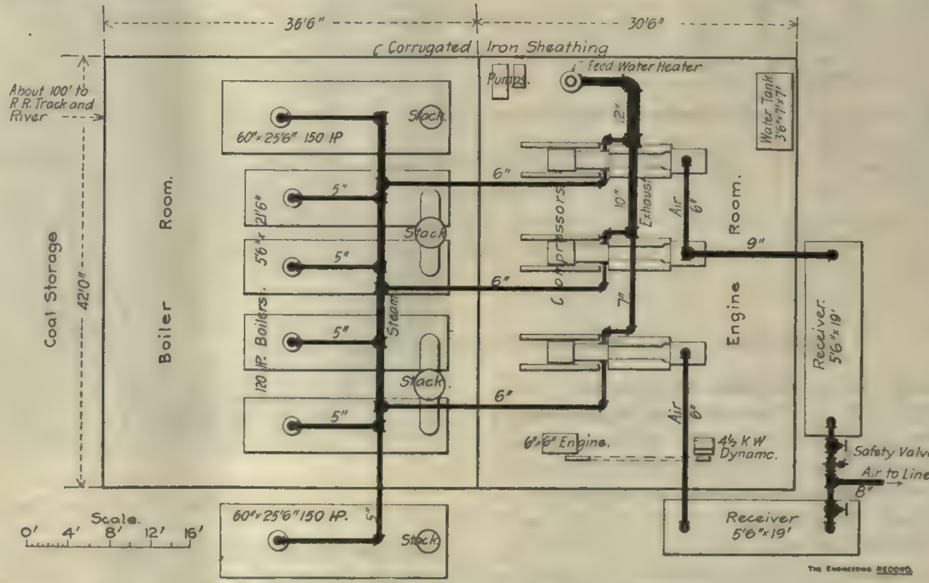
POWER PLANT OF MESSRS. NAUGHTON & COMPANY.



POWER PLANT OF MESSRS. FARRELL, HOPPER & COMPANY.

The boilers are two in number and are of the horizontal water-tube type, built by the Aultman-Taylor Company, the total heating surface being 4,074 square feet. Steam is generated at 135 pounds pressure. The boilers are set in a battery and have a guyed steel stack, and burn No. 1 buckwheat coal. The feed water is supplied from the city mains by a Korting injector and by a 6 x 4 x 6-inch Snow duplex feed pump. The boilers are each connected by a 5-inch branch to a 6-inch main steam header carried overhead to the high-pressure throttle valve and connected to it through a Sweet separator. The compressor is of the cross-compound steam and air type. It has steam cylinders 22 and 40 by 48 inches, provided with Corliss valve gear, and air cylinders 24 and 39 by 48 inches. The normal speed is 65 revolutions per minute, controlled by a throttling governor and an automatic air-pressure regulator. The compressor has a capacity of 4,320 cubic feet of free air per minute at normal speed, and with a terminal pressure of 80 to 100 pounds develops 450 to 750 indicated horse-power.

The exhaust is 14 inches in diameter and is connected to a tee, one branch of which is carried vertically to the roof for free exhaust, the other being led to a 10 x 18 x 18-inch Dean jet condenser and air pump set below floor-level. This pump draws its condensing water from the East River, a distance of about 150 feet, through a 6-inch pipe, the return being through an 8-inch pipe. The air is discharged through a 7-inch pipe to a 20 x 5½-foot riveted-steel receiver placed just outside the engine room and provided with a safety valve. From the receiver the air is led by a 10-inch wrought-iron pipe underneath the sidewalk to the street. It is carried underground along Forty-second Street to First Avenue, then over to Forty-first Street and so to Park Avenue, where a 6-inch branch is taken to supply the section for which Mr. Shaler is the sub-contractor, the 6-inch branch being reduced to 4-inch at Thirty-fourth Street. The main, reduced to 8-inch, continues along Forty-second Street and Broadway to Forty-seventh Street, the end of the Degnon & McLean section, the diameter being reduced successively to 6 and 4 inches. The pipe was laid with reference to avoiding the strains due to expansion, and there have been no breakages from this cause. The air is used for all drills, hoisting engines, pumps and pneumatic riveting tools throughout the two sections. The capacity of the plant, according to estimates furnished by Mr. Weber, is 25 3¼-inch Rand drills and 30 7 x 10 double-cylinder hoisting engines, allowing the latter to be in actual operation only one-third of the time. The plant is in practically continuous operation. The assistant engineers for Mr. Shaler are Mr. J. C. Hilton and Mr. Charles E. Fraser. Mr. H. C. Sanford is the engineer for the Degnon-McLean Construction Company on this section.

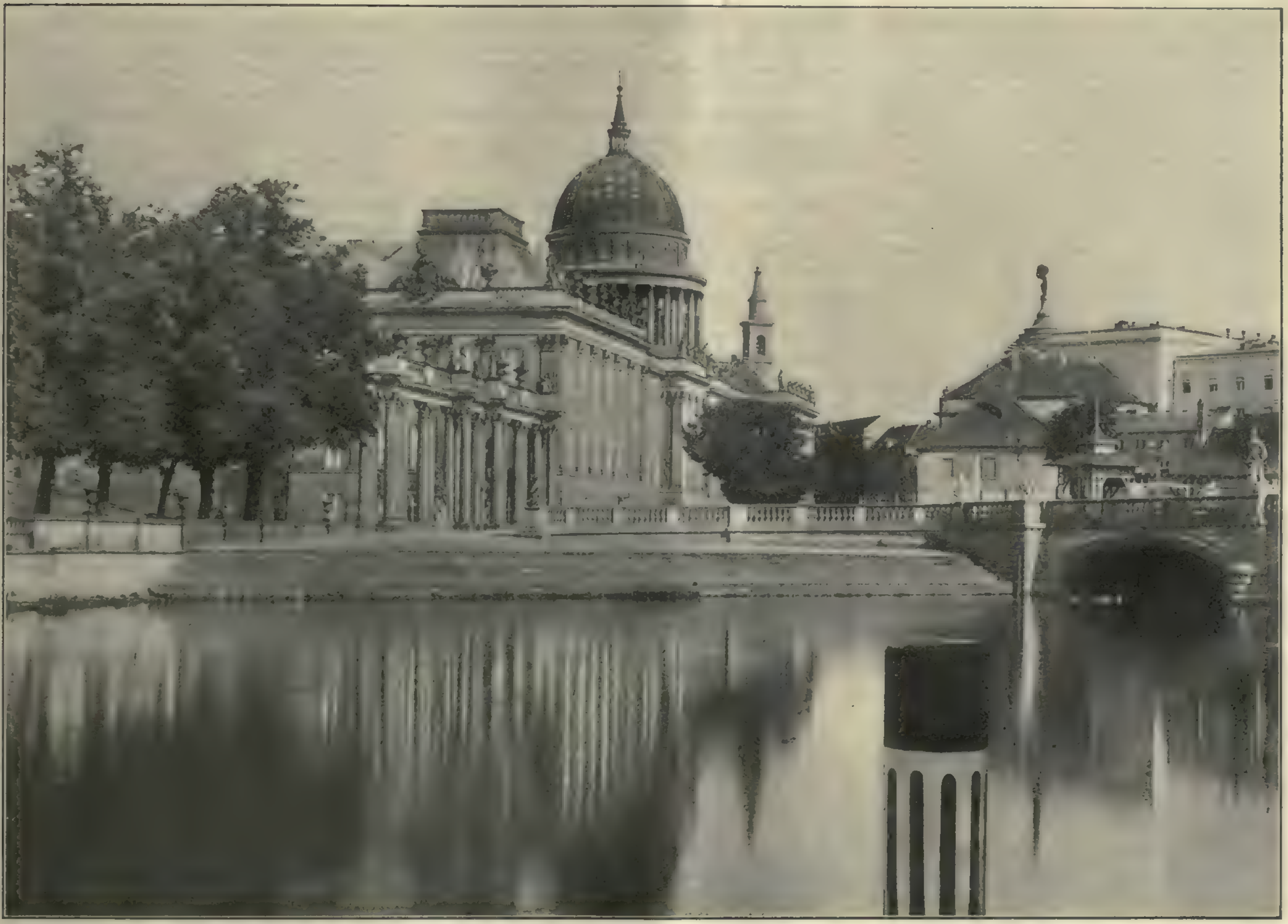


POWER PLANT OF MESSRS. L. B. MCCABE & BROTHER.

Section 5B, from Forty-seventh Street to Sixtieth Street, along Broadway, is being built by Naughton & Company, whose engineer is Major G. W. McNulty. They were able to obtain a location for a power plant on the east side of Broadway, between Fifty-eighth and Fifty-ninth Streets, adjoining the tunnel excavation, there being sufficient space to afford a small storage yard as well. The building is a frame structure, 40 x 76 feet, divided into an engine and a boiler room. The ground plan is shown on the drawing. It contains two 22 x 22¼ x 24-inch and one 24 x 24¼ x 30-inch Ingersoll-Sergeant straight-line compressors driven by two 100 and two 125-horse-power horizontal return tubular boilers. Pea coal is used, the supply being delivered daily by team and the ashes removed in the same way. Each boiler has a 5-inch connection to an 8-inch steam main, which leads to the engine room and from which one 6-inch and two 5-inch branches are taken to the compressors. The larger compressor is identical with those of the same make already described, the smaller ones differing only in size, their capacity being 960 cubic feet of free air per minute, at 94 revolutions, developing 192 horse-power. The exhaust connections are 6 and 7 inches in diameter, leading to a 10-inch main and thence to a Wainwright feed-water heater placed alongside the boilers. Over the larger compressor there is a 7-inch free exhaust connection to the roof, in which is placed a relief valve. There are two single Knowles feed pumps, placed as shown, supplied with water from a tank into which the exit water from the cooling jackets is led. There is also an underground pit provided for the boiler blow-off. The air from the compressor passes through 5 and 6-inch connections to an 8-inch inlet to the receiver, which is 54 inches in diameter and 12 feet high, and has a 1½-inch safety valve on the outlet, set at 110 pounds. The outlet is 8 inches in diameter and leads underground to the street. Just beyond the curb it branches with a long sweep tee, the line to the south being 5 inches in diameter for about 1,500 feet and reducing to 4 inches for 1,500 feet to Forty-seventh Street. The branch to the north is 4 inches in diameter and is about 1,000 feet long, extending to Sixtieth Street. On these mains special tongue-and-grooved tees with a 3-inch branch are used, and expansion joints are placed every 1,000 feet. The water condensing out of the air in the line is drawn off from drip pockets placed at low points. Power is supplied to 4 cableways, 32 rock drills, derricks and pneumatic tools. The compressor plant runs about twelve hours per day, for eight hours at its full capacity, that being the working time for the rock drills. The rest of the service is to operate the derricks and cableways for removing the spoil. The plant is run by an engineer and a fireman, with occasional help from a laborer.

Section No. 6, for which Mr. William Bradley has the contract, extends from Sixtieth to 104th Street, a distance of 12,211 feet. This section is all open cutting and is largely through rock. The work has been done so far with steam supplied by portable boilers for the rock drills, hoists and drainage pumps and two Hornsby-Akroyd oil engines, of about 13 horse-power each, one arranged to drive a portable centrifugal-pump outfit, the other driving a small compressor to supply air for the pneumatic riveters. Difficulty in obtaining suitable location has hitherto prevented the installation of a central power plant, but a site has now been secured at the dock at Seventy-ninth Street. The plant will be put in under the direction of Mr. R. G. Collins, the engineer for Mr. Bradley, and will consist of a galvanized-iron building containing two 24 x 24 x 30 Rand straight-line compressors, with room for a third, and four locomotive-type boilers aggregating 500 horse-power, together with the necessary pumps, feed-water heater, receiver and piping. Coal will be delivered by rail or water, and condensing water will be at hand if it is desired to add a condenser later on. The compressors are identical with those of the same make described in connection with Messrs. L. B. McCabe & Brother's plant. The distribution of the power will be by an 8-inch pipe line along Seventy-ninth Street to Broadway, the downtown branch reducing to 6 inches at Seventy-second Street and extending to Sixty-fourth Street. The uptown branch will be 3 inches and will extend only to Eighty-first Street. Air will be supplied to about 40 drills, 10 hoists, a cableway, several pumps and the pneumatic riveters. At present the drills run one shift, which will probably be increased to two when the plant is in operation.

Sections 7 and 8, extending from 103d Street and Broadway across Central Park and up Lenox Avenue to 135th Street, are contracted for by Messrs. Farrell, Hopper & Company, their engineer being Mr. Geo. Perrine. The first section is entirely rock-driven tunnel, the second being nearly all earth excavation. They have installed a compressor plant at 111th Street, near Lenox Avenue, comprising two Ingersoll-Sergeant straight-line compressors 24 x 24¼ x 30 inches, identical with those already mentioned, supplied with steam by four 120-horse-power return tubular boilers. The arrangement of the plant is shown on the drawing. The building is divided into a 30 x 30-foot engine room and a 50 x 65-foot boiler room, and is covered with galvanized-iron sheathing. Pea coal is used, delivered by teams as required. The boilers are set two in a battery, with a steel stack to each pair. The steam pressure is 100 pounds, controlled by a Kieley damper regulator. The steam main is 8 inches in diameter, there being a 6-inch branch to each compressor. The ex-



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXVII, POTSDAM, THE LONG BRIDGE.

A pleasing bridge with ornamentation by statuary, better arranged than in the Berlin examples. The quay, with its generous flight of curving steps immediately adjoining the bridge, is particularly happy.

haust is taken through a feed-water heater, thence to the roof. The waste water from the cooling jackets is used for the boiler feed, as in previous plants, and there are two 6 x 4 x 6-inch Worthington feed pumps. The compressors discharge to a 5½ x 18-foot receiver, in which about 90 pounds pressure is carried. The pipe connection to the line is 8 inches, and is carried underground to the line, where a branch is carried as far downtown as 104th Street and Amsterdam Avenue. The branch running uptown extends as far as 126th Street, beyond which portable boilers are used, there being no rock cutting in this portion. The part from 116th to 135th streets has been sub-let to Messrs. John C. Rodgers & Son, who are installing an electrically-driven Brothers cableway. The compressor plant runs practically 24 hours a day.

Section No. 11, from 104th to 125th streets, along Broadway, is being built by Mr. John M. Shields, whose engineer is Mr. J. T. Shipman. Difficulty in securing a location has prevented the installation of a compressor plant to supply this section up to this time, power having been furnished by portable boilers at different points along the line. Mr. Shields has, however, recently received permission to occupy a part of the street for that purpose, and is now putting in a 24 x 24 x 30-inch Rand straight-line compressor and a locomotive boiler in the space between the sidewalk and the tunnel excavation, at 118th Street. From this point a pipe line will be carried in either direction to deliver air to the hoisting engines and drills in the vicinity. An electrically-driven cableway built by the W. T. Brothers Company, operated by current received from the local company, is also in use, and is said to be giving entire satisfaction.

Section 12 is being built by Mr. E. P. Roberts, and extends from 125th to 133d streets. Steam power from portable engines is being used exclusively.

Sections 13 and 14, extending from 133d Street along Broadway and Eleventh Avenue to Hillside Avenue, are being built by Messrs. L. B. McCabe & Brother, their engineer being Mr. T. P. Kinsley. They have installed a compressor plant between 162nd and 163d streets, on the banks of the North River, to supply power to their work, the major part of which is rock tunnel. The building is 76 x 42 feet, of galvanized-iron sheathing over a wooden frame, and is divided by a partition into a boiler and an engine room. The floor-level is about 10 feet above mean high tide. There are three 24 x 24 x 30-inch Rand straight-line compressors driven by six locomotive-type boilers, four of 120 and two of 150 horse-power, carrying 90 to 95 pounds steam pressure. They burn buckwheat coal, which is delivered in cars on the railroad siding adjoining the boiler house. Each compressor has a capacity of 1,335 cubic feet of free air per minute at 85 revolutions, and, when compressing to 100 pounds terminal pressure, develops about 280 horse-power. They are governed by an automatic speed and pressure regulator. The exhaust is led through a 12-inch pipe to a 750-horse-power Wainwright feed-water heater, passing thence to an exhaust head on the roof. The feed-water is drawn from a tank receiving the waste cooling water from the compressor-cylinder jackets, any deficiency in this amount being made up by a float valve opening the city water connection if the level falls in the tank. There are two Knowles duplex feed pumps, 7½ x 4½ x 6 and 4½ x 2¾ x 4 inches. There is also a 6 x 6 slide-valve engine made by James Beggs, which runs a 4½kilowatt General Electric dynamo, furnishing light to the dump. Current from the local company's mains is used for lighting the tunnel. The air from two of the compressors is led through a 9-inch pipe to a 5 x 18-foot receiver placed just outside the engine room, and the air from the third compressor is led by a 6-inch pipe to a second similar receiver, placed as shown, the latter being large enough to take care of a fourth compressor which will later be installed. The main-line connection is taken from both receivers and is 8 inches in diameter. It is carried up the bluff to 165th Street and Broadway, and at 168th Street is reduced to 6 inches and later on to 4 inches, it being the intention to carry the line to Fort George as the work progresses. At 165th Street a 6-inch branch is taken along the tunnel line to 133d Street, reducing at 157th Street to 4 inches. The plant is in operation 24 hours per day, the actual drilling time being 16 hours, the remainder being for clearing away the spoil. There are 4 cages, 6 derricks, about 40 Rand rock drills and 4 drainage pumps now operated by the compressed air. The opening of the tunnel at the Fort George end will necessitate a fourth compressor and additional working tools.

The Steelwork in Skeleton Buildings.

Extracts from a lecture delivered at the School of Architecture, University of Pennsylvania, by Mr. William Copeland Furber, M. Am. Soc. C. E.

The present architectural design of buildings in which an iron frame is used for supporting the masonry is the cheapest form of dissimulation, and we can imagine the disgust with which our successors in years to come will regard the work of the present generation. The cause of this trouble lies in the attempt to apply the same architectural details to a skeleton building that are usually applied to a masonry building, or, in other words, to apply the architecture of stone to a structure of iron. The fundamental basis of the present architectural forms has the merit of once having stood for something of utility. The console, the dentil, the pediment, the column, all once had a utilitarian office, and to them ornament has been applied until they have assumed a graceful form and have become the words of the architectural language in stonework. But they had the truth for their prototypes and they have consequently developed rationally.

The architecture of the iron building of to-day is indefensible because it is, first of all, a sham, a mere pretense, purporting by its detail to be a masonry structure, yet violating every principle of masonry construction. It is ridiculous, to say the least, to see a building in which the cornices, brackets and consoles, which are the visible evidence of the bones of the structure and apparently support the work above them, are wired or strapped to the iron skeleton. The galvanized iron cornice and similar shams are surely no worse.

The solution of any problem is arrived at by a series of compromises, and any one charged with responsibility should fully understand what these compromises involve from an artistic and utilitarian point of view; for the best results cannot follow when one or the other is ruthlessly sacrificed without consideration, but with a proper appreciation of the value of the two, an architectural and structural solution can generally be found which does justice to each and is also practical.

The first and most important thing to be done, after the requirements of arrangement have been determined, is to rough out the plan and fill in the main lines of construction; for if this is done, it is surprising how easily the rational development of the scheme will follow. It is well in beginning this method, to have more than one approximate plan, and they should not be determined plans. The purposes of the building and the general or specific uses to which it is to be put should have been carefully studied out, and the designer should have fixed in his mind the limitations of the problem, or in other words, he should have found out the things he cannot do. It is wonderful how it clears up the atmosphere to possibilities to discover what the impossibilities are. When you have discovered what you cannot do; the things you can do crowd themselves upon you.

Rust protection.—There is probably no part of the material in an iron skeleton building which receives so little protection from corrosion as the skeleton, and this is because it is covered up. The ancient adage, "out of sight out of mind," is as true regarding this neglect as it is in many other matters relating to buildings.

Rustproofing a structure is, however, a very simple matter. Rust in steel or iron is due to three factors working together, water, an acid and oxygen. These three must work together to produce it. Ironwork in a building is liable to corrosion through the presence of water which is probably sufficiently charged with an acid and sufficient oxygen to furnish all the properties required to begin the work of disintegration at once, or, if it is not, can readily acquire them in short order.

Fortunately, we have a material which possesses many useful qualities and at the same time the very valuable property of rendering harmless any water which may reach the iron. In the foundations of buildings which are below water line, or near enough to it to be wet by capillary attraction, we cannot hope to keep the ironwork dry, but by neutralizing any acid that may be present in the water we can insure against corrosion. Portland cement, because it is a product of lime, furnishes an admirable base for any acid that may be found in water under ordinary conditions, and by reason of this, any water which may find its way through the cement cannot produce rust because only one of the combination which produces rust is present.

It is, therefore, highly important that with one of the three present, we keep out the others, and this demands that the concrete be in contact with the metalwork at all points. It becomes, then, absolutely necessary to guard against such defects in the concrete envelope as would permit their entrance.

The concrete should be in the closest contact with the metal, and for this to be possible the metal must be clean, that is, free from mill scale and rust and not painted. In order, however, to protect the metal from accidental corrosion before it leaves the shop, it should be covered with one coat of raw linseed oil. This oil is destroyed by the cement and does not prevent the close contact of the steel and the concrete. In time to come specifications will require that all metalwork shall have the surface cleaned with the sand blast so that the covering can be applied directly to the metal and not to the scale or skin which ordinarily covers it when it is received from the rolling mills.

After the surface of the metal work is clean, it is best, if possible, to cover its surface with a simple mixture of Portland cement and sand, but as this is not always practicable, a close contact can be assured by using a concrete made with a liberal proportion of mortar and the aggregate or filler in small pieces, ranging in size from particles as large as a pea to those which will just pass through a ¾-inch ring. If the material forming the aggregate is larger than this, it is apt to bridge over voids and prevent the ramming of the concrete into a solid homogeneous mass. The rate of expansion from heat being practically the same in iron and cement, if the contact is properly made between them they will act together thereafter, so that success in this rust-protection demands that the work be done right in the first place.

Above the foundation construction, the next most vulerable points are the external columns and girders. Rain and moisture can readily find their way through stone and brick walls, and if the metal is not covered with anything more than paint, which the mortar in the masonry has already destroyed in places, it is not a great while before corrosion begins. The concrete envelope should be placed around all external columns and girders, and the inside ones as well, if they are to be efficiently fireproofed. The concrete envelope is best secured in place by a fabric of wire netting of close mesh, which should have its edges bound together where they join. Around this netting should be placed the temporary boxing which is removed after the material has hardened.

Fireproofing.—One of the greatest faults of the modern systems of fireproofing is the thinness of the covering. Any non-conducting incombustible covering will prove reasonably efficient if it is thick enough, and thoroughly secured to the columns and girders. The reason the coverings have been made so thin is this: In the transposition from materials of low resistance like stone and brick to materials of high resistance like iron and steel, the difference in the areas required for walls and piers was so great and the space saved so valuable, that the temptation has been to restrict the space occupied by the columns to the minimum. Consequently as little has been allowed for the column and girder coverings as the law allowed, and as a result a good deal of the so-called fireproof covering is insufficient and in many instances improperly applied.

In the fire-clay covering and other rigid materials, the common practice is to unite the component parts with mortar. This is not sufficient. Coverings of any kind of rigid or plastic materials should be fastened on with wire netting to give fibrous qualities, and prevent separation in case of blows sufficient to break the covering.

Semi-porous terra-cotta can be heated to redness and then plunged into water without apparent disintegration, and is probably one of the most durable materials which can be applied to the protection of ironwork from heat. This knowledge of its virtue, however, has led the manufacturers and the architects to decrease the thickness of the covering to such a point that it no longer answers its purpose in a satisfactory manner. This is particularly true of the covering of the lower flanges of the floorbeams, where the covering is only about an inch in thickness. In this detail, another great sacrifice is made, namely, that of air-cells. Dead air space is a very poor conduction of heat; but this valuable property has been sacrificed to keep the floor arches of the minimum thickness, notwithstanding the great loss of efficiency in the fireproof covering caused thereby.

A material which combines many good qualities useful in fireproofing is Portland cement, which, if mixed with sand, forms almost an admirable fireproofing material applicable in a plastic state on a wire-mesh fabric to any structural member.

The high temperature at which Portland cement is made indicates its fire-resistance. It is also a poor heat conductor, and, if applied properly and in sufficient thickness, with air spaces between the coverings, will answer the purpose of fireproofing very well. It has, however, the defect of its qualities, that is, it can be applied so readily and so easily as to require careful inspection to be sure it is properly mixed and then properly put on.

The fireproof floor is usually made of porous hollow tile, expanded metal and concrete, or wire-mesh arches imbedded in concrete. All these floors are good ones if they are carefully put in place.

The porous hollow tile can be easily laid, requiring merely a centering of flat boards propped up under the floorbeams. The tile is strong and easily laid and easily inspected, and defects in tile and laying can be readily detected.

The concrete floors of any construction require inspection in the mixing and the laying. Carelessness or dishonesty in the mixing or carelessness in the laying may lead to bad results later on. The strength of concrete is dependent on the use of suitable materials and careful treatment. Without these, good results cannot be expected.

In any system of flooring, the flanges of the floorbeams should be abundantly protected, for the failure of a floorbeam through heat would open a hole in the floor which would permit the spread of fire.

Partitions can be made of several materials; mackite, hollow tile, expanded metal and wire lath all have their uses, and all are good. Where a partition is required to be of the minimum thickness, wire lath or expanded metal on steel studs permits the thinnest construction. Care should be used to see that any partition is well secured to both the floor and the ceiling near the doorways, for if it is not the jarring of the door is apt to break it loose.

Wind-bracing.—In arranging a building for wind-brace sections, sometimes the floor plans will permit a symmetrical arrangement of the cross-section in which the wind-bracing is to be put. Frequently, however, no such desirable arrangement is possible, and only certain sections can be utilized; this complicates matters somewhat, but careful study will usually permit a satisfactory solution of the problem. In some instances, due to the great uplift on the windward side or to the lightness of the wall carried by the column, the weight of an adjoining column has to be engaged to contribute its load to the load on the wind-brace column, which is done by means of a stiff diagonal strut. This condition is met with only in high and narrow buildings.

Where each line of columns in a cross-section through the building is not utilized as a stiff section, the lines not so braced should be attached by means of a floor system to the stiff section, so that the unstiffened sections shall transfer their wind loads to the stiff sections at each floor or every other floor. This is best done by a system of diagonal rods below the finished floor line with turnbuckles for tightening them up.

Wind-bracing in a high building performs, during and after erection, the very practical office of facilitating erection by enabling the columns to be maintained in their correct vertical position; for with the best shop work, the play of the temporary bolts in the holes is sufficient to allow a serious deviation from the vertical to occur, and with the temporary bracing of wood struts, this can rarely be prevented. Departures from the vertical of 2 inches in a height of 100 feet can readily occur and are not noticeable except when compared with a plumb line. Wind-bracing can be made of certain lengths to fit between the columns and requires that each column shall be in its proper place before the bracing will fit, so that no great error can accumulate. Great care, however, must be used to see that the columns are vertical before the riveting is done. The plumbing is usually done by means of heavy iron weights attached to wire. The plumb-bob is first steadied in a bucket of water.

The wind-bracing also performs an additional office of preventing any movement of the building which cracks the plaster and eventually weakens the connections. In the Woman's Temple Building in Chicago, which is built with cast-iron columns, without wind-bracing of any sort, the movement of the building is perceptible and is sufficient to cause pictures suspended against the walls to describe an arc in oscillating.

Eccentric loading of columns.—In designing a building the equal spacing of the span of girders should be adhered to if possible. Sometimes the architectural treatment, if decided upon in advance, does not permit it, yet it can frequently be accomplished if the pros and cons are rationally considered. If the loading is equal on both sides of the column in either axis, then the column can be made of a minimum section, for no extra material has to be included to provide for the strain caused by bending. But if the plan or the elevation does not allow an equal spacing of the column, then the sectional area of the column must be increased or the radius of gyration must be increased, so that the increased strain caused by the bending of the unbalanced load does not increase the strain from the vertical loads beyond the unit strains allowed.

An eccentric load will increase the sectional area of the column materially, depending, of course, upon the load and the lever arm through which it acts. Where the columns are continuous or a splice is made between the ends of the abutting columns sufficient to transmit bending, the bending strains are reduced—because of the continuity of the column—by the force necessary to make a contrary flexure, and such a reduction in the strain is justifiable under ordinary conditions. The only condition such a consideration requires is that every alternate floor shall not be loaded, and every intervening floor be empty. This is not likely to occur at any time in any building except a warehouse, where such loading might occur.

Good design will eliminate many of the evils of eccentric loading. In many instances the wall beams can be placed on the outer side of the column, balancing, or nearly balancing, the interior floor girder load at right angles.

Long and short spans vs. spans of uniform length.—It is advisable always to make the column spaces uniform along the line of girders so that the girders can be of the same depth and of minimum section. The following example will show the economy of the uniform span of girders compared with long and short spans alternating.

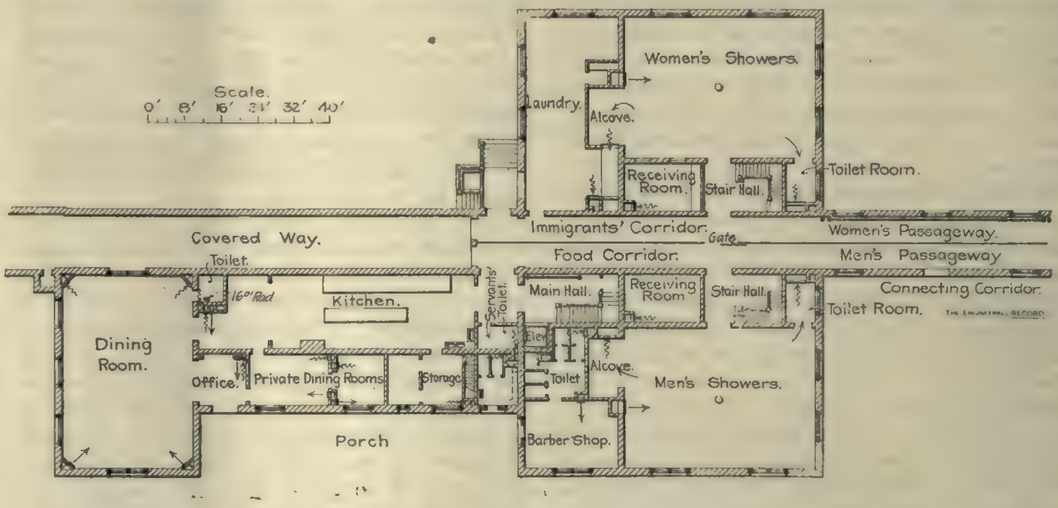
Take a building having a width of three spans of 16 feet each, the rows of columns being 16 feet on centers, and assume the gross floor load at 140 pounds per square foot. The load on each girder will be $16 \times 16 \times 140 = 35,840$ pounds. At a 16,000-pound fiber strain, a 15-inch, 42-pound I-beam at 16 feet span will carry 39,270 pounds, or more than enough. But taking this weight, the metal required for the girders in these three spans will be $3 \times 16 \times 42 = 2,016$ pounds. Now, compare the distance of 48 feet divided say, into two spans of 20 feet each and one span of 8 feet, as might be required under possible circumstances for a corridor. The load on the long girders will be $20 \times 16 \times 140 = 44,800$ pounds. A 15-inch, 65-pound beam will carry 45,230 pounds, a little more than enough. The short span will be $8 \times 16 \times 140 = 17,920$ pounds. An 8-inch 17.75-pound beam will carry 18,960 pounds, which is a trifle over our needs, but it will answer. The total weight of metal required will be: $(2 \times 20 \times 65) + (8 \times 17.75) = 2,742$ pounds, or an excess over the spans of uniform length of 726 pounds or 36 per cent.

Open vs. closed column section.—The practice in bridge work has always been to require that the members of the truss be open and not to be of a box or tubular form. The open form was required because of the necessity of frequent repainting, and, because of this necessity, the most economical disposition of the metal was often sacrificed. The same requirement is now bein applied to buildings, not on account of the repainting, which can never be done, but because the protective covering can usually be applied in a better manner and the work can be inspected while this is being done.

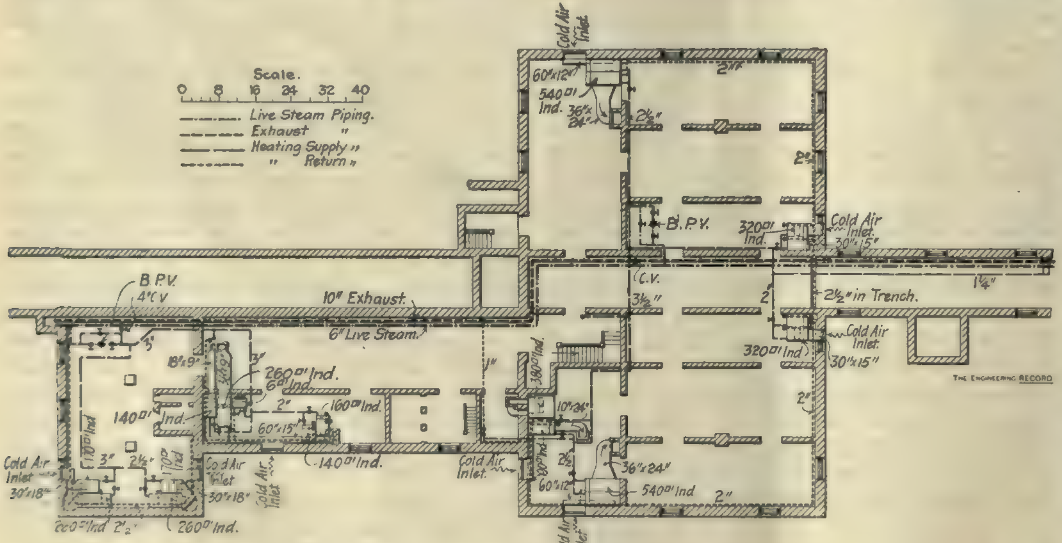
The principal objection to the closed section is that it permits the accumulation of chippings, rivet heads and debris of all kinds during erection, and these, with the water which is likely to get in, will produce rust. In some instances, the closed section is the most economical and is the best structurally, but the liability to rust outweighs its advantages. In other instances, however, where the loads are great and the space to be occupied by the column is limited, a closed section is the only one which can be used. Where this is the case, the interiors of the columns should be filled with concrete before the section above is put in place, particularly if the column is in the outside wall. The erectors of the iron work will probably object to this because it will delay their work, but their protest should not be allowed to interfere with this necessary precaution. Haste is a good thing under certain conditions, but permanence should not be sacrificed to haste. The specification requiring this, however, should be clearly set forth not only under the particular heading but under the ironwork as well.

Central Heating Plant, Ellis Island, N.Y.—II.

Ellis Island, in New York Harbor, is a landing station for immigrants to the United States. As explained in last week's issue, a new colony of buildings has been under construction there for the last few years for this purpose and a central lighting and heating plant was included in the general plan. The interesting features of the central station and the general problems of steam distribution for heating purposes were described, the scheme involving the location of both steam and return pipes overhead in covered connecting ways, owing chiefly to the water with which the earth is saturated throughout the greater part of the island. It remains in the present article to take up the features of the heating and ventilation in the main buildings.



First Floor, Kitchen and Bath Buildings.



Basement, Kitchen and Bath Buildings.

The restaurant and kitchen building and the bath and laundry building practically form a single structure, both two stories in height. The heating and ventilating is separate so far as the steam connections are concerned, but united as regards the air distribution. Characteristic features of the apparatus are as follows: Heating is almost entirely obtained by indirect radiation, with the indirect radiators grouped at various points, each group supplied by independent air inlets. Ventilation is maintained by a natural system from these radiators combined with a vent system of ducts and flues, the action of the latter being rendered also positive, however, by the insertion of aspirating surface. Steam is supplied at two points for the two buildings, each steam system connected to either or both the exhaust and medium-pressure mains from the covered-way conduit. The individual clusters of the indirect radiators are noticeably large.

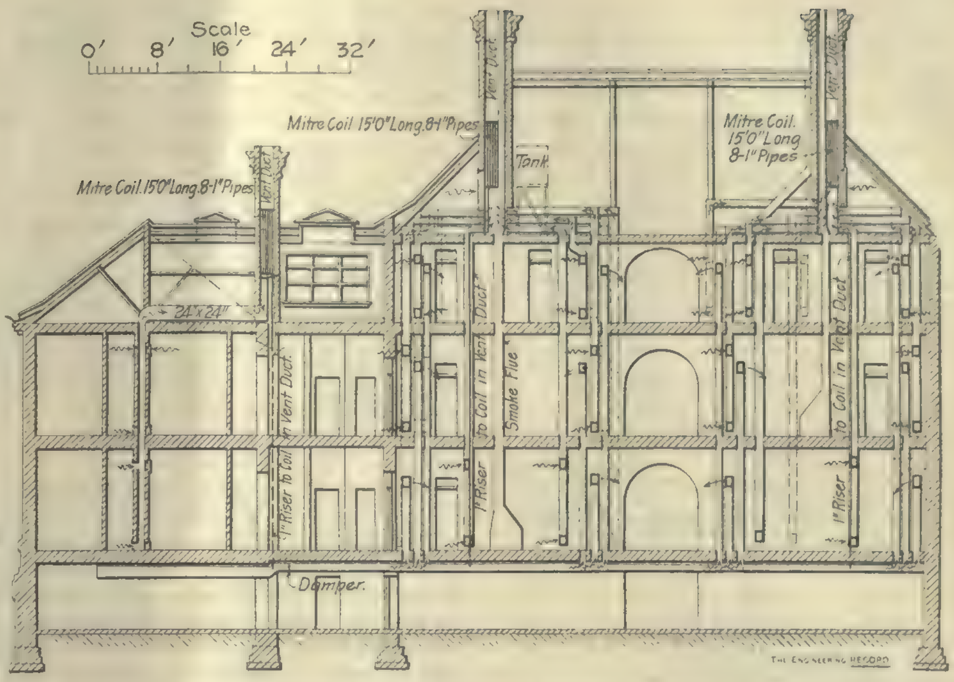
Plans of the basement and the first floor serve to show the system and the general arrangement of rooms. The restaurant building is largely occupied on the first floor by the kitchen and dining rooms, while on the second floors there are two large rooms used as dormitories. The bath building has two large shower rooms, for men and for women, respectively, on opposite sides of the corridor which passes through the building in a continuation of the covered way and has a barber shop and a laundry across the corridor from each other. The second floor of this building is also devoted to two large dormitories.

The steam supply for the apparatus is taken in each case in a 4-inch pipe from the exhaust main in the covered way and in a 2-inch pipe from the medium-pressure main; in the former case it has a check valve to prevent a outflow of steam from the building heating mains, should the pressure in the heating pipes exceed that in the exhaust main, as would be possible with the use of the medium-pressure system. Besides being an auxiliary supply, the medium-pressure steam may also be used exclusively for either apparatus should it seem desirable to use the exhaust steam in the main building lying beyond, and vice versa. The entrance of the medium-pressure steam into the apparatus is through a pressure-reducing valve with the usual by-pass.

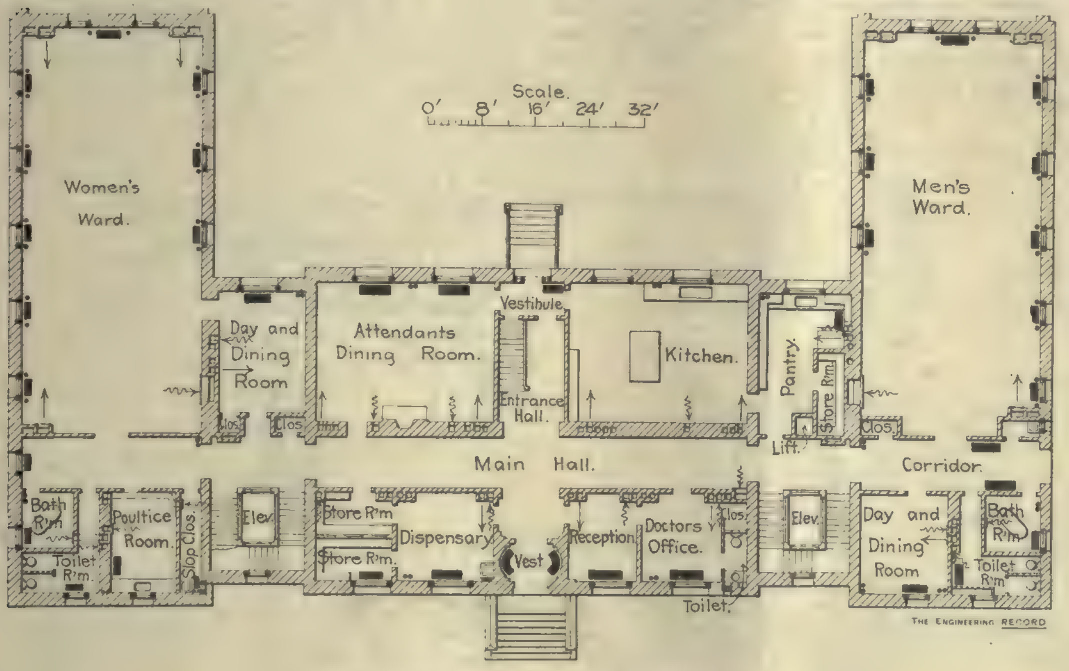
There are 15 clusters of indirect radiators in the whole building feeding as many flues. As stated, most of the radiators are quite large, and those of the greatest number of sections are divided into two sections, each separately connected to supply and return. The radiators are carried in general, on 4-inch I-beams, one end of which is imbedded in the building wall and the other end supported on a pipe standard. The inlets to the ducts leading to the different groups of indirect casings have the usual protecting screens at the mouth, of galvanized iron wire of about ⅝-inch mesh. All flues, including those for the vitiated air, are lined throughout with galvanized iron, which was given one coat of Venetian red paint before placed in position. The top of the fresh air flues are provided with a choke damper set at the completion of the apparatus to equalize the air distribution throughout the building. The exhaust air flues in general have two openings from the room served, at floor and ceiling respectively, which may be used for winter and summer ventilation respectively, the upper one providing for a more rapid outflow of the warm air. These flues in the attic are connected into a system of attic ducts which deliver to a chimney at a central point up which the vitiated air from the two buildings escapes. The aspirating surface consists of 24 1¼-inch pipes each about 10 feet long, extending diagonally across the chimney and connected by return bends at the upper end and by a header at the lower end. Automatic temperature regulation has been provided in the dining room and two large shower rooms, the thermostats operating the valves of the indirect radiators supplying those rooms.

The piping throughout the apparatus is pitched to carry the water of condensation in the direction of the flow of the steam, and the water from each indirect radiator is drained into the return at that point, the return mains for the building being carried around on the floor and in trenches were required. The water is received by a power trap, one of which there is corresponding to each of the two supply steam connections, and the water is delivered into the overhead return main in the covered way. The steam connection to each trap is obtained from the medium-pressure main through a 1-inch pressure-reducing valve, which also has a by-pass for use when the reducing valve fails or needs attention, this by-pass being small to throttle to a more or less degree the steam passing through it, so as to prevent too sudden a discharge from the trap with resultant water hammer.

The hospital building is a three-story structure about 156 feet across the front and having two rear wings, one from each end, giving a maximum depth of 88 feet. The building is warmed by forced ventilation supplemented by direct radiation. The air supply is tempered, but for the wards may be heated to any higher temperature desired, independently for each room, by auxiliary heating surface at the flue bases. The direct radiation in these rooms is designed altogether as an auxiliary, the heated air being depended on for heating, so that should there be a failure of the fan system, the direct radiation could be called into play; this arrangement of heating apparatus thus makes it possible to have local higher temperatures at different beds should the cases require it. The air distributing system presents a notable feature in the use of two fans, one at each end of the building, blowing into the opposite ends of a large central longitudinal duct constructed at the top of the basement corridor. This arrangement provides for running the whole plant from one fan in case of necessity and leaves the corridor free as an unobstructed continuation of the covered way leading to that building. The heating piping is overhead in the basement and the apparatus is supplied, after the manner described for the whole colony of buildings, with exhaust steam and live steam as an auxiliary.

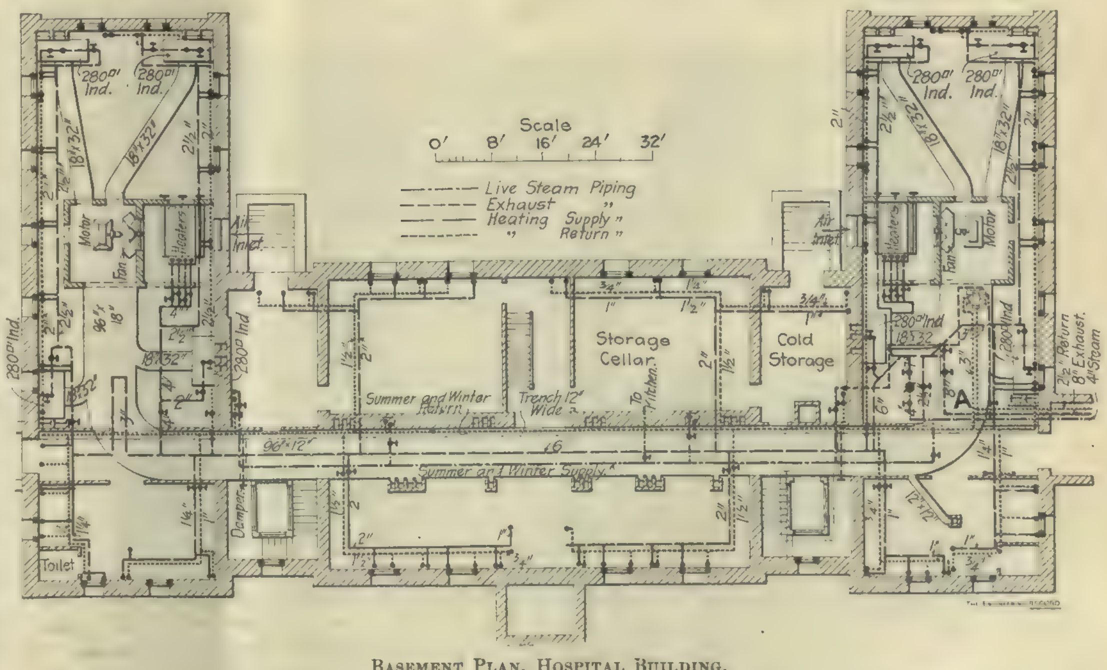

Scale
0' 8' 16' 24' 32'
Mitre Coil 15'0" Long 8-1" Pipes
Mitre Coil 15'0" Long 8-1" Pipes
Mitre Coil 15'0" Long 8-1" Pipes
Vent Duct
Vent Duct
Tank
24"x24"
1" Riser to Coil in Vent Duct
1" Riser to Coil in Vent Duct
Smoke Flue
1" Riser to Coil in Vent Duct
Damper
The Engineering Record

Transverse Elevation Through Hospital Building.



First Floor Plan, Hospital Building.

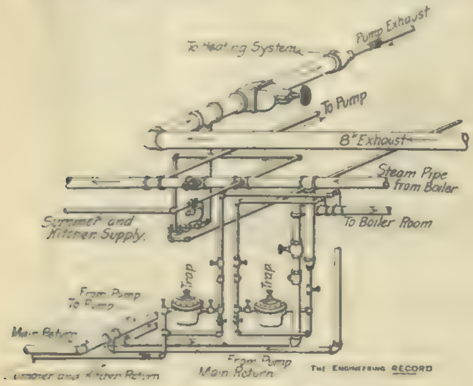
The layout of the heating apparatus is shown in an accompanying drawing of the basement. It is symmetrical about the center line of the building, one half being practically identical with the other. Each blast unit is of the type which draws the fresh air through the heating coils and delivers directly into the ducts. It is enclosed in a brick chamber within the basement, this divided into two parts, one for the heater and the other for the fan. The air inlet is provided with the usual protecting screen of galvanized-iron wire and the heater is supported above the floor to allow for the desired by-pass underneath. This is fitted with a damper and there is a set of dampers in front of and behind the heater, as shown in an accompanying drawing, which shuts off the air entirely from the heater when necessary. Each heater is 66 inches high, including the base, and is composed of pipe coils connected in four units of two sections to the unit and aggregating in all 2,400 square feet of surface, including base and elbows. Each fan is a Baldwin centrifugal duplex cone fan, 90 inches in diameter having 16 blades, and it is designed to deliver 25,000 cubic feet of air per minute against a pressure of one ounce and at a speed of about 200 revolutions per minute. Each fan is driven by a direct-connected electric motor installed with a capacity of 7.5 kilowatts when running at a speed of 300 revolutions per minute and arranged for operation at six speeds from 50 to 300 turns per minute.



Basement Plan, Hospital Building.

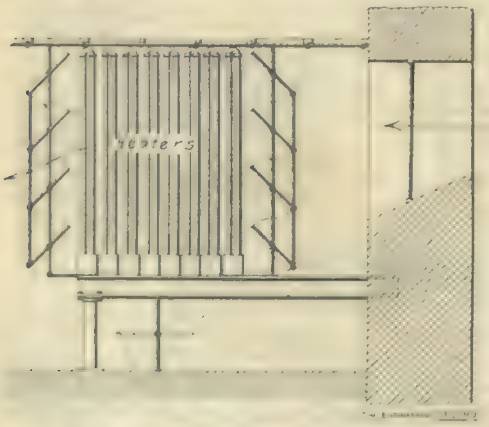
The fan chamber in each case is substantially a plenum chamber and supplies a large duct 8 feet across and 18 inches high. Besides this there are two 18 x 32-inch ducts which start from the fan chamber and except for these and two others, also 18 x 32 inches in cross-section branching from the large duct (all of which connect with indirect radiator casings), all other connections are made with the main duct practically direct to the flues. An interesting point is the insulation of the main duct where it passes through the corridor which is more or less exposed on account of its position near the covered way. The specification required a covering from one fan room to the other with ¾ inch of plastic magnesia, containing 85 per cent. of magnesia, put on over a galvanized-wire mesh, this attached to the duct to leave ¾-inch air space between duct and covering. The flues terminate in side wall registers about 6 feet above the floor line, distributed as indicated on the plan of first story. Vent registers are provided near floor and near ceiling opening into the same flue, the upper opening providing for a more rapid outflow of air when necessary and termed the summer vent in distinction from that at the floor which tends to create a better diffusion and circulation of the incoming fresh air, as desirable in winter. At the attic different groups of the flues, all of which, as well as the fresh-air flues, are lined throughout with galvanized iron, are brought to four chimneys or centers of discharge, and the flow upward into the atmosphere is accelerated by the use of aspirating coils, consisting of 1-inch pipes, eight pipes 15 feet long in each chimney. These are supplied from the medium pressure steam system, so that they may be kept under steam throughout the year.

The hospital building, it will be remembered, is located at one end of the covered way, so that the steam and return piping is brought to it at that end of the building. The exhaust steam main feeds into the heating system, joining also an exhaust pipe from the pumps which are employed to discharge the condensation through the return main in the covered way to the boiler house. The medium pressure system is also connected with the heating system, through a pressure-reducing valve arranged with by-pass, and it is continued in a separate system for supplying the kitchen and the aspirating or vent coils in the attic. The condensation from medium-pressure main and that from the vent coils is delivered separately into the return main through bucket traps, but the condensation in the exhaust piping had to be handled by a return trap, arranged with steam connection from the medium-pressure main, because the pressure in the return main might easily be greater than the pressure in the exhaust main at any time. The discharge from the return trap is carried into the receiving tank of the return pump.



Detail at A, Hospital Basement.

The piping for supplying the riser lines is carried at the ceiling except through the corridor where the return is carried in a trench. There are two duplex pumps, 6 x 4 x 6 inches in size installed in duplicate, and operated under the control of a pump governor. The water of condensation from each tempering or primary heater is taken by a trap discharging intermittently into the return tank. This trap, and also the return trap already mentioned, receives a steam supply reduced in pressure from the medium-pressure piping, or when it is necessary to cut out the reducing valve through a ¾-inch pipe, the idea being not to subject the water in the trap to a comparatively high-pressure and cause too sudden or violent a discharge. The whole apparatus is largely under thermostatic regulation, the rooms supplied with hot air having the air temperature varied by double dampers mixing the tempered and heated air in proper proportions, and the rooms heated by direct radiation having diaphragm valves on the supply and return connections to the radiators.



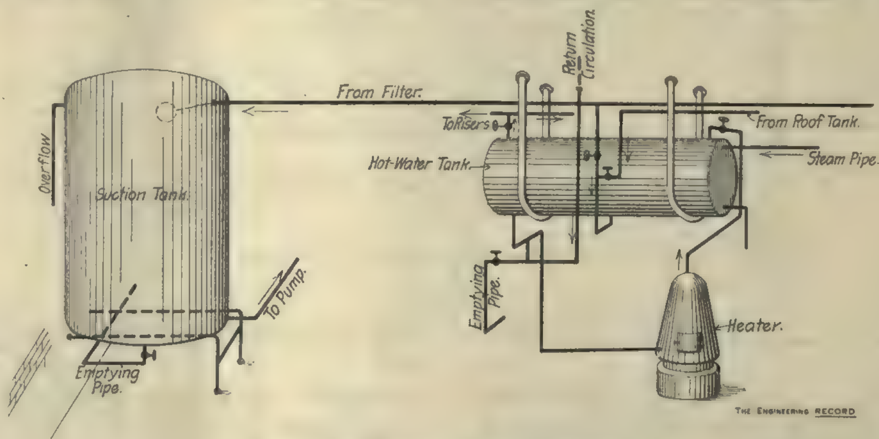
Section Through Primary Heater.

The buildings were planned by Messrs. Boring & Tilton, of New York, under the supervision of Mr. James Knox Taylor, supervising architect of the Treasury Department, and Mr. William J. Baldwin, of New York, is the consulting mechanical engineer for the plant.

(To be continued.)

Plumbing in a New York Residence.

The plumbing in the four-story residence of Mr. P. A. Rollins in New York is interesting on account of the direct and simple arrangement of the water supply pipes and the elimination of kitchen and laundry boilers. The 2-inch street supply is metered and passed through a Loomis filter with a capacity of 30 gallons a minute, and thence fills a 500-gallon suction tank in the cellar. The tank is a galvanized steel cylinder with a wooden cover, and is filled through a ball cock. A 2-inch suction pipe is run from the tank to a direct-connected triplex electric pump of 1,000 gallons capacity which is arranged with an automatic regulator to maintain a constant water-level in the roof tank.



Hot-Water System in the Basement.

The roof tank is of 5/16-inch galvanized steel and is 3 feet high, 3 feet wide and 17 feet long. It is set in a galvanized flanged steel safe supported on two longitudinal 10-inch I-beams built into the walls in the upper part of the fourth story in a narrow room partitioned off at one side of the light shaft. The tank is set high enough to supply the fourth story fixtures and is provided with a wooden cover. It can be filled either through a street-pressure pipe or the pump pipe, both of which enter it through the upper edge of the front side and discharge through ball cocks. The 2-inch house-supply pipe is taken from the bottom of the front side, and all these pipes and the ½-inch telltale pipe are offset so as to pass horizontally under the tank to the wall and then go vertically down to the basement in a corner of the stair well, which is enclosed by a rounded plaster surface. The house-supply pipe has, above its valve, a vacuum pipe which is carried over the top of the tank and has a check valve set in the horizontal part under the tank, so as to prevent a flow of water into the tank. The tank overflows and is emptied through 2-inch pipes, the former discharging into the slop sink in the fourth story and the latter into one in the third story.

All hot water for domestic purposes is heated in a 200-gallon cylindrical boiler suspended from the cellar ceiling in the boiler room. This heater is normally supplied by a 2-inch connection from the roof tank, but it also has a direct connection to the street-pressure pipe from the filter to the suction tank. There is one 2-inch outlet from which a pipe is run on the cellar and basement ceilings, to supply all the risers to fixtures in the basement and upper stories. From the top of each hot-water riser there is a ½-inch return circulation pipe to a 1¼-inch pipe on the cellar ceiling which connects to the cold-water pipe from the Sunray heater by which the water is warmed in the summer. In the winter the water is heated by a steam coil supplied from the low-pressure apparatus provided for warming the house. All hot and cold water and return circulation risers are valved at their connections with the cellar ceiling lines, and have connections above the valves to a 1-inch emptying pipe which discharges into the cellar sink. All the riser lines are 1¼ inches in diameter and are put together with unions arranged to enable them to be taken apart at any branch.

All the pipes in the cellar are covered with asbestos and canvas. No water pipes are carried under the floors, and where they are suspended from the cellar ceiling they are supported on grooved wooden cross-pieces with vertical hanger pipes through the ends. The upper ends of the vertical pipes have tees and cross-pieces built into the arches of the fireproof floors and caps are screwed on the lower ends to give bearings for the wooden strips. The basement laundry contains no plumbing except a row of wash tubs, and the kitchen on the first floor contains no plumbing except a large porcelain sink with a marble wall slab and a Tucker grease trap. There is a toilet room with wash-basin and water-closet adjacent to the first-floor billiard room, and there are two bath rooms in both the second and third stories. These are all floored and wainscoted with white tiles, and each contains a porcelain bath, a wash-basin and a water-closet. All the wash-basins have table slabs 2 inches thick and no aprons, and their straight nickel-plated brass legs are offset 4 inches inside the front edge of the table to be well cut of the way.

Messrs. McKim, Mead & White were the architects of the building, and the plumbing was done by Mr. T. J. Byrne.

A Series of Pulley and Belting Tests have been commenced at the laboratories of the Worcester Polytechnic Institute by Prof. Chas. M. Allen, of that school, and Prof. Floyd C. Furlow, of the Georgia School of Technology. It is proposed to investigate thoroughly the merits of steel, wood, leather-faced wood and cork-faced pulleys, the last-named being a steel pulley with its face plugged with ¾-inch cork insets projecting slightly. The experiments are made with a special testing apparatus, including both transmission and absorption dynamometers, the latter of the type designed by Mr. Geo. I. Alden, M. Am. Soc. M. E.

Tests of the Strength of Guastavino Floor Arches.

A report by Mr. W. W. Ewing, Engineer of the Board of Buildings, New York City, to Pres. James G. Wallace of that Board.

The Guastavino floor arches of 6, 10 and 12-foot spans were thoroughly tested by uniformly loading them with pig iron. Each arch was 3 feet wide and the rise of the crown of each was one-tenth of the span. Each arch was topped off with cement mortar, 1 part of Portland cement to 3 parts of sand, 1 inch deep, uniformly spread over the area of 1 : 2 : 5 stone concrete which filled the spandrels over the arched tiling, sprung from I-beam to I-beam. These beams were connected by steel tie-rods, as shown in the illustrations. These tie-rods were measured before and after the arches were loaded, from which it was found that no appreciable change in length had taken place. The I-beams in all cases were simply set in a ½-inch groove cut in the wooden beams upon which they rested. No other protection or lateral support was used except, in the case of the 12-foot span, the abutments were made to lie against the beams.

The arches of 6, 10 and 12-foot spans were built two, four and three courses thick respectively of flat tiling about 15 x 6 x 1 inch thick, all joints being broken. The vertical joints of the first course were laid up in neat Portland cement mortar; all other mortar was composed of 1 part of Portland cement and 2½ parts of Cow Bay sand, except in the case of the arch of 6-foot span, where 2 parts of sand were used. The arches successfully withstood the loads to which they were subjected.

Behavior of 4-course, 10-foot arch.—The reference points on the bottom of the arch were: No. 1, at the left-hand end 8 inches from the beam; No. 2, at the center; No. 3, 8 inches from the right-hand beam. The results of the loading are given in Table 1.

Table 1.—Test of Ten-Foot Arch.

Load in lbs. per sq. ft.	Readings at the Three Points, in Inches.			Deflection at center of arch.
	No. 1	No. 2	No. 3	
600	0.05	0.07	0.05	0.02
900	0.10	0.15	0.13	0.04
1,200	0.16	0.23	0.18	0.06
1,500	0.24	0.31	0.27	0.06
1,800	0.29	0.39	0.31	0.09
2,100	0.38	0.47	0.37	0.10
2,400	0.45	0.58	0.45	0.13
2,700	0.56	0.66	0.51	0.13
3,000	0.66	0.78	0.59	0.16
3,300	0.79	0.90	0.68	0.17
3,705	0.96	1.07	0.81	0.19

After the uniform load of 3,705 pounds per square foot had remained 48 hours, the arch was unloaded with results as follows:

3,705	1.29	1.37	1.02	0.22
3,300	1.28	1.36	1.00	0.22
3,000	1.26	1.34	1.00	0.21
2,700	1.25	1.32	0.98	0.21
2,400	1.22	1.31	0.97	0.21
2,100	1.20	1.27	0.96	0.19
1,800	1.16	1.24	0.94	0.19
1,500	1.13	1.20	0.94	0.17
1,200	1.09	1.17	0.91	0.17
900	1.05	1.12	0.89	0.15
600	1.00	1.07	0.86	0.14
0	0.82	0.88	0.74	0.10

After remaining unloaded 9 days the readings were:

0	0.57	0.54	0.37	0.07

It will be noticed in the above arch of 10 feet span that the deflection just after the greatest load was imposed on it was 0.19 inch, and after the load remained 48 hours the deflection increased to 0.22 inch; also just after all load was removed the deflection was 0.10 inch, and after remaining nine days unloaded the arch showed a permanent set of 0.07 inch.

Behavior of 2-course, 6-foot arch.—In Table 2, giving the positions of reference points above or below the original position of the arch before loading, the minus sign indicates a rise of the reference point above its original position. Point 1 was on the bottom of the arch 1 foot from the left-hand I-beam, point 2 at the center and point 3 was 1 foot from the right-hand I-beam.

Table 2.—Test of Six-Foot Arch.

Load in lbs. per sq. ft.	Readings at Reference Points, in Inches.			Deflection at center of arch.
	No. 1	No. 2	No. 3	
250	0.04	0.06	0.05	0.01
500	0.06	0.09	0.09	0.01
750	0.08	0.14	0.13	0.03
1,000	0.09	0.19	0.18	0.05
1,250	0.10	0.23	0.22	0.07
1,500	0.11	0.27	0.26	0.08
1,750	0.13	0.30	0.28	0.09
2,000	0.14	0.34	0.32	0.12
2,250	0.16	0.37	0.35	0.12
2,500	0.16	0.39	0.38	0.13

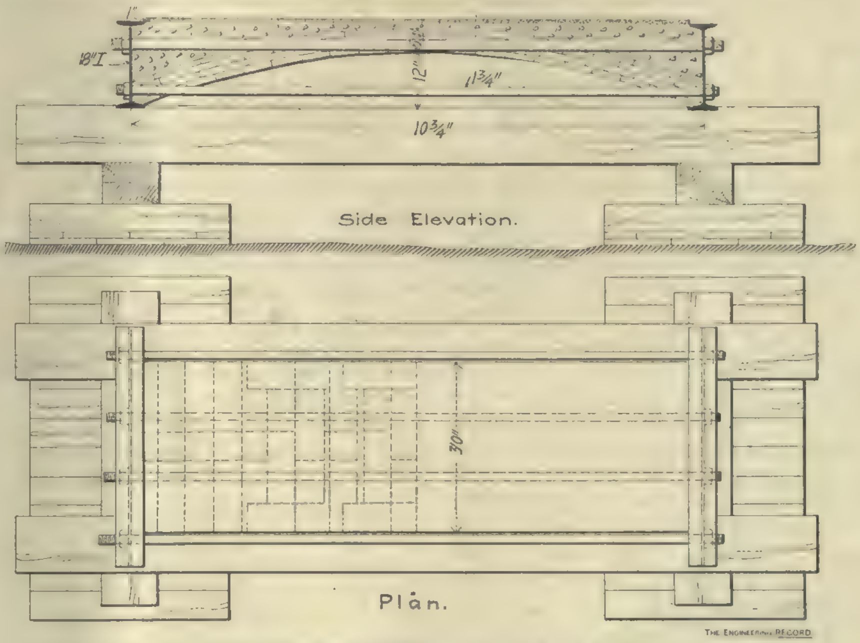
The arch was uniformly unloaded after the above maximum load of 2,500 pounds per square foot had remained 48 hours, and the following readings were recorded:

2,500	0.12	0.43	0.47	0.15
2,250	0.12	0.43	0.47	0.15
2,000	0.10	0.41	0.45	0.15
1,750	0.10	0.40	0.45	0.14
1,500	0.08	0.39	0.44	0.14
1,250	0.08	0.37	0.43	0.13
1,000	0.05	0.35	0.41	0.13
750	0.03	0.32	0.39	0.12
500	0.00	0.28	0.36	0.11
250	—0.03	0.23	0.33	0.09
0	—0.10	0.12	0.27	0.05

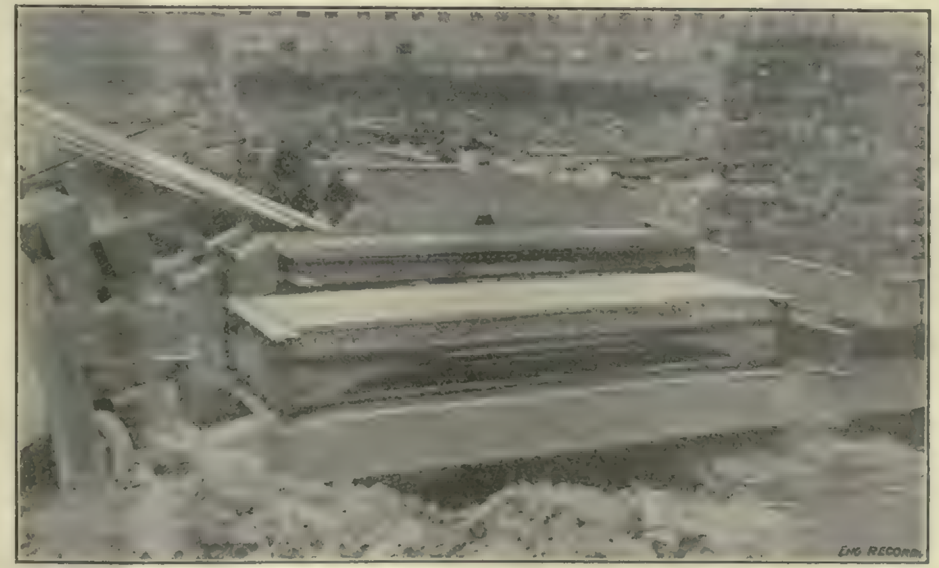
Final readings taken after the arch remained unloaded 3 days were recorded as follows:

0	0.16	0.07	0.19	0.03

It will be noticed that in this 6-foot arch the deflection just after the greatest load was imposed was 0.13 inch and after the load remained 48 hours the deflection increased to 0.15 inch; also just after all the load was removed the deflection was 0.05 inch and after remaining 3 days unloaded the arch showed a permanent set of 0.03 inch.



Arrangement of Test Arch, 10-Foot Span.



View of Two Arches Ready for Testing and One Loaded.

Behavior of 3-course, 12-foot arch.—The positions of the reference points on the bottom of the arch on which the readings of Table 3 were taken were: No. 1, 1 foot from the left-hand I-beam; No. 2, at the center of the arch; No. 3, 1 foot from the right-hand I-beam.

Table 3.—Test of Twelve-Foot Arch.

Load in lbs. per sq. ft.	Readings at Three Reference Points, in Inches.			Deflection at center of arch.
	No. 1	No. 2	No. 3	
150	0.02	0.03	0.02	0.01
250	0.04	0.06	0.04	0.02
500	0.08	0.13	0.08	0.05
750	0.12	0.20	0.13	0.08
1,000	0.17	0.28	0.19	0.10
1,250	0.23	0.36	0.24	0.13
1,500	0.29	0.45	0.29	0.16
1,750	0.34	0.54	0.35	0.20
2,000	0.41	0.63	0.41	0.22
2,250	0.46	0.71	0.46	0.25
2,500	0.52	0.79	0.52	0.27
2,750	0.58	0.87	0.58	0.29
3,000	0.65	0.96	0.64	0.32
3,125	0.70	1.01	0.69	0.32

The arch was uniformly unloaded after the maximum load of 3,125 pounds per square foot had remained 48 hours, and the following readings were recorded:

3,125	0.96	1.31	0.95	0.36
3,000	0.96	1.31	0.94	0.36
2,750	0.94	1.29	0.93	0.36
2,500	0.93	1.27	0.91	0.35
2,250	0.92	1.25	0.90	0.34
2,000	0.90	1.21	0.89	0.32
1,750	0.87	1.18	0.86	0.32
1,500	0.84	1.14	0.84	0.30
1,250	0.82	1.09	0.81	0.28
1,000	0.79	1.04	0.79	0.25
750	0.74	0.98	0.75	0.24
500	0.69	0.90	0.70	0.21
250	0.62	0.79	0.64	0.16
150	0.59	0.75	0.61	0.15
0	0.54	0.67	0.55	0.13

Final readings taken after the arch had remained unloaded for 12 hours were as follows:

0	0.47	0.58	0.59	0.10

It will be noticed that in the 12-foot arch the deflection just after the greatest load was imposed was 0.32 inch, and after the load remained 48 hours the deflection increased to 0.36 inch; also just after all the load was removed the deflection was 0.13 inch, while after remaining unloaded for 12 hours the arch showed a permanent set of 0.10 inch.

An inspection of the arches at the conclusion of the tests showed that they had sustained no injury whatever from the loading and were in as good condition as before the tests began, so far as could be seen.

I would recommend that the above arches be allowed for use, when constructed as tested, for the following working loads:

The 4-course 10-foot arch for loads up to 370 pounds per square foot.

The 2-course 6-foot arch for loads up to 250 pounds per square foot.

The 3-course 12-foot arch for loads up to 312 pounds per square foot.

The arches were built on April 9, 1901; the tests were started on May 13 and completed on May 24, 1901.

The Accident to the Brooklyn Bridge on July 24 has been the subject of an official report by Mr. C. C. Martin. He states that on that day two of the 5 x ½-inch steel bands around the north cable at the center of the main span were found to be broken and also seven of the 2½-inch steel suspension rods connecting the cable and transverse girders at this part of the bridge. The trusses have slip joints at the center of the main span, where there is a maximum longitudinal movement of about 7 inches. As this movement does not occur in the cables but only in the trusses, the lower ends of the suspension rods move backward and forward as the truss expands. In order to provide for this a steel trunnion block was introduced into this connection, which permitted a rolling motion without producing cross strains in the rods. These cast-steel trunnion blocks are 5¼ inches deep, the rods passing through them freely, and a nut was placed beneath the block to hold the whole in place. Examination shows that all of the broken rods are broken in these blocks and entirely out of sight, until enough of them had been broken to allow the cable to lift or the floor to settle sufficient for the broken ends of the rods to come into sight nothing would be known of the break. An examination of the fracture of two of the rods indicates unmistakably that they have been broken for a long time. Mr. Martin's explanation of the breakage of the bands and rods is as follows: "As to the broken cable bands, there are 1,760 of them around the cables on the bridge, and it is quite possible, notwithstanding the rigid inspection to which they were subjected before they were put in place, that occasionally a defective band may have been used. Constant inspection since the bridge has been in use has detected a few, and these have been replaced without in any way affecting the strength of the bridge or impeding traffic. In my judgment, the cause of the present breaking of several of the suspender rods is as follows: As I have said before, two of the broken rods show old breaks—one much older than the other—as indicated by the broken ends of the rods. One rod having broken, would throw additional strains on those adjoining it, and in the course of time these would give way, and the process would naturally continue unless the broken rods were replaced. The fact that the rods on all of the other cables are sound would seem to indicate that my theory is correct, and that the fact that one rod in all respects like all of the others so far as can be seen, broke long in advance of the others, or that it broke at all, would seem to indicate that it was originally defective."

Trade Publications.

Publishers of pamphlets mentioned in the following notes will be glad to have The Engineering Record mentioned by its readers who apply for copies.

The Buffalo Forge Co., Buffalo, N. Y., has issued an interesting catalogue of the many types of engines, horizontal center and side crank, vertical, double vertical and marine, and numerous modifications, which it now makes. Their construction is described in detail and there are many tables of the dimensions of the various types and their horse-power under different conditions.

A new edition of the handsomely illustrated guide book to the Thousand Islands, issued in the Four-Track Series of the New York Central Lines, has been published by Mr. Geo. H. Daniels, general passenger agent, New York.

A large variety of roofing materials, insulating and sheathing papers, paints, cements and paving materials are described in the new catalogue of the Trinidad Asphalt Mfg. Co., St. Louis, Mo. The pamphlet gives full directions for using these supplies, explains the purposes for which each material is best suited, and reproduces many letters from satisfied users of them. Architects, engineers and contractors will all find useful data in the book.

The Osborn Engineering Co., Cleveland, O., has issued a new 55-page pamphlet of general specifications for superstructures for all classes of highway bridges. It is classified under fifteen general heads which include, besides those usually found in specifications, pavements, wheel guards and curbs, car tracks and trolley poles, railings, lighting and erection. A blank form is given which indicates all the essential data necessary for the general design and has references to specific paragraphs of the specifications in which choice may be made of several alternative requirements. The clauses regarding floors and pavements are intended to give full descriptions of constructions for different localities and requirements, and contain complete specifications for plank floors, brick, Medina block, sheet asphalt and cement pavements and catch basins. Cement tests and the methods of executing the work are specified.

The album of views of engineering structures and buildings in which Lehigh Portland cement was used, which has just been published by the Lehigh Portland Cement Co., Allentown, Pa., contains a large number of pictures which most readers of The Engineering Record will be glad to examine. Not only are the subjects interesting but the accompanying text, mainly letters from large users of the cement, gives data which which be found of permanent usefulness.

The method of splicing wire ropes is minutely described in a valuable pamphlet just issued by the John A. Roebling's Sons Co., Trenton, N. J. Each step is illustrated by large engravings from photographs taken for the purpose at the company's works during the splicing of a ¾-inch regular-lay rope of six strands and a hemp center. The pamphlet will be of permanent usefulness to contractors and engineers.

Advance sheets of the new catalogue of the Jeanesville Iron Works Co., Jeanesville, Pa., describe the arrangement of a mine pumping station of medium capacity and explain the construction of centrally packed pumps. The tables of dimensions and capacities of the pumps are unusually complete.

The series of circulars of the Westinghouse Electric Mfg. Co. has had two additions recently. The first describes the new No. 68 railway motor for city and suburban service and contains, in addition to full information concerning its design and construction, an interesting explanation of the various methods of rating motors. The second circular describes the standard switchboards for 1,100 and 2,200-volt polyphase circuits which the company makes for small plants.

The Omega Portland Cement Co., of Jonesville, Mich, with works at Mosherville, Mich., having an annual capacity of over 150,000 barrels, has published a valuable little handwork on its product and uses. The method of making the cement is briefly outlined and a number of views of the plant are reproduced. The properties and methods of testing cement are sketched and full instructions are then given for the use of the material in sidewalks, floors, curbs and general concrete structures. The pamphlet closes with reports of tests of Omega cement at various laboratories.

A water-excluding preparation called "cement coating," which has been used for some years in a number of cities, is composed of Portland cement and a special fluid for brush-work on brick walls, and of the same materials and sand for plaster. Its purpose and uses are described in a book issued by the Chicago Cement Coating Co., Monadnock Block, Chicago, which contains many large and well-printed engravings of notable buildings where it has been employed.

A new type of engine for gasoline, distillate or gas has been brought out in sizes from 6 to 75 horse-power by the Weber Gas & Gasoline Engine Co., P. O. Box 1114-Z, Kansas City, Mo. A circular illustrating the new motor is now ready for distribution.

In the manufacture of paints there is needed a variety of machines for mixing, grinding and cooling the materials. Some of this apparatus is a specialty with the industry, yet most parts are also used in manufacturing other products, from chocolate through a long list of articles to cement and fertilizers. For this reason a new catalogue of paint machinery just issued by C. O. Bartlett & Co., Cleveland, will be found of much general interest.

An interesting discussion of the special machinery for heating and purifying the feed water for steam boilers is furnished in a 96-page pamphlet published by the Stilwell-Bierce & Smith-Vaile Co., 279 Lehman St., Dayton. The book is considerably more than a mere list of heaters and purifiers, and will interest anyone having to design or keep up a boiler plant, particularly where scale-producing feed-water must be used.

An Examination for the position of Assistant Engineer, Grade A, Rapid Transit Commission, New York City, will be held by the Municipal Civil Service Commission, on Wednesday, August 14, at 10 A.M. The subjects of the examination will be technical knowledge, writing a report, mathematics and experience. For applications address Mr. Lee Phillips, secretary, 346 Broadway.

A New Pipe Flow Formula is proposed by Prof. Robert H. Smith in "The Engineer." It is $v = s^{1/2} r (f + F) \div (r^{1/2} + 0.5)$, where r is the mean hydraulic radius in feet, and f and F are "measures of the frictional smoothness of the solid surface of the channel and the limpidity—the reciprocal of the viscosity—of the liquid." For round pipes running full the formula becomes $v = 96 s^{1/2} d \div (d^{1/2} + 1)$, for the same roughness as is expressed by $n = 0.012$ in the Kutter formula. For other degrees of roughness, $f + F = 42 + (1.8 \div n)$. "With pure water it makes the resistance due to viscosity about one-fifth of the whole, and with muddy water it may be about one-fourth of the whole. This ratio, however, depends upon the smoothness or roughness of the solid surface of the channel."

Personal and Obituary Notes.

Mr. E. C. Dunn has been elected city engineer of Alexandria, Va.

Mr. Frank M. Kerr has been appointed on the Louisiana State Board of Engineers.

Mr. Arthur C. Jackson, of New York City, has won a competition for plans for the Utica, N. Y., Public Library.

Mr. George Campen has been appointed city engineer of Lincoln, Neb., to succeed Mr. Adna Dobson, recently appointed state engineer.

Mr. Charles McCrery has been elected vice-president and general manager of the Tennessee Coal, Iron & Railroad Company, Birmingham, Ala.

Mr. Sydney Clopton has been appointed bridge and building inspector for the Atchison, Santa Fe & Topeka railway, with headquarters at Silsbee, Tex.

Mr. C. K. Durbin has been appointed superintendent of construction of electric lines for the Colorado & Southern Railway, chiefly for suburban roads out of Denver.

Assistant Naval Constructor S. F. Smith, U. S. N., has been ordered to the works of the Crescent shipyard, Elizabeth, N. J., as assistant to the superintending constructor.

Dr. John S. Billings has sailed for Europe and is to visit Andrew Carnegie in reference to the establishment of public libraries in New York City, for which the latter gave $5,200,000.

Thomas S. McNair, M. Am. Sos. C. E., chief engineer of the Union Improvement Co., of Hazleton, Pa., and president of the Diamond Water Co., died July 25 from pneumonia, aged 75 years.

Messrs. Benezette Williams, of Chicago, George Y. Wisner, of Detroit, and Allen Hazen, of New York, have been appointed a commission to recommend a plan for bettering the St. Louis water supply.

Mr. Edwin Duryea, Jr., M. Am. Soc. C. E., who was resident engineer in charge of the Brooklyn anchorage and tower foundations of the New East River bridge, has been appointed by the New York District Attorney to report as to the safety of the New York and Brooklyn bridge.

Chief Engineer F. O. Maxson, U. S. N., has been ordered to hold himself in readiness for duty at Cavite Station, P. I., and Chief Engineer R. C. Hollyday has been assigned to his place at the Boston Yard and the latter's duties at Mare Island Yard are to be performed by Chief Engineer H. R. Stanford.

Dr. E. H. Jenkins, of New Haven, and Mr. Robert A. Cairns, city engineer of Waterbury, Conn., have been re-elected president and secretary, respectively, of the Connecticut State sewage commission. Mr. Frederick L. Ford, of Hartford, is to co-operate with the commission in the collection of data regarding rainfall and watershed areas throughout the State.

Charles A. Schott, an assistant in the United States Coast and Geodetic Survey since 1848, died at Washington, D. C., on July 31. He was born at Mannheim, Baden, Germany, in 1826 and was graduated from the Polytechnic School at Carlsruhe in 1847. He was the author of many papers on hydrography, geodesy, tides and meteorology and received a medal from the French Academy for researches in terrestrial magnetism.

General Gillespie, Chief of Engineers, U. S. A., has made the following assignments in the Corps of Engineers: Col. Chas. R. Suter, to New York City as division engineer of the Northeast Division; Col. Samuel M. Mansfield, to New York City, to the Eastern Division; Col. Peter C. Hairs, to Baltimore, to the Southeast Division; Lieut-Col. Thos. H. Handbury, after November 15, to Cincinnati, to the Central Division; Lieut.-Col. Oswald H. Ernst, to Chicago, to the Northwest Division, as mentioned last week; Col. Amos Stickney, to St. Louis, to the Western Division; Lieut.-Col. Henry M. Adams, to New Orleans, to the Gulf Division; Col. Jared A. Smith, to San Francisco, to the Pacific Division. Among recent changes in the station and duties of other officers of the Corps of Engineers are the following: Major William T. Rossell is to assume charge of river and harbor works, removal of wrecks and bridge supervision in charge of Lieut.-Col. Charles W. Raymond, Corps of Engineers, at Philadelphia, and his place at Mobile is to be taken by Capt. Spenser Cosby. Major John Biddle, whose appointment as Engineer Commissioner of the District of Columbia, to succeed Capt. Lansing H. Beach, was mentioned last week, has been granted a three months' leave of absence. Capt. George P. Howell has been ordered to St. Louis to relieve Capt. Mason M. Patrick of work in connection with the Mississippi River Commission and the latter will report to the Chief of Engineers at Washington. Capt. William E. Craighill is to go to Wheeling, W. Va., and Capt. Harry Taylor, to Boston, the latter to take charge of the works for defense of Boston Harbor.

Notes.

Compressed Air Supplied to Offices is a feature of the Rose Building, a large office building recently erected in Cleveland, the compressed air provision, it may be said, being intended as an attraction to physicians and dentists. A 6 x 8 x 8-inch Marsh compressor operated to maintain a pressure of 40 pounds to the square inch and a pressure tank 3 feet in diameter and 8 feet high are located in the basement and a 2-inch main is carried around the basement supplying a number of 1¼-inch risers. Branches are taken from these under the wood floors and a ¼-inch pipe carried to an outlet in each room at the chair rail. A similar system of piping, only of larger sizes, has also been installed for supplying illuminating gas for mechanical purposes, the illumination of the building being electric, and the heating, steam. The gas outlets are at the floor to distinguish them from the air outlets, which are at the chair rail, as stated.

The Engineering Branch of the British Navy seems to be having the same kind of trouble as that which vexes the American navy. According to "Engineering," it is impossible to obtain competent officers for the engineering department, even by lowering the requirements for admission in a manner dangerous to the efficiency of the service. At the last examination, fourteen candidates appeared, four passed, and yet such was the need of engineer officers that the ten unsuccessful men were offered commissions on approval. The reason is said to be the class distinction drawn by the line officers against the engineers, who are not given even the same measure of authority over their men that the officer of marines has over his force. If it was not for the same narrow, unpatriotic and sadly demoralizing condition in our own navy, it would be interesting to comment on this state of affairs. Under the circumstances, however, it behooves the American critic to pay strict attention to the beam in his own eye before gazing abroad too searchingly.

The Hydraulic Elevator Pressure Tanks in the Electric Building, Cleveland, O., are supported above the elevator pumps. There are four Otis passenger elevators, which include an equipment of two Worthington compound pumps and two tanks. The basement has a clear height of about 12½ feet and the tanks, which are 6 feet in diameter and 18 feet long, are located one directly over each pump. They are carried on cast-iron saddles bolted to 12-inch I-beams which in turn are set in grooves in the square tops of cast-iron columns about 5 feet 6 inches high above the floor level, spaced in three rows of four columns each. Each pump discharges directly upward into the tank above it through a short piece of pipe fitted with a slip joint. Mr. George F. Hammond, of Cleveland, was architect for the building, and the apparatus was installed by the Otis Elevator Co., under the direction of Mr. J. W. Vanderwerf, also of Cleveland.

The Controversy over American Competition which has recently afforded British newspapers much interesting copy without cost has drawn forth a letter from Sir Guilford L. Molesworth that merits notice on this side of the Atlantic. He says in part in this letter, which was written to the "Standard," of London: "There is no doubt that the workshops of the United States can compete successfully with those of Great Britain, as regards both price and workmanship, but the secret of their success lies chiefly in their perfect organization and in the use of labor-saving appliances." In support of this view he quotes as follows from a letter from "an experienced engineer, who for several years managed a large bridge-building establishment in England" and is now inspecting bridge and railway material in the United States: "I had an idea before I came out this time that the Americans made good, but rough, bridge work; but this is quite a mistake. The work is as well finished as any English work, and quite as good if not better than any turned out in England as regards workmanship, finish and material. I am speaking now only of the ——— Co., as they are turning out a splendid job in every way. . . . I have a good deal of testing, but luckily the steel is excellent, and there is no attempt to scamp in the shop. . . . The drawing-office methods are excellent, and the way the drawings are made out and tabulated is most workmanlike."

A Separator for Portland Cement, called a flourometer by the inventor, Mr. W. F. Goreham, Belvedere, Kent, Eng., was shown at the recent annual conversazione of the Institution of Civil Engineers. According to the description of it in "Engineering," its object is to separate out from cement the fine particles which alone have any value. For this purpose the material is placed in a conical vessel and air is blown through it at a definite pressure by means of a central pipe extending nearly to the bottom of the receptacle. This churns up the cement thoroughly, and the fine particles are carried off by the ascending current of air and are finally collected by passing the air through a large vertical cylinder, in which its velocity is reduced so much that the cement can no longer be retained in suspension, and is consequently deposited. In the apparatus shown air was supplied at a pressure of about 3 inches of water from a gasholder of the usual type. The pressure at which the air was delivered could be altered by changing the weights on the bell of this holder. Samples were also shown by Mr. Goreham of the flour obtained in his apparatus, and of the residue left, which forms in commercial cements about 50 per cent. of the total bulk. By passing this residue again through the apparatus and using a slightly higher pressure of air, slightly coarser flour can be separated than that obtained originally, but this, though it will pass through practically any sieve, proves to have no cementitious properties.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Muskogee, Ind. Ter.—Plans, specifications and estimates are wanted until Sept. 10 for a system of water-works, as advertised in The Engineering Record.

Morton, Minn.—Bids are wanted until Aug. 19 for furnishing materials and constructing a system of water-works, as advertised in The Engineering Record.

Solon, Ia.—Bids will be received Aug. 9 for the construction of a system of water-works. J. J. Fiala, Town Clk. J. S. Bittner, Mayor.

Washington, D. C.—Bids are wanted Oct. 5 for furnishing and delivering, at the pumping station, 20 water gates, as advertised in The Engineering Record.

Glens Falls, N. Y.—Bids are wanted Aug. 12 for raising Keenan storage dam, as advertised in The Engineering Record.

Moline, Ill.—Bids are wanted Aug. 8 for 9,000 ft. of 12-in. water main on several streets with crosses, valves and hydrants. P. H. Wessel, Pres. Bd. of Local Imp.

Cleveland, Tenn.—The City Water Co. has offered to sell its plant, franchises, etc., to the city for $55,000.

New Berlin, Pa.—Press reports state that this place is to have a gravity water system.

Salt Lake City, Utah.—Articles of incorporation have been filed by the Upper Canal Irrigation Co. Capital stock, $30,000. S. A. Casto, Pres.; F. F. Hintze, Vice-Pres.; and J. H. Brinton, Sec'y and Treas.

Marseilles, Ill.—The Local Board of Improvements has under consideration the question of constructing water-works.

Randolph, Neb.—Arnold C. Koenig, of Grand Island, Neb., is preparing plans and specifications for a new pumping plant and brick pumping station. H. S. Fisher, Clk.

Manchester, Va.—A resolution has been adopted by the Council for the appointment of a special committee to inquire into the expediency and cost of having the city water supply filtered or of suggesting some other plan for securing pure water.

Breese, Ill.—It is proposed to form a water-works company with a capital stock of $15,000. Address J. O. Koch.

Los Angeles, Cal.—Local press reports state that the Los Angeles City Water Co. has accepted the $2,000,000 compromise proposition of the City Council for the purchase of the water-works plant.

Colorado Springs, Colo.—The City Council has under consideration several propositions for securing an increased water supply, one of which is the purchase of the Seven Lakes reservoir site for $100,000.

Grand Rapids, Mich.—The Board of Public Works is said to be in favor of the proposition to secure a water supply from the Grand River above the Soldiers' Home, sand filtration to be used. Estimated cost, $1,296,931.

Marble Rock, Ia.—Press reports state that a water-works system will be installed.

Mankato, Minn.—The Board of Public Works is stated to have been authorized to purchase 50 water meters.

Oneida, N. Y.—The question of establishing the meter system is said to be under consideration.

Waterloo, Ia.—Bids for the pumping station for the Waterloo Water Co., from plans by Murphy & Ralston, architects, are stated to have been received as follows: Paul Kertz, Waterloo, $19,218; W. J. Zitterell, Webster City, Ia., $17,955; Geo. F. Dunham, Waterloo, $16,736.

Bozeman, Mont.—Engr. C. M. Thorpe writes that it is proposed to construct a reservoir at the head of Bozeman Creek, at an estimated cost of $10,000, but that work will probably not be done this year. T. F. Stevenson, Pres. of the company.

Dyersburg, Tenn.—City Recorder F. N. Latta writes that propositions are wanted for a water-works franchise. Address the Mayor.

St. Louis, Mo.—Allen Hazen, of New York, Geo. Y. Wisner, of Detroit and Benezette Williams, of Chicago, have been appointed on the Water Commission to conduct an extensive investigation and decide upon the best method of supplying St. Louis with clear and wholesome potable water supply. Hiram Phillips, Pres. Bd. of Pub. Imp.

Linton, Ind.—City Clk. Guy H. Humphreys writes that the franchise for the construction and ownership of water-works (bids opened July 16) has been awarded to F. H. Beeman, of Louisville.

Frackville, Pa.—The Frackville Water Co. has been chartered and will buy out the Haupt Water Co. and expend $25,000 in extending the works, work to be commenced soon.

Spokane, Wash.—Robt. E. Clark, Sec'y of the Board of Pub. Wks., writes that the work of replacing the water mains in the 4th Ward with larger mains will be done by day labor, the city furnishing the pipe. Estimated cost of improvement, $48,000. Engr. in Charge, Otto Weile.

Lewiston, Mont.—City Clk. E. R. Chandler writes that the question of water-works construction is before the City Council, but no action has as yet been taken.

Albany, N. Y.—Bids are wanted by the Board of Contract and Supply until Aug. 5 for 50 iron meter boxes and valves for the Bureau of Water. Isidore Wachsman, Clk. Bd.

National Military Home, Kan.—Bids are wanted Aug. 14 for furnishing and laying about 4,400 ft. of 10-in. water main. W. B. Shockley, Treas.

Sault Ste. Marie, Mich.—City Engr. J. A. Lawrie writes that the Holly Mfg. Co., Lockport, N. Y., has received the contract for a 5,000,000-gal. pumping engine, bids opened June 17 by the Board of Public Works. The engine offered is a 4-cyl. crank and flywheel pump with a rated duty of 115 million ft.-lbs.; price, $20,700.

Winters, Cal.—Water bonds to the amount of $17,000 are reported to have been sold.

Kokomo, Ind.—City Engr. Jackson Morrow writes that the testing of the water supply site for the proposed municipal water works plant has proven satisfactory and the letting of the franchise for constructing the plant, which has been delayed because of the test, will be made Aug. 26.

Ft. Greble, R. I.—Bids are wanted by H. P. Young, Q. M., Newport, R. I., until Aug. 8 for constructing a frame pump and boiler house, also for pumping system at Ft. Greble.

Rimouski, Que.—The contract for constructing water works and an electric light plant has been awarded to Joseph Gosselin, of Levis, Que., for $52,500.

Malvern, Ark.—City Recorder W. J. Whitthorne writes this city will issue bonds and contract for the construction of a water works plant. estimated to cost $20,000. An engineer will be engaged to supervise same.

Springfield, O.—Bids are wanted Aug. 20 for $10,000 water-works improvement bonds. R. N. Lantz, City Clk.

Lewes, Del.—It is stated that new bids will be received Aug. 7 for the construction of water-works, sewers and an electric light plant. Robt. R. Waples, Sec'y Bd. of Pub. Wks.

Waupun, Wis.—M. J. Tappins, Sec'y State Bd. of Control, Madison, writes that the contract for building water tank and tower at State Prison, Waupun, has been awarded to the American Bridge Co., of Milwaukee, for $3,049.

Austin, Pa.—Boro. Secy. M. N. Johnson writes that it was voted July 30 to issue $20,000 bonds for water-works.

Solvay, N. Y.—See "Power Plants, Gas and Electricity."

Pittsburg, Pa.—Bids are wanted Aug. 7 for pipe laying in a large number of streets. Edward M. Bigelow, Dir. Dept. of Pub. Wks.

East Hartford, Conn.—Bids are wanted Aug. 12 for $130,000 water fund bonds. Wm. L. Hunting, Chmn. of Com.

Sharpsburg, Pa.—Bids are wanted Aug. 6 for putting down a system of wells (not less than 5 wells, depth 56 ft. below present surface of ground), laying cast iron suction pipe and connecting same. A. H. S. Black, Boro. Clk.

Redwood Falls, Minn.—Bids are wanted Aug. 14 for constructing a steel water tower. Loweth & Wolf, of St. Paul, Engrs. C. G. Johnson, City Recorder.

Hendricks, Minn.—Bids are wanted Aug. 17 for $9,500 water-works bonds. R. M. Burlingame, Village Recorder.

Boston, Mass.—Bids are wanted Aug. 27 for sections 8, 10, 11 and 16 of the Weston Aqueduct, as advertised in The Engineering Record.

Paris, Mo.—The lowest bid received recently for the construction of water-works and an electric light plant was from J. A. Bender, of Kansas City, at $18,742.

Armada, Mich.—It is stated that a vote has been taken in favor of bonding for water-works.

Ft. Branch, Ind.—The citizens are considering the question of constructing a municipal water-works system.

Harrison, Ark.—The Town Council has decided to put in water-works and sewers. G. J. Crump, Chmn. of Com.

Newmarket, N. H.—The commission appointed by the New Hampshire superior court to determine the value of the Newmarket water-works has placed the value of the entire property and franchise at $83,000 and the town will buy the plant at that price.

Caney, Kan.—Press reports state that a water-works plant is to be built. Estimated cost, $16,000.

Lonaconing, Md.—Bids are wanted Aug. 23 by the Elk-Lick-Midland Water Co. for constructing a masonry dam, pipe line and furnishing cast-iron pipe and specials, valves and valve boxes. Chas. S. York, Engr., Baltimore, Md.

Kaufman, Tex.—Town Secy. A. G. McDonald writes that on July 27 it was voted to issue $20,000 bonds for water-works.

Hastings, Neb.—The Fire & Water Commissioners have been instructed to take immediate steps for the construction of a 1,000,000 gal. reservoir.

Gallatin, Tenn.—Bonds to the amount of $6,000 have been authorized for the extension of the water-works.

Boise, Idaho.—The Stanley Basin Power & Water Co. has been organized with a capital stock of $500,000. The officers and directors are as follows: Frank Steunenberg, Pres.; F. W. Hunt, Vice-Pres.; Gen. J. L. Weaver, Secy.; Judge B. F. Olden, Treas.

Salt Lake City, Utah.—Local press reports state that the following bids were opened recently for the water pipe line in City Creek Canon: Keifer & Rush, $48,451; N. P. Glann Construction Co., $48,652; P. J. Moran, $52,193; Green & Reeve Co., $61,330.

Hunter, N. Y.—The Schoharie Water Co. has been incorporated with a capital stock of $10,000 to supply water to Hunter, Greene County, in which town the principal office is located. The directors are: Renwick Dibbell and Louis J. Hyser, of Tannersville; Paul Goepel, of New York City, and others.

West Springfield, Mass.—Bids are wanted by the Board of Water Commissioners until Aug. 14 for material and labor necessary to raise and add to the Mittineague stand pipe.

Detroit, Mich.—In regard to the proposed tunnel from the pumping station to an intake crib to be built in the river, Clarence W. Hubbell, Engr. to the Water Board, writes: "Upon my recommendation and preliminary estimates the Board of Water Commissioners has instructed me to prepare complete detail plans, specifications and estimates, which I hope to have ready in about three months. The total cost of improvement will not be less than $200,000."

Lebanon, Pa.—J. D. Kerr, Sec'y of the Water Dept., writes that the following bids for approximately 9,200 ft. of 20-in. cast iron force main, were opened July 24: Risser & Mark, Cornwall, Pa., $35,058; Hawman & Bro., Reading, Pa. (awarded), $37,930; T. J. Humphreys, Lebanon, Pa., $35,183; Geo. Pfeiffer, Jr., Camden, N. J., $36,553.

Florence, Pa.—Boro. Engr. C. P. Collins, of Johnstown, Pa., writes that the contract for constructing water works at Florence has been awarded to P. F. McCann, of Greensburg, Pa., for about $15,800. Detail bid of successful bidder was as follows: Excavating, 50 cts.; puddle wall, $1.75; masonry, $5 and $7; dry wall, $4; paving overflow, $1 per sq. yd.; pipe, 12-in., $1.20; 8-in., 80 cts.; 8-in., 86 cts; gate valves, 12-in., $37.25; 8-in., $18; 4-in., $6.

New London, Conn.—Engineer W. H. Richards writes that the following bids were opened July 25 by the Board of Water Commrs., for the construction of a dam and reservoir; A, C. H. Eglee & Co., $49,655; B, Geo. M. Atkins & Co., $61,860; C, Taylor & Tylee, $57,100; D, F. M. Lewis & Co., $42,680; E, N. L. Constructing Co., $48,615; F, Stone & Thurston, $39,335; G, Robbins & Potter, $35,415. Detail bids were as follows:

Quantities.	A	B	C	D	E	F	G
Grub'g, 193,000 s. y..	$.05	$.10	$.10	$.05	$.07	$.03	$.03½
Spoil, 2,000 c. y......	.35	.30	.30	.27	.30	.25	.30
Fill, 5,000 c. y........	.30	.20	.25	.30	.30	.20	.25
Embank., 23,000 c. y.	.40	.45	.45	.35	.35	.45	.35
Mort. mas., 375 c. y..	8.00	9.00	7.00	8.00	8.00	7.00	8.00
Dry rubble, 230 c. y..	6.00	7.00	4.00	3.00	3.50	4.00	3.00
Concrete:							
No. 1, 100 c. y....	5.75	6.00	6.00	5.00	6.00	7.00	5.25
No. 1 or 2, 2,000 c. y.	5.75	6.00	6.00	5.00	5.50	5.50	4.70
Exca., 0′-8′, 5,000 c. y.	.75	.70	.50	.50	.60	.35	.20
Exca., 8′-16′, 700 c. y.	1.25	1.00	1.00	1.00	1.00	.50	.90
Exca., 16′, 200 c. y..	3.00	3.00	2.50	2.00	2.50	.75	2.00
Plast'g, 2,500 s. y...	.25	.25	.25	.40	.50	.10	.15
Castings set, 10 tons	5.00	10.00	5.00	20.00	15.00	20.00	8.00
Paving, 15″, 800 s. y..	1.25	1.50	1.10	1.00	1.00	.75	.70
Pav., 12″, 4,200 s. y..	1.25	1.50	1.00	.75	.75	.75	.50

Boston, Mass.—The following bids were opened July 25 by the Metropolitan Water & Sewerage Board for excavating soil, section 8, Wachusett reservoir, and completing Westerly portion North Dike, Clinton, Boylston & Sterling:

Items and Quantities.	*Newell & Snowling Cons. Co., Uxbridge.	Nawn & Brock, Boston.	Long & Little, Leominster.
Clearing and grubbing, 410 acres	$55.00	$80.00	$100.00
Soil excavation:			
Area A on plan, 80,000 cu. yds.	.27	.32	.30
Area B on plan, 560,000 cu. yds.	.33	.33	.36
Area C on plan, 15,000 cu. yds.	.37	.45	.40
Area D on plan, 205,000 cu. yds.	.39	.33	.37
Area E on plan, 75,000 cu. yds.	.39	.42	.40
Earth excavation:			
At dike, 13,000 cu. yds.........	.22	.24	.30
For covering soil, 33,000 cu. y.	.18	.24	.30
Gravel excav., 31,000 cu. yds....	.27	.24	.25
Totals	$360,870	$377,830	$403,100

*Contract awarded.

Crestone, Colo.—Gen. Irving Hale, of Denver, has applied for franchises for a water-works system and an electric light plant

SEWERAGE AND SEWAGE DISPOSAL.

Webster City, Ia.—Bids are wanted Aug. 5 for the construction of an 18-in. pipe sewer in Second St., length about 2,500 ft. P. M. Banks, City Clk.

Davenport, Ia.—Bids are wanted Aug. 6 for the construction of sewers in several streets. Thos. Murray, Engr.

Keokuk, Ia.—The City Council will on Aug. 30 contract for building about 1,500 ft. of 8-in. sewer with appurtenances. J. Ross Robertson, City Engr.

New Brighton, Pa.—Bids are wanted Aug. 5 for sewers in numerous streets. F. C. O'Rourke, Sec'y of Council.

Sharpsville, Pa.—A proposition is under consideration for the formation of a company to construct a system of sewerage. Dr. A. E. Cattron, Chmn. of Com.

Mt. Vernon, N. Y.—City Engr. Geo. W. Drumheller writes that plans are being prepared for the sewerage of two sections of the city.

Monmouth, Ill.—The Sewer Committee has reported in favor of the adoption of plans prepared by City Engineer McClanahan for a system of sewage disposal. Estimated cost, $12,200.

Cincinnati, O.—The Board of Public Service has passed a resolution declaring it necessary to improve a portion of Glendora Ave. by sewering. Estimated cost, $5,432.

York, Pa.—The Highways Committee has decided to recommend to Councils that a loan ordinance be passed for $50,000 for sewers and macadamizing streets.

Haddonfield, N. J.—The Borough Council has voted to adopt the intermittent sand filtration system. Contracts for sewers and sewage disposal plant have not yet been awarded.

Melrose, Mass.—W. Dabney Hunter, Engr. & Supt. Pub. Wks. Dept., writes that sewer work contemplated will cost about $15,000.

Whitinsville, Mass.—The town has voted to spend $2,200 for securing plans for a sewerage system. Jerome V. Prentice, Chmn. Bd. of Selectmen.

Lowell, Mass.—The Common Council has passed orders for sewers in Meadowcroft and other streets. Cost, $27,500; also in Crescent and other streets; cost, $5,400.

Guelph, Ont.—The City Engineer is preparing plans for a system of sewers.

Conneaut, O.—Plans for a sewerage system for Sewer Districts Nos. 3 and 4 have been prepared by Geo. S. Pierson, of Kalamazoo, Mich. A considerable portion of the work will be constructed this season.

Waverly, Ia.—Bids are wanted Aug. 6 for the construction of an 8-in. pipe sewer. F. H. Munger, City Clk.

Oshkosh, Wis.—Bids are wanted Aug. 24 for furnishing material and constructing a sewer in Waugoo St. Frank Monahan, Chmn. Bd. of Pub. Wks.

Bird Island, Minn.—Bids are wanted Aug. 15 for the construction of a sewer in Seventh Ave. Wm. McMahan, Pres. of Common Council.

Harrison, Ark.—See "Water."

Cranford, N. J.—Local press reports state that bids are wanted by the City Council until Aug. 13 for the construction of a sewer in Burnside Ave.

Hammond, Ind.—Bids are wanted Aug. 6 for constructing a brick sewer in Hohman St. Peter J. Lyons, City Engr.

Wheaton, Ill.—Press reports state that plans are being prepared for a sewer system.

Salina, Kan.—The Sewerage & Drainage Committee has reported favorably on two extensions of the main sewer and the construction of two laterals.

Fresno, Cal.—The Madera Sewerage Co., with Fresno as the principal place of business, has filed articles of incorporation. Directors: F. and F. J. Knobloch, Jr., David Boger, A. W. Anderson and Louis Manuel; capital, $30,000.

Lewes, Del.—See "Water."

Newberry, S. C.—City Clk. W. S. Langford writes that an election has been called for Aug. 20 to vote on the issue of $25,000 bonds for the construction of a sewerage system.

Elkhart, Ind.—Bids will be received by the City Clerk until Aug. 28 for the construction of a trunk line and lateral sewer. L. E. Hitchcock, City Engr.

Syracuse, N. Y.—Bids are wanted Aug. 5 for 12, 15 and 18 pipe sewers in Division, Hudson and Oneida Sts. respectively. Jos. H. Saunders, City Clk.

Indianapolis, Ind.—Bids are wanted Aug. 12 for constructing a sewer in the 1st Alley south of 13th St. Albert Sahm, Chm. Bd. Pub. Wks.

Marshalltown, Ia.—City Engr. Wm. Brenner writes that the contract for about one mile of 8-in. pipe sewer has been awarded to T. H. Weatherly, of Marshalltown, at 38 cts. per ft. for 8-in. pipe, and 44 cts. per ft. for 10-in. pipe; manholes, $24 each.

Kansas City, Mo.—Plans have been made for sewers in two districts. Estimated costs, $10,000 and $15,000.

Springfield, Mass.—Bids are wanted Aug. 9 for constructing a brick sewer in Mill and Hickory Sts., length 845 lin. ft., size inside 2′ 2″ x 3′ 3″, earth excavation 2,250 cu. yds., rock excavation 1,570 cu. yds. Chas. M. Slocum, City Engr.

Providence, R. I.—The Common Council has passed a resolution to issue $100,000 bonds for sewer work.

Phoebus, Va.—The Town Council has under consideration the question of constructing a sewerage system.

Houston, Tex.—Local press reports state that bond issues as follows were voted July 25: $240,000 for paving, $60,000 for sewerage and $50,000 for new school buildings.

Fowler, Ind.—Bids are wanted Aug. 12 for a sewerage system to consist of a main sewer 3,988 ft. long, average cut 10½ ft., and three branches about 3,500 ft. long, average cut 10 ft. Frank Carter, Town Clk.

Norwood, Mass.—The enabling act, which gives this town power to construct a sewerage system, was accepted at a recent town meeting.

Sault Ste. Marie, Mich.—City Engr. J. A. Lawrie writes that the following bids were opened June 17 for excavating and laying pipe for sewer construction: A, Charles S. Beadle, Sault Ste. Marie, $38,403 (awarded); B, James Healy, Chicago, Ill., $79,691; C, R. W. Roberts, Sault Ste. Marie, $73,407; D, J. F. Arnott, Sault Ste. Marie, $70,864; E, J. H. Greene, Appleton, Wis., $65,848. Detail bids for above work were as follows:

Bidders.	Earth, 20,226 yds.	Boulders, 3,108 yds.	Rock, 6,821 yds.	Manholes, per vert. ft.	Catch basins, per vert. ft.	Drain wells, each.	Sp. lumber, per M.
A—	$1.50	$1.50	$2.75	$2.50	$3.25	$18.00	$10.00
B—	1.90	3.70	4.40	2.20	3.20	16.00	26.00
C—	1.55	3.60	4.15	1.00	3.50	11.50	25.00
D—	1.60	3.35	4.10	1.75	2.00	12.00	19.50
E—	1.47	3.25	3.85	1.70	2.60	8.00	18.00

BRIDGES.

Annapolis, Md.—Plans and specifications are wanted Aug. 6 for a pivotal steel draw for South River Bridge. Chas. Himelheber, Clk. Bd. of County Commrs.

New Brunswick, N. J.—Bids are wanted Aug. 7 for an iron bridge to cross South River at Old Bridge. R. J. Dougherty, Co. Engr.

East Providence, R. I.—Bids are wanted Aug. 6 for the construction of a stone and wooden bridge across Ten Mile River on Roger Williams Ave. E. Rowland Phillips, Chmn. of Com.

Monticello, Ill.—Bids are wanted Aug. 6 for a 60-ft. steel highway bridge on stone masonry in Goose Creek Township. For specifications address S. A. Goodman, Town Clk., De Land, Ill., or Ira O. Baker, of Champaign, Ill., Engr.

Pueblo, Colo.—Property owners have petitioned the City Council to let contracts for the construction of abutments for the proposed Main St. viaduct.

Syracuse, N. Y.—Bids are wanted Aug. 5 for $14,000 bridge bonds. E. F. Allen, City Treas.

Kalamazoo, Mich.—The Street and Bridge Committee will, according to local press reports, let contracts at once for a bridge to cross Portage Creek at Bryant St.

Wausau, Wis.—It is reported that a new bridge is to be built across Wisconsin River, south of the city.

Salt Lake City, Utah.—It is reported that County Commissioners Stanford and Wilson have been authorized to procure plans and specifications for a steel bridge to span Ogden canyon.

Sharon, Pa.—The Penn Bridge Co., Beaver Falls, Pa., is stated to have received contracts in amount $7,075 and $5,050 for bridges across Shenango River.

Baltimore, Md.—The County Commissioners have passed an order for the construction of a bridge over the Northern Central R. R. tracks at Sherwood station; estimated cost, $14,000.

Cohoes, N. Y.—The State Canal Board has approved plans for a $13,000 bridge over Champlain Canal.

Olivet, S. D.—Bids are wanted Sept. 4 for constructing a steel bridge across James River at Milltown, said bridge to have one main span of 125 ft., one span of 35 ft. and two approaches, one 16 ft., the other 20 ft., roadway 16 ft. clear. D. D. Wipf, Co. Aud.

Wilmington, Del.—The Baltimore & Ohio R. R. contemplates the erection of a bridge to carry its tracks over Lovering Ave. The total width of Lovering Ave. is 80 ft. and it is proposed to erect a clear span plate girder bridge.

Terre Haute, Ind.—Bids are wanted Aug. 24 for constructing a bridge, with approaches, across Wabash River at Wabash Ave., bridge to have 5 120-ft. spans, 2 90-ft. spans and 1 75-ft. span; a roadway 36 ft. in clear, brick pavement, and 2 walks 8 ft. in clear, cement. Bids will be received for the substructure and superstructure both separately and together. W. P. Boatman, Chmn. Bd. of Commrs. Vigo Co. Jas. Soules, Auditor.

Topeka, Kan.—It is stated that bids will be received by the County Commissoners Aug. 16 for a bridge on Sardou Ave. Appropriation for same $20,000.

Alexandria, La.—Bids are wanted Aug. 26 for building a steel highway bridge, with foundations and approaches, over Bayou Rapids. Ira W. Sylvester, City Engr.

San Jose, Cal.—It is stated that bids are wanted Aug. 19 for a 120-ft. steel span bridge on concrete piers. Chas. H. Pieper, Deputy Co. Surveyor.

Woodsdale, O.—Bids are wanted Aug. 23 by the County Commissioners, at Hamilton, O., for constructing at Woodsdale a three-span bridge with 17½-ft. roadway.

Medo, Minn.—Bids are wanted until Sept. 3 for the construction of an iron bridge to cross Bull Run Creek. Address the County Auditor, Mankato, Minn.

Mountain View, N. J.—Plans, specifications and bids will be received by the Joint Committee of Passaic and Morris counties on Aqueduct bridge, at Alexander Gillard's Hotel, Pompton Plains, N. J., until Aug. 5 for a steel bridge 160 ft. long and 17 ft. roadway, to cross Pompton River. Garret Berdan, Chmn. Passaic Co. Com., and John T. Post, Chmn. Morris Co. Com.

Summerville, Ga.—It is stated that bids are wanted Aug. 22 for building a steel or wooden span bridge, 100 ft. long, across Chattanooga River. A. S. Hamilton, Chmn. of Com.

Milwaukee, Wis.—The following bids were received for repairing and altering the sub-tsructure of the Chestnut St. bridge: Jos. A. Meyers, $10,449; P. J. Kelley, $14,000; A. F. Bruce, $13,654, and R. W. Forrestal, $10,985.

Broad Ripple, Ind.—Indianapolis press reports state that Asst. Engineer Kent, of the Chicago, Indianapolis & Louisville R. R. has been arranging for a new steel bridge over White River.

Springfield, Mass.—The city and the N. Y., N. H. & H. R. R. have agreed on the size of the St. James Ave. bridge and City Engineer Slocum has been instructed to prepare plans.

Turin, N. Y.—The American Bridge Co., it is stated, has secured the contract for building a $70,000 bridge at Pratt's Landing.

Camden, N. J.—County Engineer Albertson is reported surveying for a bridge over Cooper's Creek at Pine St.

Cincinnati, O.—Chas. L. Stroebel is stated to have the contract for repairng and extending the superstructure of 88th St. viaduct; amount, $22,990.

Ottawa, Ill.—It is stated that the Indiana Bridge Co. has received the contract for building a bridge over Fox River for $9,650.

Windsor, N. Y.—The Owega Bridge Co. is reported to have received the contract for the superstructure of a bridge over Susquehanna River for $15,000.

Worcester, Mass.—Local press reports state that the street railway company will build a $10,000 bridge over the B. & A. R. R. at James St.

Vicksburg, Miss.—It is stated that bids are wanted Sept. 2 for building a draw bridge 140 ft. long, to cross Big Black River. Wm. Curphy, Pres. Bd. of Supervisors.

Los Gatos, Cal.—Press reports state that a steel bridge is to be built over the Coyote on Tully Road.

Topeka, Kan.—The American Bridge Co. was the lowest bidder for Gage's Park bridge, amount $17,995, and the Missouri Valley Bridge Co., Leavenworth, the lowest bidder for Valencia bridge, amount $18,979. Bids for Sardou Ave. bridge were rejected because the appropriation was exceeded.

Troy, N. Y.—Wm. E. Martin of Troy is said to have received the contract for remodeling and strengthening the Union Bridge Co.'s bridge between this city and Waterford; estimated cost, $25,000.

Lowell, Mass.—J. H. Bickford & H. P. Graves, of Salem and Lowell, have prepared plans for the proposed bridge at Pawtucket Falls, for which preliminary work only has been done. Estimated cost of bridge, $150,000.

San Mateo, Cal.—It is reported that bids will be received Aug. 19 for $27,500 bridge bonds.

Napa, Cal.—Engineer Buckman's plans for a stone arch bridge across Little Creek, 83 ft. long and 47.6 ft. wide, are reported adopted by the City Council.

Johnsonville, Tenn.—The Louisville Bridge Co., of Louisville, is stated to have the contract for the Nashville, Chattanooga & St. Louis railway bridge across Tennessee River; amount, about $75,000.

Chicago, Ill.—The following bids are reported for two bascule bridges across the Chicago River, *a*, Harrison St.; *b*, State St.: *Superstructure.*—American Bridge Co., *a* $93,500, *b* $87,900; King Bridge Co., *a* $103,700, *b* $104,100. *Substructure.*—G. H. Sager & Co., *a* $60,372, *b* $67,363.85; Jackson, Corbett & Co., *a* $66,498, *b* $66,855.55; Lydon, Drews & Co., *a* $55,274, *b* $58,845.85; Morrison, La Bounty & Co., *a* $68,369, *b* $74,411.55; The Fitz-Simons & Connelly Co., *a* $62,094, *b* $64,448.08; Thomas Phee, *a* $78,119.

PAVING AND ROADMAKING.

Houston, Tex.—Bids are wanted by County Commissioners until Aug. 22 for constructing 25 miles of paved roads, as advertised in The Engineering Record.

Houston, Tex.—Bids addressed to Arthur Lipper, City Sec'y, will be received until Aug. 19 for paving protions of numerous streets. I. Austin Miller, City Engr.

New Brunswick, N. J.—Bids are wanted Aug. 12 for brick paving on Liberty St., 1,200 sq. yds., and on Burnet St., 1,100 sq. yds. Chas. A. Oliver, Chmn. Street and Roads Com..

The Council has adopted ordinances for the following paving: Spring Alley, with brick; Kirkpatrick St., with Telford; Seaman St., with brick.

Evansville, Ind.—Bids are wanted Aug. 10 for asphalt paving on several streets. Jas. D. Saunders, City Engr.

Des Moines, Ia.—Bids are wanted Aug. 9 for paving W. 22d St., about 4,859 sq. yds., with Trinidad pitch lake asphalt, 1½ in. surface, 1 in. binder course upon concrete base; also for 1,215 sq. yds. of brick gutter and about 3,522 lin. ft. of Portland cement curbing. Bids are wanted until Aug. 12 for grading W. 22d St., about 4,692 cu. yds. G. A. Eberhart, Chmn. Bd. of Pub. Wks.

Elyria, O.—Bids are wanted Aug. 19 for improving a portion of West Ave. W. H. Park, City Clk.

Waterbury, Conn.—Bids are wanted Aug. 13 for laying a sheet asphalt pavement on West Main St. R. A. Cairns, City Engr.

Cleveland, O.—Bids are wanted Aug. 31 for grading, draining and macadamizing or paving the State Road running through Brooklyn and Parma townships. Wm. H. Evers, Co. Surveyor. Julius C. Dorn, Co. Clk.

Hillsdale, Mich.—The contract for paving Howell St. was recently awarded to H. P. Streicher, of Toledo, for $12,346. The work comprises about 7,200 yds. of brick paving with Medina curb.

Salem, O.—The City Engineer has been directed to prepare plans and specifications for paving Columbina St.

Charlotte, N. C.—An election is to be held in September to vote on the issue of $200,000 bonds for road improvements.

Bay City, Mich.—Bids are wanted Aug. 5 for paving a portion of Lincoln Ave. with brick on a 6-in. concrete foundation, and curbing with Medina stone; bids are also wanted for paving the crossings and wings on Lincoln Ave. Matthew Lamont, Chmn. Bd. of Pub. Wks.

York, Pa.—See "Sewerage and Sewage Disposal."

Mansfield, O.—Bids are wanted Aug. 10 for improving a portion of Park Ave and Orchard St. Bonds for said work, amounting to $3,000 and $6,700 respectively, will be sold Aug. 12. F. M. Remy City Clk.

Swissvale, Pa.—Bids are wanted Aug. 5 for curbing and paving Delaware Ave. 2,700 lin. ft. curbing and 3,700 sq. yds. paving. C. B. Judd, Boro. Engr.

Scottsburg, Ind.—Bids are wanted by the Scott County Commissioners until Aug. 20 for building 7,731 miles of free gravel roads in Vienna and Finley townships. C. C. James, Co. Aud.

Fowler, Ind.—Town Clk. Frank Carter writes that the contract for brick paving (bids opened July 29), has been awarded to H. C. Finley, of Hoopston, Ill., as follows: Veedersburg standard block at $1.34; curb at 45 cts.

Worcester, Mass.—The committee on streets has recommended paving Main St., partly with granite blocks in cement and partly with wood; estimated cost, $100,000.

Appleton, Wis.—City Engr. C. H. Gillett, on July 30, writes that the Common Council has decided not to lay any asphalt pavement this year. Bids had been asked and were to have been opened Aug. 7.

Steubenville, O.—City Engr. C. E. Flanagan writes that contracts will probably soon be let for about 3,000 yds. of brick paving.

Hammond, Ind.—Bids are wanted Aug. 13 for paving a portion of Hohman St. with brick. Peter J. Lyons, City Engr.

Moscow, Idaho.—Local press reports state that bids will be received by the Street Committee until Aug. 15 for macadamizing Main and other streets.

Marinette, Wis.—Bids are wanted Aug. 20 for macadamizing portions of Ludington and Wells Sts. W. H. George, Chmn. Bd. of Pub. Wks.

Oklahoma, Okla. Ter.—Local press reports state that new bids will be asked for brick or asphalt paving.

Cleveland, O.—The County Commissioners have adopted the surveyors' schedule for improvements on North Woodland Ave., the State road and Miles Ave. The proposed improvements will cost about $150,000.

Niagara Falls, N. Y.—Asphalt paving contracts have been awarded as follows: To Barber Asphalt Paving Co., Elizabeth St., for $10,336; to American Contracting Co., Cedar Ave., at $11,147, and Seventh St. at $11,135.

St. Louis, Que.—The Council has authorized the issue of $150,000 bonds for street improvements.

Annapolis, Md.—Gloucester St. is to be paved with vitrified brick.

Watertown, Mass.—Local press reports state that all bids opened July 25 for building the new Watertown boulevard have been rejected by the Park Commissioners, Boston, as bids were above the amount of the appropriation, $50,000.

Ogdensburg, N. Y.—A special tax of $10,000 has been voted for the improvement of city streets.

Chicago, Ill.—The Board of Local Improvements decided July 25 to pave Lincoln St. between Harrison and Twelfth Sts. with asphalt instead of vitrified brick. Estimated cost, $19,000.

Hudson, N. Y.—Schute & Ryhlmeyer are stated to have secured a $40,000 macadam road contract.

New Orleans, La.—Local press reports state that all bids, received July 2 for paving on Canal St., have been rejected, and that new specifications will be prepared so that the contract may be let in several sections. For bids received July 2 see The Engineering Record of July 13.

New Orleans, La.—The Barber Asphalt Paving Co. was the lowest bidder at $2.20 per sq. yd. for asphalt paving on both Royal and Chartres Sts.

Scottdale, Pa.—The contract for curbing and paving Loucks Ave. has been awarded to Brown & Coates for $22,735.

Middletown, N. Y.—Contracts are about to be let by the city for 175,000 to 240,000 vitrified brick for street paving.

Connecticut.—The Towns of Glastonbury, Plainsville, Rockville, Mansfield, Norwich and Torrington have each voted an appropriation of $9,000 for good roads.

Topeka, Kan.—The Council is stated to have passed ordinance for the issue of $45,269 paving bonds.

Green Bay, Wis.—The Council Committee on Streets and Bridges has reported in favor of a brick pavement on Monroe Ave.

Grosse Pointe, Mich.—At the election held July 27 a vote was taken in favor of issuing $165,000 bonds for the construction of 14 miles of macadam road.

Tipton, Ia.—The Committee appointed to investigate various kinds of paving has reported in favor of asphalt.

Boston, Mass.—Bids are wanted Aug. 6 for excavating, grading, masonry, brick pavement, granolithic walks, sewers, drains, etc., at State House Grounds. Address Ernest W. Bowditch, 62 Devonshire St.

Bellefontaine, O.—It is stated that bids are wanted Aug. 17 by the County Commissioners for grading and macadamizing Lake View and Muchinippi Pike in Stokes Township. Estimated cost, $10,600.

Buffalo, N. Y.—The supervisors have recommended the purchase of three sprinklers and an engine for use on the county roads.

Hoboken, N. J.—Local press reports state that contracts are about to be let for asphalt paving on several streets.

Niles, Mich.—It is stated that at a special meeting of the city council, it was decided to pave Main St.

Cincinnati, O.—Bids are wanted by the Hamilton County Commissioners Aug. 31 for the improvement of Montgomery road north from River road at Burton's farm. Eugene L. Lewis, Co. Aud.

Huntsville, Ala.—Brick paving, to the amount of $10,000, is being considered.

Indianapolis, Ind.—Bids are wanted Aug. 12 for paving 1st Alley north of Ohio St. with brick and a portion of New York St. with asphalt. Albert Sahm, Chmn. Bd. Pub. Wks.

Schenectady, N. Y.—Bids are wanted by the Common Council Aug. 13 for furnishing material and grading, paving and curbing Chestnut St.

Portland, Ore.—Bids are wanted Aug. 9 for the construction of a wagon roadway known as Vancouver bridge. W. M. Cake, Co. Judge.

Houston, Tex.—See "Sewerage and Sewage Disposal."

Evansville, Ind.—Bids are wanted Aug. 17 for improving 2 alleys between Main and Locust Sts. and 1st and 2d Sts. by grading and paving with brick. W. E. Clark, Clk. Dept. Pub. Wks.

Norristown, Pa.—The contract for paving Walnut and Sandy Sts., by the Chestnut Hill, Roxborough & Norristown Electric Railway, has been awarded to the John T. Dyer Co., under the supervision of S. Cameron Corson, Boro. Engr. There will be 4,300 yds. of brick paving on 5-in. concrete foundation.

Flushing (L. I.), N. Y.—The following bids were opened July 30 by Jas. P. Keating, Commr. of Highways, N. Y. City, for repaving Main St. with asphalt on macadam pavement prepared as foundation. The estimated quantities of the work are 11,150 sq. yds. asphalt; 4,300 lin. ft. new curb; and 11,150 sq. yds. macadam foundation preparation, for which the detail bids are: Fruin-Bambrick Paving Co., $3.13, $1.17 and 78 cts., respectively; Barber Asphalt Paving Co., $2.99, $1.09 and 63 cts.

St. Joseph, Mich.—City Engr. W. J. Cleary writes that a block paving contract amounting to $11,508 has been awarded to C. H. Defrus, of South Bend, Ind., his bid being as follows: Burr clay block at $1.08 per sq. yd.; Townsend block, $1.15; Trimble blk, $1.16, and Buckeye blk., $1.21; cement curb, 25 cts. per lin. ft.

The contract for asphalt paving has been awarded to J. J. Duffy & Co., Chicago, Ill., as follows: Paving, $1.85 per sq. yd.; excavation, 15 cts.; curb, 53 cts.; total, $10,257.

Brooklyn, N. Y.—The following bids were opened July 30 by Jas. B. Keating, Commr. of Highways, N. Y. City, for repaving Fifteenth St. and Coney Island Ave., with asphalt and granite block on a concrete foundation: A, Brooklyn Alcatraz Asphalt Co.; B, Cranford Co., 524 St. Marks Ave.; C, Eastern Bermudez Asphalt Paving Co., Morgan Ave. and Stagg St.:

Items and Quantities.	A	B	C
Asphalt, 11,137 sq. yds.	$2.83	$2.96	$3.03
Stone relaid, 50 sq. yds.	.59	.75	.63
Concrete, 2,402 cu. yds.	6.00	6.00	6.25
Cement curb, 3,937 lin. ft.	1.25	1.35	1.40
Old curb, 10 lin. ft.	.55	.50	.62
Granite, 6,081 sq. yds.	2.63	2.75	2.87

Bids were also received as follows for repaving Morris Ave., Boro. of The Bronx, with asphalt on present pavement and with granite blocks on concrete foundation with asphalt strips: A, Asphalt Construction Co.; B, Barber Asphalt Paving Co.; C, Fruin-Bambrick Paving Co.:

Items and Quantities.	A	B	C
Asphalt, 22,700 sq. yds.	$2.63	$2.69	$2.89
Stone relaid, 22,500 sq. yds.	.42	.43	.47
Concrete, 400 cu. yds.	6.60	6.70	7.25
New curb, 7,500 lin. ft.	1.28	1.27	1.40
Old curb, 800 lin. ft.	1.00	1.02	1.15
Granite block, 2,000 sq. yds.	3.28	3.30	4.00
New bridgestone, 1,200 sq. ft.	.55	.55	.63

New York, N. Y.—The following bids were opened July 30 by Jas. P. Keating, Commr. of Highways, for repaving with asphalt on present pavement as foundation: A, Barber Asphalt Paving Co.,; B, Continental Asphalt Paving Co.; C, Fruin-Bambrick Paving Co., New York; D, Uvalde Asphalt Co., New York; E, Sicilian Asphalt Paving Co., New York:

Bidders.	Asphalt, sq. yds.	Pavt. relaid, sq. yds.	Concrete, cu. yds.	New curb lin. ft.	Old curb, lin. ft.	Manhole covers.
Sixth Ave., from 35th to 42d St.						
	9,100	9,150		2,775	100	10
A	$3.43	$.52	...	$1.05	$.49	$24.00
B	3.29	.50	...	1.09	.60	25.00
C	3.72	.50	...	1.09	.60	23.50
D	3.32	.47	...	1.05	.50	23.00
E	3.59	.51	...	1.08	.60	24.25
Sixth Ave., from 42d to 59th St.						
	23,000	23,050		6,420	1,720	48
A	$3.43	$.52	...	$1.05	$.49	$24.00
B	3.30	.50	...	1.09	.60	25.00
C	3.72	.50	...	1.09	.60	23.50
Seventh Ave., from 23d to 42d St.						
	32,800	29,900	530	500	500	119
A	$3.43	$.52	$6.50	$1.05	$.49	$24.00
B	3.49	.54	6.55	1.09	.57	25.00
C	3.84	.57	7.00	1.09	.60	23.50
Seventh Ave., from 47th to 58th St.						
	18,250	15,600	370	700	50	57
A	$3.43	$.52	$6.50	$1.05	$.49	$24.00
B	3.47	.53	6.55	1.09	.57	25.00
C	3.84	.59	7.00	1.09	.60	23.50
E	3.39	.51	6.45	1.06	.60	24.25

Mobile, Ala.—The Board of Public Works has recommended the paving of Water and other streets with asphalt at a total estimated cost of $55,814. J. N. Hazlehurst, Ch. Engr. of Bd.

St. Marys, O.—Bids for paving Perry St. are reported as follows: Gantz & Parady, Columbus; Logan block, $1.65 per sq. yd., $16,981. Pfaff, Ringwald & Smith, Chilicothe, Massillon block at $1.96; $20,241. Porter & Bowlin, Tipton, Ind., Logan block, $1.87; $19,335. Hennessey & Co., Troy, O., Logan block at $1.95; $20,214.

Detroit, Mich.—The following are reported lowest bidders for paving work, bids opened July 24 by Commr. of Public Wks. Moreland: Taylor Ave., asphalt, American Contracting Co., $12,181.15; $2.18 per yd. Stanton Ave., cedar block, G. W. Winterhalter, $13,052.56; $1.25 per yd. John R. St., asphalt repaving, American Contracting Co., $16,553.37; $1.82 per yd. Myrtle St., cedar, J. A. Mercier, $9,844.63; $1.27 per yd.

POWER PLANTS, GAS AND ELECTRICITY.

Shakopee, Minn.—The contracts for constructing an electric light plant have been awarded as follows: Electrical apparatus to McBride Electric Co., 146 E. 4th St., St. Paul, for $8,700; steam plant to A. L. Ide & Son, per J. G. Robertson, Manhattan Bldg., St. Paul, for $5,500.

Cambridge, N. Y.—Village Clk. J. W. Smith writes that a 5-year contract for lighting the streets and engine house has been awarded to the Consolidated Electric Co., of Greenwich, N. Y., at $12 each per year for 120 25-c.p. incandescent lights.

Seattle, Wash.—The Snogualmie Falls Power Co. will expend about $350,000 in improvements to include the construction of a new power chamber at the falls and the installation of new machinery. Chas. H. Baker, Pres.

Milwaukee, Wis.—Local press reports state that active work on the new gas plant to be erected by the Milwaukee Gas Light Co., on 25th St. will begin about Sept. 1. Cost of the plant complete will be about $1,350,000. Rezeau B. Brown will supervise its construction.

Emporia, Kan.—The Committee on Lighting is stated to have recommended that the citizens be asked to vote bonds to the amount of $20,000 to increase the capacity of the electric light plant. D. W. Morris, Chmn. Com.

Findlay, O.—The Board of Improvements is stated to have approved the ordinance granting a franchise to Chas. F. Smith to construct and operate a heating plant.

Batavia, N. Y.—C. C. Rose, of Fulton, Thos. B. Crary, of Binghamton, and others representing a syndicate controlling the Alden natural gas fields are reported to be trying to secure permission to pipe Batavia and run pipes from Alden to Batavia, a distance of 18 miles.

Little Rock, Ark.—The Council on July 23d is stated to have appropriated $20,000 for enlarging the city electric light plant.

Mountain Lake, Minn.—The citizens are stated to have voted to issue $6,000 bonds to establish a gas plant.

Martin's Ferry, O.—The Council has passed on second reading an ordinance for the improvement of the electric light plant, to cost about $8,000.

Keokuk, Ia.—L. J. Cooley, of Chicago, Ill., has been engaged by the Keokuk & Hamilton Water Power Co. to make an investigation and report in August on the advisability and practicability of developing the water power of the Mississippi River at Keokuk.

Riverside, Cal.—J. H. Barbour, Sec'y of the Riverside Power Co., writes that bids will be opened about Aug. 15 for the construction of a canal and power plant, estimated to cost $80,000. Total investment, including lands, water rights, canal transmission line and power plant, about $250,000. Sam'l Storrow, Douglas Bldg., Los Angeles, Cal., Engr. in Charge.

Indianapolis, Ind.—Local press reports state that the Board of Public Works will receive bids Aug. 16 for the public lighting contract.

Fremont, O.—The Northwestern Ohio Natural Gas Co. is reported to have sold its entire Fremont plant to a Detroit, Mich., syndicate headed by J. T. Lynn and T. K. Pelton. It is also reported that the new company will erect a large power house and an immense gas manufacturing plant at Fremont and will on Sept. 1 cease furnishing Fremont with natural gas and transfer the supply to Toledo.

St. Joseph, Mich.—The Ft. Wayne Construction Co., Ft. Wayne, Ind., is stated to have received the contract for constructing the municipal electric light plant; cost about $12,000.

Solvay, N. Y.—The Village Trustees are stated to have awarded to the Syracuse Light & Power Co. the contract for pumping the village water and furnishing the electric lighting, at $6,250 a year for a term of 5 years.

Renfrew, Ont.—Bids are wanted by the Renfrew Power Co., Limited, until Aug. 24 for the construction of a wooden dam and flume and power house. Thos. A. Low, Sec'y.

Grand Rapids, Mich.—The citizens are reported to have voted to issue $25,000 municipal lighting bonds.

Rimouski, Que.—See "Water."

Le Mars, Ia.—Press reports state that bids are wanted by the City Council until Aug. 8 for lighting the city for 5 years. There will be required 13 arc light of 1,200 c. p. and 118 incadescent lights of 30 c. p., or 118 gas or naphtha lamps and 39 gas lamps.

Lenox, Mass.—The contract for an electric light plant for Hotel Aspinwall is reported to have been awarded to the Western Electric Co. of Chicago, Ill., for about $20,000.

Washington, D. C.—Bids are wanted Sept. 21 for steam generating equipment, steam piping, etc., at Trumbull St. pumping station, as advertised in The Engineering Record.

Olin, Ia.—City Clk. C. P. Rummel writes that on July 29 it was voted to grant a franchise to the Olin Light & Power Co. for an electric light plant.

Lewes, Del.—See "Water."

Waverly, Tenn.—Gen. Mgr. A. E. Justice, of the Waverly Electric Light Co., writes that bids are wanted Aug. 15 for the construction of an electric light plant. A 100 H. P. engine will be required. Estimated cost of plant, $5,000.

ELECTRIC RAILWAYS.

Columbus, O.—The Franklin County Commissioners are stated to have granted a franchise to H. R. Young, representing the Columbus, Granville & Newark Traction Co.

Ch. Engr. A. N. Jones, of the Scioto Valley Traction Co., writes that contracts for the construction of 21 miles of road have been awarded as follows: Grading and bridging for 16 miles, to Luchtenburg & McKinnon, 610 Wyandotte B'dg., Columbus; grading and bridging for 5 miles, to Rowe & Mowery, Circleville, O.

Cincinnati, O.—The Hamilton County Commissioners are stated to have granted a right of way along the Cincinnati, Columbus and Wooster turnpike to the Cincinnati, Milford & Goshen St. Ry. Co.

The Cincinnati Traction Co. is reported to be considering the question of placing all its trolley and feed wires underground.

Canastota, N. Y.—The Canastota & Morrisville Ry. Co. is stated to have secured franchises through the village of Canastota and the towns of Lenox, Lincoln, Fenner and Smithfield.

Canton, O.—The Starke County Commissioners are stated to have granted the Canton-Massillon Ry. Co. a franchise for a line between Massillon and Navarre.

Hazleton, Pa.—A press report states that John W. Crellin, of Hazleton, received the contract for constructing a trolley line between Hazleton and Wilkes-Barre, and P. J. Donohue, of Kingston, the contract for the tunnel through the Wilkes-Barre Mountain. Contract price of tunnel reported to be $75,000, and it will be 2,600 ft. long.

Monticello, N. Y.—The State Board of R. R. Commissioners is stated to have granted the Monticello, Fallsburgh & White Lake R. R. Co. permission to construct its road; it will be an electric line, about 16½ miles long.

Battle Creek, Mich.—The Council is stated to have granted a franchise to the Detroit, Pontiac, Lapeer & Northern Electric Ry. Co.

Westfield, Mass.—Engr. Geo. N. Merrill, of Springfield, writes that the Westfield Valley Electric Ry. Co. proposes to construct a railway, but surveys have not yet been made.

Mt. Joy, Pa.—The Council is stated to have granted a franchise to the Lancaster & Mt. Joy Electric Ry. Co.

Stafford Springs, Conn.—The Stafford Springs Ry. Co. has been organized with Thos. C. Perkins, of Hartford, as Pres. and F. G. Sanford, of Stafford Springs, as Secy. The company will construct a line in Rockville, Snipsic Lake, Crystal Lake, West Stafford, Stafford Springs and Staffordville to the dividing line between the States of Connecticut and Massachusetts.

Reisterstown, Md.—The Baltimore, Westminster & Gettysburg St. Ry. Co. is reported organized to construct an electric railway from Reisterstown through Westminster, to the Pennsylvania State line and through Cumberland Valley to Harrisburg. I. A. Sweigard, Pres. Philadelphia, Pa.; Chas. E. Fink, Ch. Eng., Westminster, Md.

Hamburg, N. Y.—D. W. Allen is stated to have petitioned the Trustees for the privilege of entering the village with his electric line now being constructed between here and Buffalo.

Saratoga, N. Y.—It is stated that the Saratoga Traction Co. will extend its line from Ballston to Mechanicsville, a distance of about 13 miles. C. E. Harvey, Ch. Engr., Saratoga.

Clyde, N. Y.—The Village Trustees are stated to have granted a franchise to the Clyde Electric Power & R. R. Co.

Benton Harbor, Mich.—The West Michigan Traction Co. is stated to have been organized with a capital of $1,000,000 to construct an electric railway from the vicinity of Benton Harbor to Dowagiac, Cassopolis, Decatur, Pawpaw and Kalamazoo, a distance of 90 miles.

Marion, Ind.—The Council is stated to have granted a 50-year franchise to the Cincinnati, Richmond & Muncie Ry. Co. It is reported that the road is to be elevated within the city limits.

Wilmington, N. C.—A press report states that the Wilmington Seacoast R. R. has been sold and the purchasers will probably convert it into a trolley system; the road extends from Wilmington to Wrightsville Beach, a distance of about 12 miles.

Baraboo, Wis.—The Council is stated to have granted a franchise to the Sauk County Power & Traction Co.

Ft. Wayne, Ind.—The Allen County Commissioners are stated to have granted a right of way to the Indiana & Ohio Traction Co. for a line from Hickville to Huntington, through Ft. Wayne.

Wheeling, W. Va.—The car barns and power house of the Wheeling Traction Co. at West Wheeling are stated to have been destroyed by fire July 21. L. S. Kirker, Supt., Wheeling.

Carthage, N. Y.—The Watertown & Carthage Traction Co. is stated to have received a franchise.

Menominee, Mich.—M. D. Bryce, an attorney of Detroit, is reported interested in the construction of an electric railway from Green Bay, Wis., to Menominee.

Norwalk, O.—The Council is stated to have granted a franchise to the Norwalk, Ashland & Southern Electric Ry. Co.

Michigan City, Ind.—The Lake Michigan & Central Indiana R. R. & Navigation Co. is stated to have been organized to construct an electric railway from Michigan City to Indianapolis by way of Laporte, Hamlet, Knox, Bass Lake, Winamac, Logansport and other places.

Charlotte, Mich.—The Council is stated to have granted a franchise to Robt. Gordon, of St. Mary's, O., who proposes constructing a trolley line connecting Battle Creek, Charlotte and Lansing.

Janesville, Wis.—Geo. J. Hurd, Supt. Janesville St. Ry. Co., is reported interested in the construction of an electric railway from Janesville to Lake Geneva.

Wauseon, O.—The Council is stated to have granted a franchise to the Toledo & Indiana Ry. Co.

New York, N. Y.—The Manhattan Ry. Co. is stated ot have filed plans with the Department of Buildings for the erection of 3 power houses and one repair shop, the estimated cost of which is $133,000.

North Andover, Mass.—The Selectmen are stated to have granted a franchise to the Middleton & Danvers St. Ry. Co., which proposes to construct a line between North Andover and Lawrence.

St. Paul, Minn.—It is stated that Saml. Hill is considering the construction of an electric railway between Minneapolis and St. Paul.

Gardner, Mass.—The Wachusett St. Ry. Co. has been organized and will probably soon commence constructing an electric railway to the summit of Mt. Wachusett. F. S. Coolidge, Pres. Fitchburg. Jas. A. Stiles, Secy., Gardner.

Amsterdam, N. Y.—The Council is stated to have granted the Amsterdam St. R. R. Co. a franchise to construct an electric railway through West Main St.

Greenville, S. C.—A charter has been granted to the Greenville & Piedmont Traction Co., with a capital of $100,000, to construct an electric railway about 12 miles in length between Greenville and Piedmont. Incorporators: Geo. M. Bunting, Chester, Pa.; Bayard Hodge, Philadelphia, and others.

Kansas City, Mo.—The Interstate & Leavenworth Ry. Co. of Kansas City has been incorporated with a capital of $500,000, to construct and operate street railways in Kansas City and Jackson County, Mo., in Kansas City and Wyandotte County, Kan., and in Leavenworth County, Kan. Incorporators: W. H. Gabrial, of Cleveland, O.; H. W. Wolcott, of Leavenworth, Kan.; Frank E. Latte, of Kansas City, and others.

Utica, N. Y.—The Utica Suburban St. R. R. is stated to have secured a franchise to extend its lines from its present terminal in Oriskany to the border line of the town of Whitesboro.

RAILROADS

Tiptonville, Tenn.—J. C. Harris, of Tiptonville, is reported interested in the construction of a railroad from Tiptonville to Union City.

Eureka, Cal.—It is stated that the Eel River & Eureka R. R. Co. will extend its line 15 miles from Burnells. C. L. Rose, Supt., Eurka.

Chicago, Ill.—A press report states that the Chicago & Western Indiana R. R. Co. is to elevate its tracks in this city, at a cost of about $6,000,000. B. Thomas, Pres. & Gen. Mgr., Chicago

Liberty, N. M.—The Dawson R. R. Co. has been incorporated with a capital of $3,000,000, to construct a railroad from Liberty to Dawson, a distance of about 130 miles. Principal office to be at Alamogordo, N. M. Incorporators: Clarence Simpson, Thos. Watkins and others.

Duluth, Minn.—Bids will be received at the office of the Duluth, Virginia & Rainy Lake Ry. Co., 410 Palladio Bldg., Duluth, Aug. 8 for constructing 20 miles of railroad.

Cornish, Me.—The Ossipee Valley R. R. Co., is stated to have filed a petition with the State R. R. Commissioners for permission to construct a line about 11 miles long, from Cornish Station to Hiram, Ponter and Freedom.

Marion, N. C.—The Marion & North Western R. R. Co. is stated to have been organized, with a capital of $3,000,000, to construct a railroad from Marion to the coal fields of Tennessee. Directors: W. C. Perkins, of Boston, Mass.; J. S. Manning and Leo D. Hart, of Durham, N. C., and others.

Knoxville, Tenn.—It is reported that the Knoxville & Bristol R. R. is to be extended from Beans Station, Tenn., to Bristol, a distance of 90 miles. H. M. Aiken, of Knoxville, Gen. Mgr.

Webb, Miss.—The Sunflower & Eastern Ry. Co. has been incorporated, to construct a railroad about 12 miles long, between Parchman and Webb. Incorporators: E. M., F. E., and M. Roots, all of Little Rock, Ark.

New York, N. Y.—Permission is stated to have been granted to the Rapid Transit Commission to extend the tunnel beneath Battery Park.

Knoxville, Tenn.—The Poplar Creek Coal Co. has arranged to build 3½ miles of railroad from Oliver Springs, Tenn., to its mill in Anderson County. Col. E. J. Sanford, Pres., Knoxville, Tenn.

Pittsburg, Pa.—The contract for constructing the Mt. Washington tunnel on the Wabash R. R. has been awarded to the Ferguson Contracting Co., 69 Wall St., New York, N. Y., for about $800,000.

Pittsburg, Pa.—Bids are wanted Aug. 7 for grading and masonry between Tarrs, Ruffsdale and Hunkers and in the Big Sewickley Valley. M. R. McAdoo, Gen. Mgr. Pittsburg, McKeesport & Connellsville Ry. Co., Pittsburg.

Marlinton, W. Va.—A charter is stated to have been granted to the Iron Mountain & Greenbrier R. R. Company to construct a railroad from the mouth of Beaver Creek, in Pocahontas County, to White Sulphur Springs; capital, $100,000. Incorporators: Thos. J. Shryock, Baltimore, Md.; F. A. Hauck, Ronceverte, W. Va.; John W. Harris, Lewisburg, W. Va., and others.

Mineral, Kan.—Bids are wanted for grading and bridging the M. K. & N. W. R. R. from Mineral, Kan., to Joplin, Mo., 30 miles. Address F. W. Fratt, Joplin.

East Jordan, Mich.—The East Jordan & Southern R. R. Co. has been incorporated, with a capital stock of $250,000. It is stated that the purpose of the company is to purchase the line now being constructed between East Jordan and Antrim, a distance of 20 miles, make some improvements and operate same. Incorporators: Chas. L. Ames, Oak Park, Ill., and Abel H. Frost and Wm. Porter, East Jordan.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Olympia, Wash.—The contract for erecting the court house for Thurston County is stated to have been awarded to Chas. Patnud, of Olympia, for $19,000.

Madison, Wis.—The First Baptist Church is stated to have been destroyed by fire July 24.

Janesville, Wis.—Jas. Rawson & Son, of Iowa City, Ia., received the contract for the erection of a city hall, at $44,990.

Winnipeg, Man.—Andrew Carnegie is stated to have presented this city with $100,000 for a library.

Stillwater, Okla. Ter.—W. B. Gibbs is stated to have received the contract to erect a city hall, for $26,020.

Valley City, N. D.—Andrew Carnegie is stated to have offered this city $15,000 for a public library.

Montreal, Que.—It is stated that the Protestant Hospital for Insane at Verdun is shortly to be enlarged by the erection of 2 buildings to cost about $70,000.

Ionia, Mich.—Bids opened July 25 by the Managers of the Ionia Asylum, for the erection of 3 new buildings, are stated to have been rejected, all being in excess of the appropriation, which is $82,000.

Lake Charles, La.—The plans of the J. Rieley Gordon Co., Dallas, Tex., are stated to have been accepted for a court house, to cost $50,000.

Jacksonville, Fla.—The plans of Wilson & Edwards, of Columbia, S. C., are stated to have been accepted by the Trustees of the Presbyterian Church for a brick and stone edifice to be erected on Monroe and Ocean Sts. C. D. Rinehart, Chmn. Bldg. Com.

Utica, N. Y.—The plans of Arthur C. Jackson, 55 W. 33d St., N. Y. City, are stated to have been selected for the Utica Public Library, to cost $165,000.

Janesville, Wis.—The Library Board is stated to have rejected bids opened July 23 for the public library, all being in excess of the appropriation, which is $40,000. Architect Jennings, of Madison, will prepare pew plans, for a 1-story building.

Richmond, Ky.—Bids are wanted Aug. 12 for improvements to the Madison Co. court house. J. Tevis Cobb, Chmn. of Com. Architects, Crapsey & Lamm, of Cincinnati, O.

El Paso, Tex.—Bids will be received by E. B. Cushing, Engr. Maint. of Way, Southern Pacific Co., at Houston, Tex., until Aug. 20, for the construction of a hospital building for the G., H. & S. A. Ry. Co.

Rochester, N. Y.—Bids are wanted Aug. 21 for constructing reception, infirmary, kitchen and connecting corridor and chronic disturbed and employees' buildings, at the Rochester State Hospital. Frederick Cook, Pres. Bd. Mgrs.

Syracuse, N. Y.—Separate bids are wanted Aug. 5 for $42,000 engine house bonds and $38,000 library bonds. E. F. Allen, City Treas.

Gowanda, N. Y.—Contracts for two additions to the Gowanda State Hospital, bids for which were opened here July 26, are stated to have been awarded as follows: Erecting the 2 wings, to R. U. Taylor of Olean, $126,000; plumbing, to W. H. Simpson, Olean, $13,000; and heating, to Irlbackers Sons of Buffalo, $3,000.

Schenectady, N. Y.—Bids are wanted Aug. 5 for the erection of buildings for almshouse purposes from plans of Edw. L. Davis, 417 State St. Jacob Vine, Chmn. Com. Lands & Bldgs. of Superv. of Schenectady County.

Meridian, Miss.—It is stated that bids are wanted Aug. 12 for building a jail; probable cost, $35,000. B. V. White, Clk. Bd. Superv.

Glenville, O.—It is stated that a $50,000 R. C. Church will be erected on St. Clair St. and Parkwood Boulevard. Rev. Jos. F. Smith, Pastor.

Brooklyn, N. Y.—The Board of Estimate on July 31 is stated to have appropriated $300,000 for the Brooklyn Institute of Arts and Sciences, for the erection of a new wing.

Cleveland, O.—It is stated that a new synagogue will be erected on Forest St. and Scovill Ave. by the Anshe Emeth congregation, which now worship at 550 Erie St.; cost, $40,000.

St. Paul, Minn.—Bids will be required for complete mechanical equipment of the new Minnesota Capitol about Sept. 1st.

Bagley, Ia.—It is stated that bids are wanted Aug. 10 for the erection of a Methodist church. J. W. Thompson, Secy.

Cartersville, Ga.—Bids are wanted Sept. 17 for building a 2-story court house; probable cost, $30,000. L. B. Matthews, Chmn. Bd. of Co. Commrs.

BUSINESS BUILDINGS.

Calumet, Mich.—Chas. W. Maas, of Calumet, is stated to have prepared plans for a brick and stone business block for Martin Ruhn, to cost $20,000.

H. T. Liebert, of Hancock, is stated to have prepared plans for a brick business block for Baer Bros., of Calumet, to cost $20,000.

Chicago, Ill.—Geo. Beaumont, 115 Dearborn St., is stated to have prepared plans for a 2-story warehouse 280 x 150 ft., to be erected by the Western Cold Storage Co. on Illinois Central pier No. 2, to cost $32,000.

Morrison H. Vail, 1439 Unity Bldg., is stated to have been selected to prepare plans for the Ravenswood Y. M. C. A. building, to be erected at Hermitage and Wilson Aves., to cost $50,000.

Winnetka, Ill.—Richard E. Schmidt, 163 Randolph St., Chicago, is stated to be preparing plans for a hotel and sanitarium to be built in Winnetka, for Dr. Emil Hirshfield, to cost $75,000.

Richmond, Va.—It is stated that plans are being prepared for a 5 or 6-story fireproof hotel which Mrs. A. D. Atkinson will erect at 9th and Grace Sts.

Mr. Zimmerman is reported to be about to erect a 4 or 5-story hotel at 7th and Broad Sts., to be known as the Metropolitan Hotel. Architect not yet selected.

Paducah, Ky.—It is stated that a Masonic and Odd Fellows' building will be erected here, to cost about $50,000.

Rochester, N. Y.—Chambers & Casey, Powers Blk., are stated to have received the contract for erecting car shops for the Rochester Ry. Co. for about $30,000.

Cincinnati, O.—It is stated that the Cincinnati Traction Co. will erect an office building on 5th and Walnut Sts., to cost about $1,000,000.

Troy, N. Y.—It is stated that plans have been completed for the new union depot. It will be a 2-story structure, 400 x 47 ft., and be erected on the site of the present station, B'way, Fulton and Union Sts.; probable cost, $300,000.

Houghton, Mich.—H. T. Liebert, of Hancock, is stated to have prepared plans for a brick business block for Joseph Hodgson, of Houghton, to cost $15,000.

Jacksonville, Fla.—Arthur B. Gilkes & Alfred Rodd are stated to be preparing plans for 2 business buildings, one, a 4-story brick building 86 x 100 ft., for S. B. Hubbard, to be erected on Bay and Laura Sts.; the other, a 2-story brick building 80 x 121 ft., to be erected on Bay and Main Sts.

Pontiac, Mich.—The Pontiac Buggy Co. will erect a 4-story building, 188 x 80 ft. E. M. Murphy, Pres.

Butte, Mont.—It is reported that the Northern Pacific R. R. will erect a $45,000 station here this summer. E. H. McHenry, Ch. Engs., St. Paul, Minn.

Nashua, N. H.—A correspondent writes that the plant of Proctor Bros., manufacturers of boxes and cooperage products, has been destroyed by fire; loss, $120,000. It is stated that the company will rebuild at once.

Gainesville, Tex.—It is reported that the Santa Fe R. R. Co. will erect a $50,000 depot here. L. J. Polk, Gen. Mgr., Galveston.

New York, N. Y.—The Louis Weber Building Co., 427 E 61st St., is stated to have received the contract for erecting a 12-story hotel, 75 x 200 ft., on Madison Ave. and 29th St., for the Woman's Hotel Co. It is to be completed within 12 months. Architect, Robt. W. Gibson.

Oak Grove, Pa.—Press reports state that J. E. & A. L. Pennock, 307 Walnut St., Philadelphia, will receive sub-bids until Aug. 12 for a number of shops and engine house at Oak Grove, also an engine-house at Clearfield for the New York Central & Hudson River R. R., Pa. Division. Architect, C. A. Reed, of New York.

Madison, Wis.—Chas. Pfister, of Milwaukee, is reported interested in the erection of a hotel here, to cost about $200,000.

Kansas City, Mo.—A $20,000 brick glass factory is about to be built by a company, of which I. J. Herne is president.

Gaffney, S. C.—Bids are wanted Aug. 8 for erecting the Star Theater and office building. Architects, Hook & Sawyer, Charlotte, N. C.; A. N. Wood, Treas.

Owatonna, Minn.—The Burlington, Cedar Rapids & Northern R. R. Co. is reported to be preparing plans for a depot, to cost about $35,000. Robt. Williams, Gen. Supt., Cedar Rapids, Ia.

DWELLINGS.

Chicago, Ill.—Wilson & Marshall, 218 La Salle St., are stated to be preparing plans for a 4-story apartment house to be erected on Cottage Grove Ave. and 39th St., to cost about $100,000.

Chas. W. Van Keuren, 167 Dearborn St., is stated to have prepared plans for a 3-story apartment house, to be erected on Jackson Ave. and 46th St., for J. M. Longenecker, to cost $20,000.

Boston, Mass.—Plans have been approved for the erection of a block of 6 dwellings, on Bay State road, near Ashby St.; each to be 4 stories, brick with stone trimmings; estimated cost, $60,000; owner, Luther M. Merrill; Architect, G. W. Lewis, 6 Beacon St.

Akron, O.—O. W. Baum, 533 E. Buchtel Ave., is stated to have purchased a site on Forge and Union Sts. for the erection of a 3-story brick flat, to cost about $50,000.

East Boston, Mass.—Plans have been filed by Architect A. B. Pinkham, 36 A, Warren St., Roxbury, of a 3-story brick store and 4-family building, on Harold St. Owner J. Boleman, Roxbury. Estimated cost, $13,000.

New York, N. Y.—Architects Harde & Short, 3 W. 29th St., have filed plans for a 6-story tenement house to be erected on Ave. A and 78th St., for the City & Suburban Homes Co., to cost about $180,000. It will contain apartments for 186 families.

Kansas City, Mo.—J. B. Stone is about to build a $10,000 brick dwelling at 1003 S. Locust St.

SCHOOLS.

Chanute, Kan.—It is stated that a $25,000 school will be erected here.

Butte, Mont.—The Board of School Trustees of School District No. 1, Silver Bow Co., at a meeting July 23 discussed requirements for 3 new schools soon to be erected for the "Walkerville," "Meaderville" and "Parrott" portions of the district. The buildings contemplated will cost from $8,000 to $15,000 each.

Laprairie, Que.—The Convent of the Congregation of Notre Dame, at Laprairie, is stated to have been destroyed by fire July 27.

Somerville, Mass.—It is proposed to erect a 12-room school on Maple St.

Flint, Mich.—W. T. Cooper & Son, of Saginaw, have prepared plans for additions to the Deaf & Dumb School.

Fitchburg, Mass.—Henry M. Francis, Wallace Bldg., has prepared plans for an $18,000 brick school to be built by the city on Salem and Providence Sts.

Franklin, Pa.—City Clk. E. Jeunet writes that it was voted on July 25 to issue $60,000 bonds for the erection of a high school.

Southboro, Mass.—Winslow & Bigelow, of Boston, have prepared plans for a 3-story brick addition to St. Marks' School, 82 x 34. Cost about $30,000.

Rochester, N. Y.—Thos. W. Finucane, 3 Elton Pl., is stated to have received the contract for erecting a high school for $175,000.

Escanaba, Mich.—The citizens are stated to have voted to issue $25,000 bonds for school building purposes.

Keyser, W. Va.—Wm. A. Liller, of Keyser, is stated to have received the contract for erecting a building here for the West Virginia University, for $34,860.

Greenville, O.—Bids are wanted Aug. 10 for the erection of a school in Sub-district No. 6, in Brown Township. R. P. Vernier, Township Clk.

Delphi, Ind.—Bids are wanted Aug. 8 for the erection of a school in Tippecanoe Township. W. V. Vander Volgen, Trustee.

Indianapolis, Ind.—Bids are wanted Aug. 16 for a steam heating plant in school No. 45. John E. Cleland, Bus. Dir.

Stillwater, Okla. Ter.—Bids are wanted Sept. 2 for the construction of the Engineering and Library buildings, also a barn at the Oklahoma Agricultural & Mechanical College.

Jacksonville, Fla.—Bids are wanted Aug. 10 for the erection of a public school, estimated to cost $30,000. D. U. Fletcher, Chmn. Bd. Educ.

Syracuse, N. Y.—Bids are wanted Aug. 5 for $50,000 school bonds. E. F. Allen, City Treas.

Flint, Mich.—Bids are wanted Sept. 10 for the erection of an addition to the dining room and kitchen at the Michigan School for the Deaf at Flint. F. D. Clarke, Supt.

Cleveland, O.—Separate bids are wanted Aug. 26 for ventilating and heating two schools, one in Orchard St., the other in Milford St. Thos. H. Bell, School Dir., Rose Bldg.

Houston, Tex.—See "Sewerage and Sewage Disposal."

Pine Bluff, Ark.—Architects Mann & Gibb, of Little Rock, are about to let contracts for the construction of a convent. Estimated cost, $20,000.

Dubuque, Ia.—Bids are wanted Aug. 16 by the Board of Education, T. C. Murphy, Secy., for building the Fulton School. Estimated cost, $12,000. F. Heer & Son, of Dubuque, architects.

Milwaukee, Wis.—Bids are wanted Aug. 10 for erecting a school on Linwood Ave. and Bartlett St. Chas. J. Poetsch, Chmn. Commrs. Pub. Wks.

McKeesport, Pa.—The plans of W. F. Wilson, of McKeesport, are stated to have been accepted for a 16-room school, to be erected on Atlantic Ave.

Oshkosh, Wis.—Bids are wanted Aug. 9 for a ventilating and heating plant for the new high school. Frank Monahan, Chmn. Bd. Pub. Wks.

Boston, Mass.—The following bids for *a* building, an addition to the Bigelow grammar school, So. Boston, and *b* to furnish iron work for posts, rails, gates, etc., were opened July 29 by the School Board's Committee on New Buildings: Mack & Moore, *a* $38,500, *b* $7,000; Conners Bros. (awarded), *a* $34,400, *b* $5,400; W. H. Keyes & Co., *a* $37,850, *b* $5,500; Morrill & Whiton Construction Co., *a* $37,000, *b* $6,500.

Jersey City, N. J.—Contracts for erecting the primary school on Claremont and Rose Sts. are stated to have been awarded as follows: Mason work, Chas. Kenderly, $23,992; carpenter work, Barron & Donaldson, $13,668; ventilating and heating, Baldwin Engineering Co., 107 W. 17th St., N. Y. City; plumbing, Fergus T. Kelehar, 751 Montgomery St., $4,695.

STREET CLEANING AND GARBAGE DISPOSAL.

Mt. Vernon, N. Y.—The Mayor and the Committee on Water and Sewers will visit and inspect various garbage and sewage disposal plants.

Kalamazoo, Mich.—The proposition to borrow $5,000 for the construction of a garbage crematory, is under consideration.

Houghton, Mich.—Chris. Fox, Chmn. of the Bd. of Health, writes that a garbage crematory will be built as soon as a site is found.

Calcutta, India.—Bids are wanted by Fred. Gainsford, Secy. to the Corporation of Calcutta, until Dec. 31, 1901, for erecting, maintaining and operating for a period of 3 years, two incinerators capable of destroying 200 tons per day of street refuse, etc.

New York, N. Y.—Bids will be received at the office of Dept. of Street Cleaning, 13 Park Row, Aug. 9 for 1,200 iron cans for the use of this department.

Rome, Ga.—The City Council has under consideration the question of securing a garbage crematory.

Canton, O.—The City Council has decided to issue $20,000 bonds for the purchase of land and the building of a garbage plant.

Salt Lake City, Utah.—Local press reports state that the Board of Public Works is about to receive bids for the erection of a garbage crematory.

Allentown, Pa.—The Council is stated to have asked bids for a garbage crematory.

New York, N. Y.—Bids were opened July 30 by P. E. Nagle, Commr. of Street Cleaning, for garbage and refuse disposal in the boroughs of Manhattan and Bronx, for the period of one yr. beginning Aug. 1. The daily amount handled in Manhattan is 450 tons, and McGill & Co., 128 E. 14th St., N. Y. City, bid $140,000 for the yr. and Jas. J. Barrett, 584 Bergen St., B'klyn, $120,000. For Bronx, the estimated quantities are: Garbage, 22 tons daily average (43 tons, maximum during August); rubbish, 19 tons (175 cu. yds.) daily average (23 tons during May and June). McGill & Co. bid $30,000 for the year.

As reported in this column on June 29, bids were received on June 27 for this work on a 5-yr. basis. The rejection of these has been reconsidered and the award of the garbage-disposal contract has been made for Manhattan to the N. Y. Sanitary Utilization Co., 30 Burling Slip, at the rate of $232,000 per year.

GOVERNMENT WORK.

Ft. Hancock, N. J.—Bids are wanted at the U. S. Engineer Office, New York, until Aug. 15, for furnishing cement and broken stone at Ft. Hancock, as advertised in The Engineering Record.

Portland, Me.—Bids are wanted at the U. S. Engineer Office until Aug. 26 for placing stone on outer slope of breakwater at Rockland Harbor, as advertised in The Engineering Record.

Cleveland, O.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 22 for furnishing and installing a new boiler plant for the U. S. Marine Hospital, Cleveland, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Aug. 13 for two steel trussed covered ways in the east courts of the building for the Library of Congress, as advertised in The Engineering Record.

St. Cloud, Minn.—Bids are wanted at the Treasury Dept., Washington, D. C., until Sept. 4, for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post-Office at St. Cloud, as advertised in The Engineering Record.

Elgin, Ill.—Bids are wanted at the Treasury Dept., Washington, D. C., until Aug. 20 for the installation of a conduit and wiring system at the U. S. Post-Office, Elgin, as advertised in The Engineering Record.

Chicago, Ill.—Bids are wanted at the U. S. Engineer Office, Sept. 3, for constructing four miles or less of western section of Illinois and Mississippi Canal, as advertised in The Engineering Record.

Bremerton, Wash.—Bids are wanted Aug. 31 for a brick building 50 x 150 ft., for carpenter shop, at the Naval Station, Bremerton. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Algiers, La.—Bids are wanted Aug. 31 for four brick and steel buildings, 276 x 60, 224 x 60, 87 x 40 and 40 x 60. Plans and specifications can be seen at the Navy Yard, New York. Mordecai T. Endicott, Cr. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Portsmouth, N. H.—Bids are wanted Aug. 24 for two brick and steel buildings 275 x 60 and 37 x 35 at the Portsmouth Navy Yard. Appropriation, $98,000. Mordecai T. Endicott, Ch. of the Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Washington, D. C.—Bids are wanted Aug. 15 for constructing a conduit for electric cables between the Old Post-Office Dept. building and the Pension office building. E. A. Hitchcock, Sec'y Dept. of Interior.

National Soliders' Home, Va.—Bids are wanted Aug. 20 for repairs to breakwater and construction of sea wall at Southern Beach, National Home, D. V. S. Wm. Thompson, Treas.

Fisherman's Island, Va.—Bids are wanted Aug. 9 for a crematory at Cape Charles Quarantine Station. Jas. Knox Taylor, Supervising Archt., Treasury Dept., Washington, D. C.

New Jersey.—Press reports state that the following recommendations have been made by the United States engineer in charge of New Jersey River improvements for work for the coming year. Passaic River, $45,000 for dredging and maintaining present channel below Centre St. bridge, Newark. Improvement of channel between Staten Island and New Jersey, $30,000. Raritan River, $40,000, to widen channel. South River, $25,000, for dredging channel. Shrewsbury River, $75,562.

Philadelphia, Pa.—Bids are wanted Aug. 27 for supplying certain hydraulic machinery; also annealing furnaces and accessories for large caliber cartridge shops to be erected at the Frankford arsenal. Major Frank Heath, Commanding.

New Orleans, La.—The following bids were opened at the Treasury Dept., Washington, D. C., July 31, for the installation of an elevator plant in the U. S. Custom House at New Orleans: Howard Foundry & Machine Wks., Philadelphia, $28,056; alternate bid, $24,762; Otis Elevator Works, New York, $18,460; alternate bid, $15,430.

Norfolk, Va.—Bids were opened July 24 at the United States Engineer Office for furnishing about $20,000 worth of cement, etc., for improvements to the fortifications at Fortress Monroe. The lowest bidders were: For cement, Virginia Portland Cement Co., Philadelphia, at $1.40 per bbl.; for broken stone, McClennahan Granite Co., of Fort Deposit, Md., at $1.58 per cu. yd.; for the steel beams, etc., B. Wallis & Co., Baltimore, Md.

MISCELLANEOUS.

Baltimore, Md.—Bids are wanted Aug. 7 for constructing a stone and timber bulkhead at Cable St. Thos. G. Hayes, Pres. Bd. of Awards. N. H. Hutton, Harbor Engr.

Albany, N. Y.—Bids are wanted Aug. 5 for raising and completing high dam on Oswego River in Oswego County; for raising and completing Oswego dam, Oswego, and for raising and completing Minetto dam on Oswego River. John N. Partridge, Supt. of Pub. Wks.

Des Moines, Ia.—Bids are wanted Aug. 8 for furnishing material and constructing retaining walls along both banks of the Des Moines River from Court Ave. to Locust St. Sidney A. Foster, Pres. Bd. of Park Commrs.

Sault Ste. Marie, Mich.—Joseph Ripley, superintending Engr., is quoted as having stated that proposed improvements to the American canal at Sault Ste. Marie will cost $9,000,000.

Syracuse, N. Y.—Bids are wanted by the City Treasurer Aug. 12 for the purchase of Round Top Park bonds to the amount of $25,000.

Glen Ridge, N. J.—At a recent election a vote was taken in favor of issuing $35,000 bonds for the purchase of property for park purposes.

Philadelphia, Pa.—Local press reports state that part of the $250,000 appropriated by Councils for the improvement of navigation will be expended in dredging Tinicum Island Shoel to a depth of 26 ft. at mean low tide, and that the remainder of the sum will be used in Schuylkill River.

NEW INDUSTRIAL PLANTS.

The Herzog Art Furniture Co., Saginaw, W. S., Mich., will erect a 2-story and basement, 140 x 55-ft. factory, with a 56 x 40-ft. boiler and engine room and two 60 x 20-ft. dry kilns, to be equipped with a 100-H.-P. boiler and an engine of about 75 H.-P.

The Dunlap Vehicle Co., Pontiac, Mich., contemplates building an addition, for which plans have not been completed.

The Harnett Lumber Co., Manchester, N. C., has been incorporated with a capital of $150,000, and will want to buy or lease ten miles of 40 or 45-lb. steel rail, relaying rail preferred, and also buy two 75-H.-P. boilers, a 50 and a 75-H.-P. engine, a 25,000 to 30,000 ft. sawmill, shafting and other machinery for manufacturing lumber. W. F. Williams, Pres.

The Reliance Electric Co., 206 to 222 South Water St., Milwaukee, Wis., has leased a large factory building, in which it will install machinery for making dynamos and motors.

The Lima, O., Locomotive & Machine Co. contemplates building an addition to its plant.

The Salina, Kan., Mill & Elevator Co. will rebuild its elevator, recently burned, as soon as possible.

The Kentwood, La., Ice Mfg. & Bottling Wks., Ltd., will erect a 15 or 20-ton ice factory to replace one recently burned.

The Denver, Colo., Wire & Iron Works Co. will erect a new plant consisting of the following main buildings: Foundry, ornamental iron and wire works, plating, bridge and machine shops. Electricity will probably be used for power. The company will be glad to receive catalogues of machinery.

The Summitville, Tenn., Lime Co. has under construction a 600-bush. lime plant and will install a crushing plant for ballast, flux stone, etc.

The Schuylerville, N. Y., Paper Co. is being organized with a capital of $250,000 by J. A. Dix, I. C. Blandy, A. W. Hitchcock and D. A. Bullard, of Schuylerville, and Thompson Smith, of Albany. It is proposed to erect a 3-story and basement, 400 x 80-ft. brick building, with a large boiler and engine house and offices.

The West Disinfecting Co., 26 East 59th St., New York City, will erect a chemical building and a mechanical factory in Long Island City, installing an engine of about 25 H.-P., a boiler of about 30 H.-P. and an electric light plant.

The Consumers' Ice Co., Hopkinsville, Ky., will erect a 12 to 15-ton ice plant.

The Northern Electrical Mfg. Co., Madison, Wis., will enlarge its shops to double their present capacity. The extensions will amount to $100,000.

Wilcox, Crittenden & Co., Middletown, Conn., makers of marine hardware, will build a 4-story, 65 x 225-ft., brick addition to their plant, to be equipped with elevators and electricity for power and light.

The Canton, O., Pole & Shaft Co. will build a brick factory at Flint, Mich., to cost $20,000. Malcomson & Higginbotham, Detroit, are the architects.

BUSINESS NOTES.

The Ellington Mfg. Co., Quincy, Ill., is to take over the business of the Cornell Machine Co., of Chicago, and will continue to make gas and gasoline engines, coal, ore and gravel handling machinery, and conduct a large foundry for malleable and gray iron. The company expects within 60 days to be in its new quarters at Quincy, and will double its capacity. The officers of the company are: W. T. Dwire, Pres.; H. T. Asbury, Sec'y and Treas.; L. J. Highland, Sales Mgr.; T. C. Kennedy, Supt. and Mgr.

The Ball Engine Co., Erie, Pa., reports the following recent installations of engines: A 100-H.-P. engine for electric service for the Iowa Gold Mining & Milling Co., Silverton, Colo., ordered through Duncan Bond, Denver representative; two 80-H.-P. engines direct-connected to Crocker-Wheeler generators for the Washington County Court House, Washington, Pa., ordered through Dravo, Doyle & Co., Pittsburg representatives; an engine for testing purposes for the University of Kansas, Lawrence, Kan., ordered through C. A. Burton, Kansas City representative, and a 125-H.-P. engine for the electric plant of the Colorado Ice & Storage Co., Denver.

The Sprague Electric Co. has recently closed an order for three 500-Kw. generators to be direct connected to gas engines, utilizing the waste gases from coke ovens. They will be installed in the new works of the Lackawanna Iron & Steel Co., at Buffalo. The generators are of the Lundell split-pole type, and are designed for a continuous overload of 25 per cent. The engine speed is 100 r.p.m.

The American Woolen Co. has been so well pleased with the economy of, together with the entire absence of repair to, the 1,500-H.-P. Green economizer it has had at its Washington Mills for several years, that it has decided to extend the use of the apparatus to 4,500 H.-P. additional boilers, the contract for which was placed last week with the Boston office of the Green Fuel Economizer Co.

Stamsen & Blome, Unity Bldg., Chicago, report having been awarded numerous important contracts during the month of July, and are at work in twelve cities outside of Chicago. They recently completed 80,000 ft. of cement sidewalks at Birmingham, Ala., and have been awarded contract for 120,000 ft. at Kewanee, Ill., 168,000 ft. at La Porte, Ind., 160,000 ft. at La Grange, Ill., 60,000 ft. at Wyoming, Ill., 30,000 ft. at Neponset, Ill. Also the concrete and asphalt work of the new Chicago Tribune Building; the concrete fire-proofing of the large Great Western R. R. freight house; the concrete work and concrete fire-proofing of St. Anne's Hospital; the concrete work of the Lessing Apartments, all of Chicago, and a large concrete reservoir at Hammond, Ind.

The Osborn Engineering Co., Osborn Bldg., Cleveland, O., is preparing plans for a new power installation for the Kilbourne & Jacobs Mfg. Co., Columbus, O. Electric transmission of power will be used; total installation 1,000 H.-P. Boilers and engines have already been purchased. The buildings will be of brick and steel construction.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Aug. 5.	Valves, etc., Albany, N. Y.	Aug. 3
Aug 6.	Filter plant Reading, Pa Adv., Eng. Record, June 15 to 29, July 27.	June 15
Aug. 6.	Dam, Centralia, Ill	July 13
Aug. 6.	Wells, etc Sharpsburg, Pa	Aug. 3
Aug. 7.	Lewes Del	Aug. 3
Aug. 7.	Pipe laying, Pittsburg, Pa.	Aug. 3
Aug. 7.	Brookings, S. D	July 27
Aug. 7.	Saugerties, N Y	July 27
Aug. 7.	Binghamton, N. Y	July 27
Aug. 8.	Reservoir, Newark N. J Adv., Eng. Record, July 20 to Aug. 3.	July 20
Aug. 8.	Moline, Ill	Aug. 3
Aug. 8.	Ft. Greble, R. I.	Aug. 3
Aug. 9.	Solon, Ia	Aug. 3
Aug. 12.	Park River, N. D	July 27
Aug. 12.	Raising dam, Glens Falls, N. Y. Adv. Eng. Record, Aug. 3.	Aug. 3
Aug. 13.	Excav. at reservoir, Waterbury, Conn Adv., Eng. Record July 27, Aug. 3.	July 27
Aug. 14	Tower, Redwood Falls, Minn	Aug. 3
Aug. 14	Mains National Military Home, Kan.	Aug. 3
Aug. 14.	West Springfield, Mass.	Aug. 3
Aug. 15.	Knox, Ind	July 27
Aug. 16.	Greenwood, Miss	July 27
Aug. 19.	Morton, Minn Adv., Eng. Record, Aug. 3.	Aug. 3
Aug. 23.	Lonaconing, Md	Aug. 3
Aug. 27.	Boston, Mass Adv., Eng. Record, Aug. 3.	Aug. 3
Aug. —.	Reservoir, Dauphin Pa.	May 4
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 10.	Plans Muskogee, Ind Ter Adv., Eng. Record, Aug. 3.	Aug. 3
Sept. 18.	Soerabaya, Java	July 20
Oct. 1.	Burlington, Ia Adv., Eng Record June 29.	June 29
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 5.	Webster City, Ia	Aug. 3
Aug. 5.	New Brighton, Pa	Aug. 3
Aug. 5.	Syracuse, N. Y	Aug. 3
Aug. 6	Binghamton, N. Y	July 27
Aug. 6.	Dunkirk, N. Y	July 27
Aug. 6.	Boston, Mass Adv., Eng. Record, July 27.	July 27
Aug. 6.	Columbia, Mo Adv., Eng. Record, July 27.	July 27
Aug. 6.	Waverly, Ia	Aug. 3
Aug. 6.	Hammond, Ind	Aug. 3
Aug 6	Davenport, Ia.	Aug. 3
Aug. 7.	Lewes, Del	Aug. 3
Aug. 7.	New Rochelle N. Y	July 27
Aug. 7.	Birmingham, Ala	July 13
Aug. 7.	Oshkosh, Wis	July 20
Aug. 7	Elkhart, Ind	July 20
Aug. 7.	New York, N. Y	July 27
Aug. 7.	Appleton, Wis	July 20
Aug. 9	Springfield, Mass	Aug 3
Aug. 10.	Visalia, Cal	June 22
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Some Features of Riveted Joints in Tension.

The rational design of riveted joints for tensile stresses has been well understood in its main features for many years. Its analytical basis has been most thoroughly studied and many tests of full-size joints have been made. Values for the ultimate unit resistance of the net sections of both main and splice plates, for the shearing resistance of the rivets and for the compression between the rivets and the walls of their holes have all been determined with fairly close approximation. The bending of the plates and rivets has been noted and its effects on the ultimate resistances already described have been recognized and allowed for in their empirical determinations. The effects of punching and reaming of rivet holes, both in the metal immediately adjacent to the holes and the "shortening" effect on the metal in the net section of the plate, have been well understood for many years. Indeed, so fully has the entire question of riveted joints been investigated that it may well be supposed to have been exhausted. At the same time further investigations may add to the data already attained or at least contribute by discussion to perhaps a more complete knowledge of the subject, especially if that discussion serve either to confirm conclusions already reached or to give a new phase to that which is already known.

In the "Journal" of the Western Society of Engineers for June of this year a paper on the "Effects of Splicing and Riveting," reprinted in part in this issue, by Mr. George S. Morison, M. Am. Soc. C. E., describes ultimate tests, made at Watertown, Mass., of four steel bars each 4 inches by ⅞ inch and 16 feet long, spliced by two bars 4 inches by ⅝ inch, and 4 feet 10 inches long, rivets being used in two of the bars and close-fitting turned bolts in the other two. These bars were tested to failure, the mean ultimate resistance of the spliced bar being 82 per cent. of that of the solid bars. The mean elastic limit of the one spliced bar reported was 88 per cent. of the mean of the solid bars. The ultimate resistance per square inch of the net section of the spliced bars was 6.4 per cent. greater than that of the solid bars, being due to the "shortening" effect of the rivet hole in the spliced bar. The yield point in the net section of the spliced bars was 12 per cent. greater than that in the solid bars. The curves of these tests showed that up to a unit stress of 26,000 pounds per square inch the apparent strains in all the bars were practically the same, but above the yield point and up to rupture the elongation of the spliced bars was sensibly less than that of the solid bar.

Mr. Morison concludes from these experiments that "On the basis of behavior under working stresses we should be justified in working the spliced bar up to the gross strain that we should put on a solid bar. On the basis of elastic limit we should be justified in working the spliced bar up to seven-eighths the gross strain we should put on a solid bar. On the basis of ultimate strength we should be justified in working the spliced bar up to nearly five-sixths the gross strain we should put on a solid bar. On the basis of net sections . . . we should be justified in working the spliced bar up to a unit stress from 6 to 11 per cent. greater than we should put on a solid bar."

These conclusions are based on a total of four tests of 4-inch bars. It must be observed that that number of tests of small bars furnishes a somewhat inadequate basis for much generalizing. The conditions of stress in the interior of a riveted joint are exceedingly complicated, indeed, far too complicated to admit of being accurately analyzed. Again, those conditions vary between wide limits for different proportions of joints. It is not impossible that a single rivet hole drilled in a wide plate may make the ultimate resistance of that plate greater than that which the solid plate would possess. With the 4-inch bars tested by Mr. Morison the conditions of stress would be vastly different in the riveted joint from those which would exist in a wider plate with a much larger number of rivets and any conclusion expressed in percentages for the one case almost certainly would not hold for the other. Further than that, although the strains in Mr. Morison's solid and spliced bars were apparently the same up to the unit stress of 26,000 pounds per square inch, the actual conditions of both stress and strain were radically different in the two cases. The solid bars carried comparatively uniform stresses throughout their lengths. In the riveted joints, on the other hand, the state of stress was greatly complicated, intensities in some portions of the joint being far above and in other portions far below those in the solid bar. These actual stress conditions should not be overlooked in drawing conclusions as to the relative working loads to be imposed upon spliced and unspliced bars, especially in view of the fact already indicated that the relative conditions vary widely with the varying proportions of joints.

Although it is sometimes stated that a filled rivet hole in a tensile joint will add to the resistance of the net section it is difficult to assign any valid reason for the statement. Tensile stress above the elastic limit will, by the contraction of the metal in the net section, draw that metal away from the rivet or rivets, the presence of the latter, therefore, having no sensible influence in either direction. Neither this feature nor others of this particular set of tests of joints enable any new conclusions regarding riveted joints to be formulated. These experiments constitute a small but interesting addition to empirical data, although they are too few in number to enable us to reach any generalizations without co-ordinating them with the results of numerous others of a similar character which have hitherto been made.

Consistently with the last observation, it is scarcely justifiable to conclude from these results that plate girders may rationally be designed by the moment of inertia formula, using the gross section of web and tension flange but making an arbitrary compensation for tension metal taken out in rivet holes by a decreased working stress. The conditions of stress in the net tension web and flange metal of a plate girder is far more complicated than in the simple spliced joints tested by Mr. Morison; the secondary stresses are considerably greater and it is neither rational nor correct to use metal section which does not exist in determining the moment of inertia. Doubtless this method of designing plate girders may be and is employed with a sufficient degree of approximation for all practical cases, but it certainly is neither more rational nor more advisable than that which makes use of the actual flange sections as independent members, either with or without allowing one-sixth of the web area as available for the flanges.

The Appraisal of the Gloucester Water-Works.

The appraisal of the property of the Gloucester, Mass., Water Supply Company was one of the most interesting judicial acts, from an engineering point of view, performed in the Commonwealth in recent years. The commissioners were E. C. Bumpus, Esq., a specialist in water-works laws, and Messrs. John R. Freeman and John W. Ellis, who need no introduction to readers of this journal. The company was owned mainly by the late George H. Norman, who gave the fund for the Norman medal of the American Society of Civil Engineers. He retained as expert witnesses Messrs. J. Herbert Shedd, Charles A. Allen and William Wheeler, while the city retained Messrs. J. J. R. Croes, Rudolph Hering, George A. Kimball, Percy M. Blake and Desmond FitzGerald. The hearing was prolonged, and both legal and engineering experts testified at great length. The commissioners finally awarded the company $600,000 and interest from the time of the taking of the plant by the city, as explained at length in The Engineering Record of August 19, 1899. The company opposed the decree, and the Supreme Judicial Court of the Commonwealth has just handed down a decision on the petition, 60 N. E. Rep. 977, which is of much importance to engineers engaged in appraisals of water plants.

The first important part of the decision concerns the method of valuing three reservoirs. Two of these were the sources of the company's water supply when its property was transferred to the city. The water which feeds them was obtained by excavating two swamps and damming their outlets. No brook flowed into either swamp in its natural state and the water collected in the reservoirs comes from the watersheds directly. In the descriptions of the swamps filed by the company in the registry of deeds it is stated that "the above land or real estate has been taken for forming and erecting dams, reservoirs, to take and hold water for the purposes above set forth, and such other use and purpose as may be necessary and may be authorized by said act." The court holds that this is a valid taking of the water which gathers in the reservoirs. Where land is taken for a reservoir "to take and hold water," all water which gathers in the reservoir from springs or by percolation, none of which flows into the basin from a stream, is also impliedly taken. In such a case the requirements of an adverse taking of the water under the right of eminent domain are complied with. On this account the court rules that the water company is entitled to the value of the water which gathers in these two basins.

The case is not the same, however, with the third pond. The company purchased the mill privilege in the waters of this pond and supplied the city temporarily from this source while its permanent works were under construction. After the plant was completed the use of this pond was abandoned and no supply was afterward obtained from it. The commissioners awarded the company $20,000 as the value of the water in this pond for domestic purposes, but this award is set aside by the court, which rules that such an equivocal act as the temporary use of water for less than a year, which use is then abandoned and has never since been resumed, is not a legal taking of the water as against a person who has rights in the water in question and who did not elect to treat it as a taking of it. The mill privilege, however, is held to be an asset, which was properly taken into consideration by the commissioners, for it is of value as a step toward the ownership of the waters of the pond as an auxiliary supply.

The main feature of the decision, however, relates to the valuation of the company's business as a going enterprise, and is particularly important because the Massachusetts laws forbid commissioners to take into consideration either franchises or future earning capacity. This portion of the decision is reprinted herewith without change:

It will be convenient to consider the defendant's contention that the commissioners had no right to award the $75,000 allowed by them in addition to the cost of reproduction of the water company's plant, less depreciation, in connection with the water company's contention that evidence of past earnings of the water company should have been admitted in evidence. The act under which the award was made (St. 1895, c. 451) is an act enabling the city of Gloucester to "supply itself and its inhabitants with water." By section 16 of that act that right is made conditional on its (the city's) purchasing the property of the water company in case the water company elects to sell its property to the city. In case the city agrees to buy the water company's property under an offer from the water company made under the provisions of that section, it is provided that "said city shall pay to said company the fair value thereof;" "such value shall be estimated without enhancement on account of future earning capacity or future good will, or on account of the franchise of said company." In determining the true construction of these provisions of section 16, it is important to bear in mind the purpose which the legislature had in asking the right of the city to supply itself with water, conditional on its buying the company's property in case the company elected to sell it to the city, and in providing that, in ascertaining the "fair value" of that property it should not be enhanced "on account of either future earning capacity or future good will, or on account of the franchise of said company."

On the one hand, it is plain that a private water company, organized for net profits, cannot hope to compete with a city, which can rely upon taxes to supply a deficit in operating expenses. For that reason it is also plain that, if the legislature had not required the city to buy the water company's property, the company's property would have been practically, though not legally, confiscated. No doubt, therefore, can arise as to the reasons for the insertion of the clause in section 16 providing that the value shall not be enhanced "on account of the franchise of said company." The franchise of the Gloucester Water Supply Company was not an exclusive franchise. The grant of a similar franchise to the city of Gloucester to supply itself and its inhabitants with water was not a violation of the franchise rights of the Gloucester Water Supply Company. And finally, the sale to the city was not obligatory on the water company. The company was given the option of selling its property to the city, or of going on in competition with the city, under the act in question. Under these circumstances it is plain that the value of the company's property which the city is compelled to buy ought not to be enhanced "on account of the franchise of said company."

It is also plain, so long as a water company has no competitor in supplying a town or city with water, that it is practically in the enjoyment of an exclusive franchise, although its franchise is not legally an exclusive one. For that reason, the earnings of this company were not evidence of the "fair value" of this property. The earnings of a company which is in the enjoyment of what is practically an exclusive franchise are not a fair criterion of the "fair value" of the property, apart from an exclusive franchise. For that reason we are of the opinion that the evidence of past earnings offered by the water company was properly excluded. Newburyport Water Co. v. City of Newburyport, 168 Mass. 541, 47 N. E. 533. It is argued by the petitioner that the admissibility of such evidence derives support from St. 1891, c. 370, section 12, which provides that, in determining the "fair market value" of a gas or electric plant under similar circumstances, "the earning capacity of such plant, based upon the actual earnings being derived from such use at the time of the final vote of such city or town to establish a plant," is to be included "as an element of value;" but this clause as to the earning capacity being considered as an element of value was omitted from the act in question. The only doubt as to the propriety of the allowance of a sum in addition to the cost of duplication, less depreciation, of the water company's plant, is whether the principles on which the commissioners proceeded were sufficiently favorable to the water company.

It is plain that the real commercial market value of the property of the water company is, or may be, in fact, greater than "the cost of reproduction, less depreciation, of the different features of the physical plant." Take, for example, a manufacturing plant. Suppose one manufacturing plant has been established for some ten years, and is doing a good business, and is sold as a going concern. It will sell for more on the market than a similar plant reproduced physically would sell for immediately on its completion, before it had acquired any business. National Water-works of New York v. Kansas City, 10 C. C. A. 653, 62 Fed. 853, 27 U. S. App. 165. We think it is plain that there is nothing in the provisions of section 16 of the act in question (St. 1895, c. 451) forbidding the commissioners considering this element of value, which, as we have seen, in fact exists. The provisions of the act are that the "fair value" "shall be estimated without enhancement on account of future earning capacity or future good will, or on account of the franchise of said company." Whether that would allow present earning capacity and present good will, apart from the franchise, to be taken into account, as distinguished from future earning capacity and future good will, need not be considered.

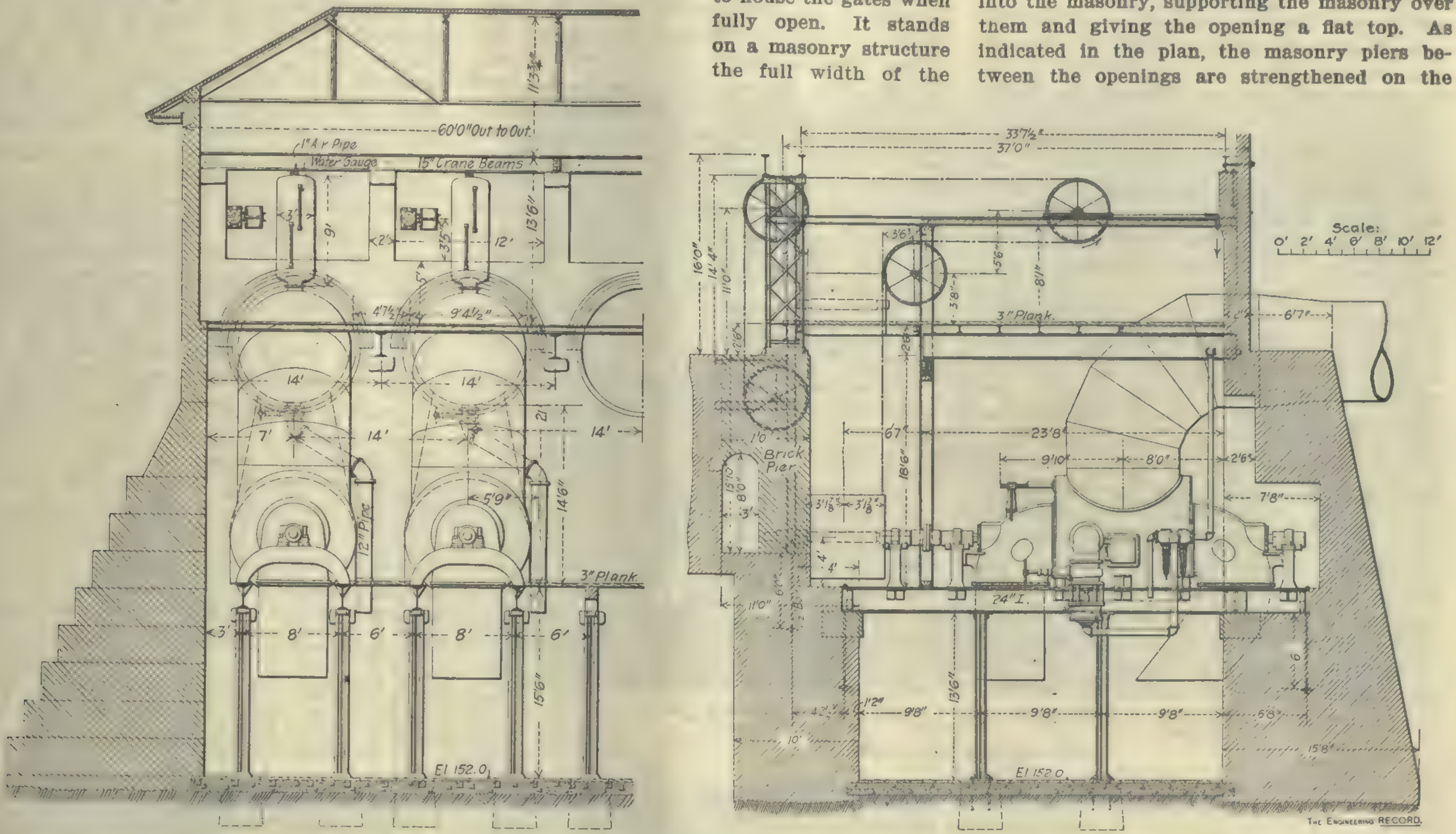
It is plain that the element of value which comes from the fact that the property is sold as a going concern, in which case it has, or may have, in fact, a greater market value than the same property reproduced in its physical features, is not excluded from consideration by that provision of the statute. It is also plain that the commissioners, in allowing the $75,000 allowed by them in addition to the cost of reproduction, less depreciation, of the plant in its physical features, did not go beyond this. They state that, in their opinion, "the cost of duplication, less depreciation, of the different features of the physical plant, . . . does not represent a fair valuation of this plant, welded together, not only fit and prepared to do business, but having brought that business into such a condition that there is an ennanced value created thereby, so that the city, in purchasing it, without considering its income or right to do business, but having the power to carry it on on its own account, should pay more for the property as such than as if this consideration did not obtain. This is a valuation that we have found to be $75,000, that has been imported into the plant, which seems to us as much a part of the property valuation as any other part of it."

The Water-Power Plant of the Empire State Power Company.

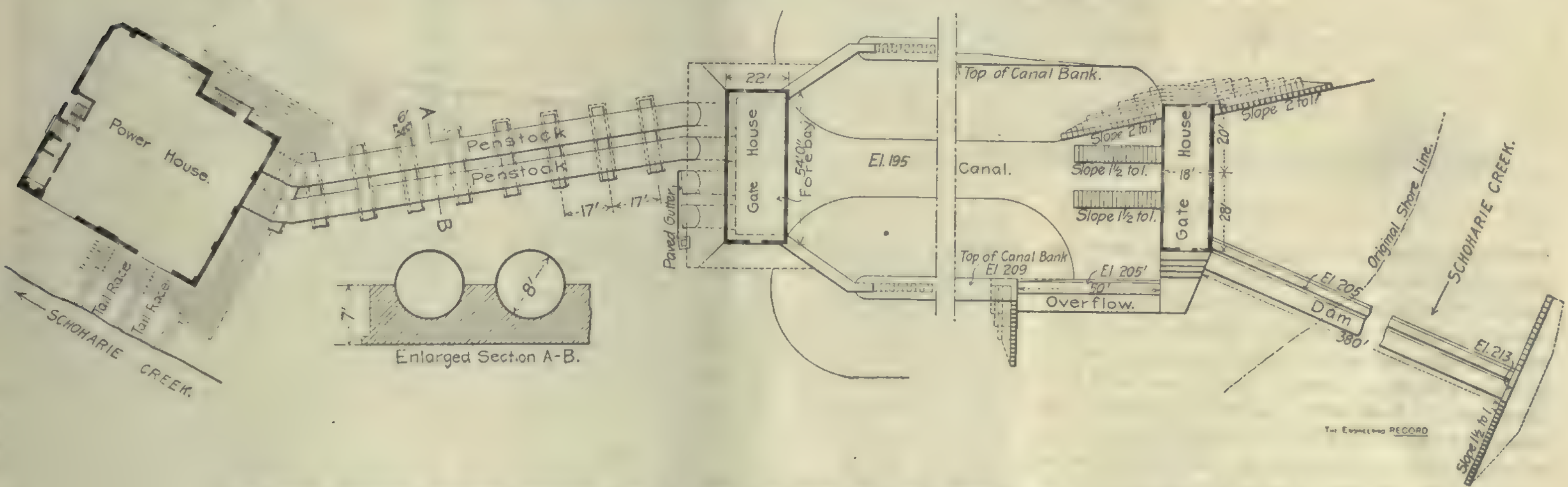
The Empire State Power Company is a corporation of Amsterdam, N. Y., which owns land and water rights along Schoharie Creek for a distance of about 15 miles that can be utilized for water-power developments. The total fall of the river along the first seven miles of the properties is 320 feet and it is along these points that the power plants, of which five are projected, are to be located. The rest of the distance, or eight miles, it is intended to use for storage reservoirs. One of these plants, known as No. 3, has already been built, and has a present installation of 3,000 horse-power in a fall of 44 feet. The development is of the type in which the water is carried from the dam through a long open canal and then through large and comparatively short penstocks to the power-house.

The creek has a watershed covering an area of about 1,000 square miles; it rises in the Catskill Mountains and is about 70 miles long, flowing through four counties, and emptying into the Mohawk River, of which it is the largest tributary. The yield of the stream was variously estimated by different engineers, among them Mr. Wallace C. Johnson, of Niagara Falls, Mr. W. R. Hill, of New York, Mr. Campbell W. Adams, of Utica, and Mr. George W. Rafter, of Rochester, and as a result, the average minimum flow during dry seasons was taken as 30,000 cubic feet per minute. During extraordinarily dry seasons, however, it is felt that reservoirs must be utilized to insure such flow. The company has in contemplation a storage reservoir, near Gilboa, which, it is estimated, will have a capacity of about 800,000,000 cubic feet impounded by a dam 140 feet in height. The reservoir, which would insure a flow of 30,000 cubic feet per minute during dry seasons, would make the total calculated minimum output of the five projected plants 9,515 horse-power. With the addition of other storage, the flow can be increased to 600 cubic feet per second, according to Mr. F. J. Lempe, and if a market can be found for intermittent power, and machinery is installed and waterways made sufficiently large for the ultimate use of 1,000 cubic feet per second, 17,386 horse-power can be developed.

The general development of the No. 3 site is indicated in a map of the plant, which, however, does not show the bend that the canal has in its course. There is a long, low dam from one end of which starts the canal. The operating gear of the gates at the head of the canal are sheltered in a gate house and an overflow is located in the canal side at that point. The forebay at the end of the canal is similarly provided with a gate house, in which are controlled the gates of the penstocks. Provision is made for four penstocks, each 8 feet in diameter. The elevation of the dam spillway crest is 205 feet, the elevation of the center line of the penstocks at the forebay about 187.5 feet, that of the penstocks entering the power-house 186.5 feet, that of the turbine shafts 171.5 feet, and the bottom of the tail-water pit, 152 feet. Allowing the head of water at the end of the canal, or forebay, to be at the 204-foot elevation, there will thus be a difference between the bottom of the tail-water pit and the water-level in the canal of 52 feet, which, with an allowance for 8 feet of water back-up in the river below the power-house, makes a useful head of 44 feet.



SECTIONAL ELEVATIONS OF THE HYDRAULIC PORTION OF THE POWER-HOUSE.



WATER POWER DEVELOPMENT NO. 3, THE EMPIRE STATE POWER CO., AMSTERDAM, N. Y.

WALLACE C. JOHNSON, DESIGNING ENGINEER; ROBERT B. SMITH, CHIEF ENGINEER AND SUPERINTENDENT.

The dam is about 13 feet high and 380 feet long, and extends perpendicularly from one bank, along which there is a wing wall above and below the dam, to a mass of masonry between which and the other bank the gate house and head works are located. The dam is founded on the rock bed of the stream and is composed of a concrete center, containing large boulders, and masonry faces laid in regular courses, the upstream face vertical and the downstream face stepped. The capstones are laid with an inclined top which gives the approaching water an upward slant of about 18 degrees. They are dowelled together and are anchored to the dam masonry by 1½-inch dowel pins, two for each stone, which is about 6 feet long; each pin was split at the bottom, fitted with a small wedge and driven in place through the top three courses, and the space around it filled with liquid cement. A heavy log structure was built on the wet side of the dam for guarding it against ice.

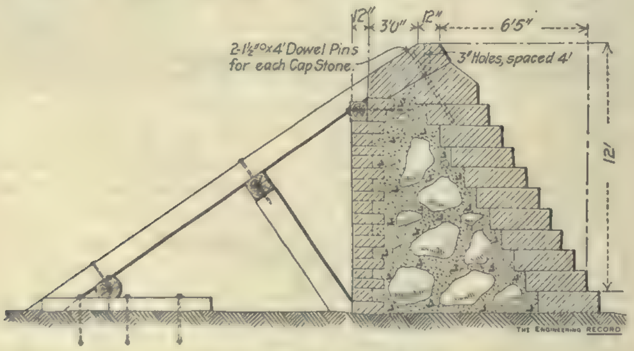
The gate house is a brick building with a frame roof, 18 x 52 feet in plan, and high enough to house the gates when fully open. It stands on a masonry structure the full width of the building, through which there are three main openings, two 10 feet wide and the other 6 feet. The bottom of the canal is 10 feet below the dam crest and the gates have a vertical lift at full opening of 12 feet. They are operated by a 20-inch wheel set in an independent chamber and discharging into the stream below the dam. The wheel is on a vertical axis and drives by means of bevel gearing a horizontal shaft supported overhead in the gate house. From this two belts are carried to the lifting mechanism of each gate, one belt crossed, so that the gates can be readily raised or lowered. Each gate is lifted by two screws by means of bevel and spur gearing from the driven pulley. The reduction in speed from the wheel to the lifting screws is 0.0225 to 1, so that with a speed of the turbine of about 350 revolutions the screw would turn at the rate of only 8 revolutions per minute.

The gates are made up of 10 x 12-inch oak timbers, held together and bolted between bands of iron ½ inch thick and 8 inches wide. The openings controlled by the gates and through which the water enters the canal are bridged over on top by oak timbers, these imbedded into the masonry, supporting the masonry over them and giving the opening a flat top. As indicated in the plan, the masonry piers between the openings are strengthened on the canal side by stepped buttresses, and the shore above and below the gate house is protected with wing walls, as is also the canal bank at the end of the overflow. The overflow is also provided with gates, which are operated by hand, to afford an outlet for surplus water, the crest of the overflow being 2 feet below the top of the full opening at the gate house.

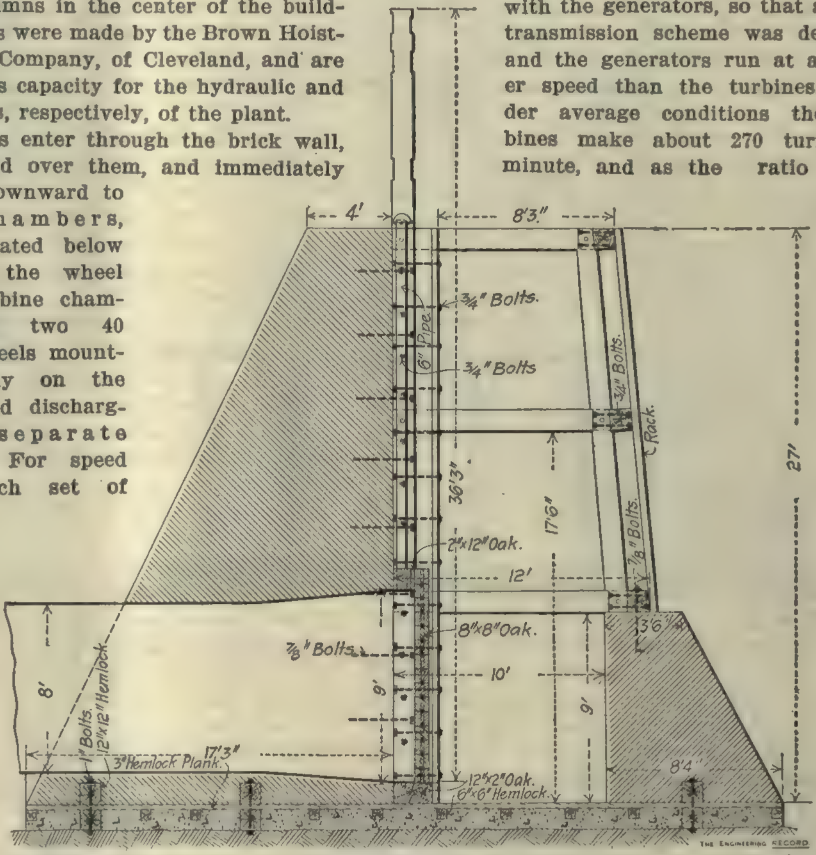
The canal is about 3,550 feet long and is of a trapezoidal section, with a width for the greater part of 20 feet and slopes of ½ foot to 1 foot horizontal. At a point about 1,500 feet from the forebay its bottom begins a slope which amounts to about 0.22 feet per 1,000 feet, bringing the bottom, there 6.4 feet wide, at an elevation of

191.61 feet. With the canal full to the level of the overflow, the cross-section of water is 400 square feet, so that at the forebay for the equivalent cross-section, the water is 12.64 feet deep; that is, with a water-level of 204.25 feet. For about 1,000 feet from the gate house the canal was almost wholly excavated, while for the rest of the distance the embankment was built with the material excavated. The canal walls are puddled for a vertical distance of 10 feet, besides having more or less of a clay puddle core extending half into the dense clay, to which the original earth was stripped before starting the embankment. The made embankment at the forebay is about 8 feet wide on top, 63 feet across at the bottom, and about 16 feet deep at the center, making a cross-section of about 560 square feet.

The forebay, at which the canal ends, is formed into a rectangular basin 9 feet deeper than the canal and about 48 feet wide. Its walls are built of concrete founded on a flooring of 3-inch hemlock laid on timbers in a concrete bed 12 inches thick; it has rubble-masonry faces, the faces inside vertical, while those outside are sloped about 1 foot in 2. The water enters the forebay proper through a rack of the usual construction, that is, narrow iron bars spaced closely together and inclined slightly, for intercepting rubbish, and the water then drops below the canal level to enter the mouths of the turbines, two of which are at present in place. The canal thus ends at a retaining wall over which the water flows down to the penstocks, and on which is supported the main members of the rack structure. The mouth of each penstock is 9 feet in diameter and is controlled by a timber gate of 8 x 8-inch oak. From the level of water in the canal to the bottom of the forebay is about 22 feet, but the penstocks are filled through an iron wicket gate in the main gate, and the main gates are accordingly operated by hand by means of screws, spur and bevel gearing. The lifting mechanism in this case is also enclosed in the gate house which is built over the forebay. The house is 54 feet long and 22 feet wide, and has a timber roof truss and shingle roof. The base of the forebay masonry wall has two rows of 4-inch porous tile, which were laid dry, and which drain to a pit emptied by a 10-inch sewer pipe leading to the tail race.



CROSS-SECTION OF THE DAM.



SECTION THROUGH FOREBAY.

The penstocks are 8 feet in diameter and about 140 feet long. As already stated, they are carried almost horizontally to the power-house, the pitch being 1 foot in the total length. Each penstock feeds a pair of turbines which drive a 900-kilowatt alternator. Allowing 1,500 horse-power, for overload and loss in transmission from turbine to generator, and 75 per cent. efficiency in the conversion of the water-power, 400 cubic feet will be required each second with a head of 44 feet. There would, therefore, be a velocity in the 8-foot penstocks of about 8 feet per second and in the canal to pass 800 cubic feet per second, a velocity of 2 feet per second, the area, as already calculated, being 400 square feet. The penstocks were made by Struthers, Wells & Company, of Warren, Pa., and are carried on masonry piers built up around them to the level of their center, spaced on 17-foot centers.

The power-house is a brick building with a wooden shingle roof on an iron frame. It is carried down below the ground surface about as far as it extends above it, in massive foundations of rubble-masonry concrete, faced on the exposed surface with brickwork. All arches are turned with brick. Its floor area is divided into two parts, one a few feet above the other. On one of these are disposed the electric machines, while on the other is the hydraulic machinery, this part at the higher level. Both extend the length of the building, 66 feet, and are about 24 and 36 feet wide for the electric and hydraulic portions, respectively; each portion is spanned by a hand-operated traveling crane mounted on I-beams, which are supported on buttresses along the building walls and on latticed columns in the center of the building. The cranes were made by the Brown Hoisting Machinery Company, of Cleveland, and are of 8 and 16 tons capacity for the hydraulic and electric portions, respectively, of the plant.

The penstocks enter through the brick wall, which is arched over them, and immediately take a turn downward to the turbine chambers, which are located below the floor in the wheel pit. Each turbine chamber contains two 40 inch Leffel wheels mounted horizontally on the same shaft and discharging through separate draft tubes. For speed regulation each set of turbines is governed by a Lombard governor, but for purposes of increasing the effectiveness of this mechanism, which, it will be remembered, is used in connection with a nearly horizontal penstock, a Lombard water-balanced relief valve was fitted to each wheel chamber. This is attached to a 24-inch outlet from the wheelcase containing a 24-inch Chapman valve normally open. Whenever the pressure within the chamber tends to increase, due to the closure of the gate, with decrease of load, the pressure acts on a piston in the relief valve, which is balanced for average static pressure, and the piston gives a vent for the water to pass through the outlet and maintain a constant velocity through the penstocks until the load reaches the average again. The valve is arranged to be set to open under different conditions, so as to meet the average loads at different times; and to maintain the static head or pressure on the under side of the piston before the valve closure has had a chance to affect the pressure throughout, a pipe from this side of the valve is run backward inside the penstock to a point near the penstock mouth, supported on brackets on the inside. The valves discharge directly into the tail race below, the turbines being carried on I-beams which span the tail race. One of the accompanying drawings shows an air chamber on the top of each wheel chamber which was designed to prevent the collapse of the penstock with sudden drawing of water; but this was replaced by a balanced collapsing valve because the open 6-inch pipe shown at the mouth of each penstock at the forebay and intended for this purpose, was not provided, and the air tank was not considered sufficient of itself. These collapsing valves are to insure against the penstocks flattening and are also for quick work in emptying or filling the penstocks at any time the water is drawn off for repairs. Each wheel chamber has the usual emptying pipe, which discharges into the tail race. The bearings for the turbine shaft are mounted on a sort of arched I-beam casting fastened to cast-iron shoes clutching the upper part of the main supporting I-beams.

The location of the wheels at the low level made it impossible to effect direct connection with the generators, so that a rope-transmission scheme was designed and the generators run at a higher speed than the turbines. Under average conditions the turbines make about 270 turns per minute, and as the ratio of the diameters of the driving and driven drums of the rope drive is 80 to 60, the generators run at 360 revolutions per minute. Each drum is 6 feet 3 inches wide and contains 30 grooves for 1¼-inch rope. The sheaves for the tightening arrangement are shown, the traveling sheave moving in a horizontal position and the weight rising and falling near the wall. The ropes are of 4-strand cotton, and for lubrication a mixture of castor oil, unbleached Japanese wax, graphite and ivory black is used.

The electric end of the plant is equipped with the Stanley S. K. C. system, employing three-phase high-tension alternators, which deliver through the switchboards to the transmission lines without the use of transformers. The Stanley inductor generators are of 900 kilowatts capacity, giving alternating current at 7,200 alternations and 12,000 volts. The alternator foundations consist of a large block of concrete 5 feet thick, to which is anchored a double set of 8 x 10-inch timbers arranged in the form of a hollow square and carrying a floor of three layers of 2 x 4-inch planking. The switchboard occupies one corner of the station, taking half of the side along which are the offices of the operating plant, separated from the switchboard by the entrance stairhall. The switchboard consists of 16 panels, 9 for the generators, being one for each phase of three generators, thus providing for a third machine, three panels for each of two transmission lines, and the last, or sixteenth, for the exciters.

Each group of generator panels has a voltmeter for the field current, with regulating rheostat below it, and the flanking panels have each an ammeter, one for alternating current in one leg of the generator, and the other for direct current, indicating the amount of current used for the excitation of the field. The feeder panels for the transmission line are fitted with an ammeter in each leg of the circuit of sufficient capacity for both machines, and below these ammeters are located the ground detectors, two of these instruments serving for the three-phase line. On the back of the board at these points are recording wattmeters. On account of the high voltage directly operated with, the switches or plugs are placed at the upper part of the board, each separated from its neighbors by slabs of marble projecting forward from the switchboard face; and the plugs are pulled out by a long pole, taken in the hand, by which the operator can lengthen out the arc in the air until it collapses. There are at present two exciters, 75-volt 50-kilowatt generators made by the Eddy Electric Manufacturing Company, and driven at 875 revolutions per minute by belt from the generator shafts. The exciter panel contains two ammeters and two rheostats, one for each machine, and one voltmeter. Each exciter is connected independently to a pair of bus bars by a two-pole switch, and when it is desired to connect the two pairs of bus bars together a three-pole switch is used, the third leg serving to connect together the exciter equalizing connections.

Turbine Governors, Rope Drive Casings and Exciters.
(Main generators in background.)

The Generators and Switchboard.

The transmission lines are carried in opposite directions from the plant, one to Howes Cave, where considerable of the power is taken by the Helderberg Cement Company's plant, and the other to Amsterdam. Passing from the building the wires are taken through a room outside the power-house, where lightning arresters are connected with them. The wires are carried overland on porcelain insulators, spaced in triangular formation, 23 inches apart, with the apex of the triangle uppermost. The poles are 30 feet long, planted 5 feet in the ground, and are set at intervals of 100 feet. The total distance to Howes Cave, measured along the surface of the ground, is 98,392 feet; and to Amsterdam, 33,644 feet. Telephone wires are carried on the poles about 15 feet above the ground, crossed every fourth pole, or 400 feet.

The president and general manager of the power company is Mr. J. George Kaelber. The general scheme of the development was designed by Mr. Wallace C. Johnson, of Niagara Falls, N. Y., and the work was done under his supervision until the fall of 1899. The construction was started in the summer of 1899, and the canal and forebay were practically finished and the dam and the excavation for the power-house commenced late that year, when Mr. E. F. Van Hoesen was employed as chief engineer. By March, 1900, Mr. Johnson suffered a severe attack of illness and had to give up the work altogether, and Mr. Van Hoesen was given entire charge of the work. Subsequently Mr. Van Hoesen re-entered the railroad engineering field and the plant has since been under the charge of Mr. Robert B. Smith, as chief engineer and superintendent. Messrs. McDonough & Cunningham, of Sandy Hill, N. Y., were the contractors for the dam and power-house, and Messrs. McKagey & Linehan, of the same place, for the canal and forebay.

Rebuilding Pier No. 4 of the Aqueduct Bridge, Georgetown, D. C.

The Aqueduct bridge was built in 1835 to 1840, to carry the Chesapeake & Ohio Canal across the Potomac River at Georgetown, D. C. In 1887, the superstructure having been removed, the substructure was used to support a United States highway bridge of nine 114-foot Pratt truss deck spans and one through span. The piers were in water up to 25 feet or more in depth, and were built of very irregular uncoursed rubble masonry made of Potomac River blue gneiss rock, quarried in the vicinity. They were built in cofferdams, but the foundations were not in all cases carried down to the solid rock, which was from 20 to 35 feet below the low-water level and covered with 15 to 18 feet of mud and sand. The cofferdams were built of double rows of sheet piling with clay puddle filled in between, and were braced by interior transverse horizontal timbers, some of which were built permanently into the masonry.

After a very high freshet in 1889 it was discovered that the river bottom had been badly scoured and that most of the piers were undermined and had settled, tipped, or cracked, and extensive repairs were made on them, as described in The Engineering Record of December 27, 1890. The cavities were filled with loose concrete and with concrete in bags laid by divers, and farther settlement of the piers was arrested. A vertical crack extending from the bottom half-way to the top of pier 4 was observed, and the masonry was banded with an iron strap, tightened with turnbuckles, and a long girder was set on top of the pier to receive the ends of the bridge trusses.

In 1893 several of the piers were found to be in a dangerous condition and a contract for repairing them was made with the Shailer & Schniglau Company, of Chicago. The smaller cavities were filled with bags of two-thirds of a cubic foot capacity, which were half-filled with Portland cement concrete and packed in place by divers. The concrete was mixed on a lighter, and was made with one part each of cement, sand and 1-inch stone, and two parts of 2-inch stone. The bags were flattened and bonded together like courses of stone masonry and were packed in the cavities as tightly as possible and protected by riprap. After the concrete set the bags adhered tightly together.

At the fourth pier from the south end of the bridge a large timber raft was carefully moored in successive fixed positions and soundings 2 feet apart in both directions were taken from it. Holes were left in the raft in which the sounding rod, 36 feet long with a ¾-inch iron tip and a graduated wooden top, was inserted. At the downstream end of the pier the rock was covered with clay from the old cofferdam and was 20 feet below the low-water level. At the upstream end it was covered by 5 to 10 feet of sand and mud and was 31 feet below the low-water level. On the sides of the pier it was bare and had many irregular holes and projections. The pier was 7.4 feet wide and 42.5 feet long under the coping, with semicircular ends and a batter of 1 to 12 on the sides. It had a granite cutwater and was 30 feet high above low water.

The pier was enclosed by timber cribs forming a double rectangle, 70 x 120 feet outside and 34 x 84 feet inside. The cribs were uniformly 18 feet wide and were 34 and 40 feet long, built of Georgia pine timber from 6 x 12 to 12 x 12 inches in cross section. The lower courses were carefully dressed to fit the profiles made from the soundings, and the cribs were built several courses high on shore, launched, towed to position, fastened together by long timbers, and the sides built up as continuous walls. Alternate courses had longitudinal and transverse struts 9 and 10 feet apart, which divided the crib into sixty pockets, about thirty of which had plank walls and floors and were partly filled with riprap stone with which the crib was sunk in place, its walls being carried up 6 feet above low water.

Wakefield piles, made of three thicknesses of 2-inch planks, were spiked to the outside of the crib and except at the downstream end, where it was difficult to penetrate the clay, were driven to the rock. From 6 to 8 feet of gravel and clay was placed around the outside of the cofferdam and pumping was commenced, the crib being braced against the masonry as the water was lowered. When the water had been pumped down about 12 feet, the top of the crib was forced in about 1½ feet on one side and large leaks were developed. These were repaired and the pumping continued until the water was down more than 19 feet below low water, when the sheet piling at one place broke and allowed the cofferdam to fill in ten minutes. At this point the crib had rested on several feet of mud which was washed out by leaks between the piles, and left the lower ends of the piles unsupported below the bottom of the crib so that they bent inwards and broke off. A second row of piles was driven over the broken ones, backed up with stone and covered in front with clay puddling, after which the cofferdam was pumped dry and easily kept so.

A 7 x 23½-foot wooden tower 23 feet high was built on the cofferdam at each side of the pier, with its long side transverse to the bridge axis and its top just above the pier coping. Under its sills the interstices between the crib timbers were blocked up solid, and the bearings were made as good as possible under the bottoms of the cribs. Two timber A-trusses 34 feet long and 17 feet deep on centers were set on top of the towers, parallel to and directly under the roadway curbs. The trusses were connected by middle sway bracing and by a lateral system in the plane of the bottom chords, and their members were made in pairs to clear the bridge trusses and the vertical post supporting the roadway platform over the center of the pier. This post was carried by an oak beam passed through it near the top and suspended by vertical bolts from the truss caps. The end lower-chord pins of the bridge trusses were suspended from the tops of the falsework trusses by pairs of vertical U-bolts with nut bearings on the oak apex blocks. The trusses were calculated for 160-ton center loads, and their inclined top chords had 400 square inches of sectional area for a calculated compression of 260,000 pounds. All timber was southern pine, and the bottom chords had a gross area of 288 and a net area of 216 square inches for a calculated tension of 203,000 pounds per square inch. Before the cofferdam was pumped out the overhanging pier masonry was shored up by divers and the U-bolts were screwed up to transfer a large portion of the live and dead bridge load from the pier to the falsework.

The bottom course of the pier masonry was found to have been in a horizontal plane, carried down to bed-rock at the downstream end, but at the upstream end resting above it on mud and sand 3 or 4 feet deep except under the toe of the cutwater, where the depth was about 10 feet. About 12 feet of the upstream end of the pier was undermined and a large amount of the lower part of the pier masonry and cutwater had fallen into the cavity and been partly washed away, leaving the bottom of the overhanging portion about 19 feet above the surface of the bare rock. A small interior cofferdam was built around the upper end of the pier and excavation was carried down inside it to the depression in the bed-rock, 31 feet below the low-water level. The rock was levelled and the cofferdam filled with 7 feet of concrete on which a new breakwater was built and bonded into the old pier masonry. Cavities 3 or 4 feet deep, extending under both sides of the pier for almost the whole length, were filled with rubble masonry and the repairs were suspended for lack of farther appropriation. The cofferdam was purchased by the Government and maintained in position for use in future repairs, although it was allowed to fill up by leakage.

In 1897 a contract was let to the Houston Construction Company, of Philadelphia, for rebuilding all the pier except the new part at the upstream end. The weight of the superstructure was again transferred to the falsework towers and trusses, and 14 feet of the upper part of the masonry had been removed when, in consequence of the Spanish-American war, it was necessary to carry a large amount of military traffic between Washington and Virginia across the bridge and it was deemed inadvisable to leave the spans supported on falsework. Temporary rubble masonry in Portland cement mortar was therefore carried up to the coping to replace that which had been removed, and the superstructure was transferred to bearings on it.

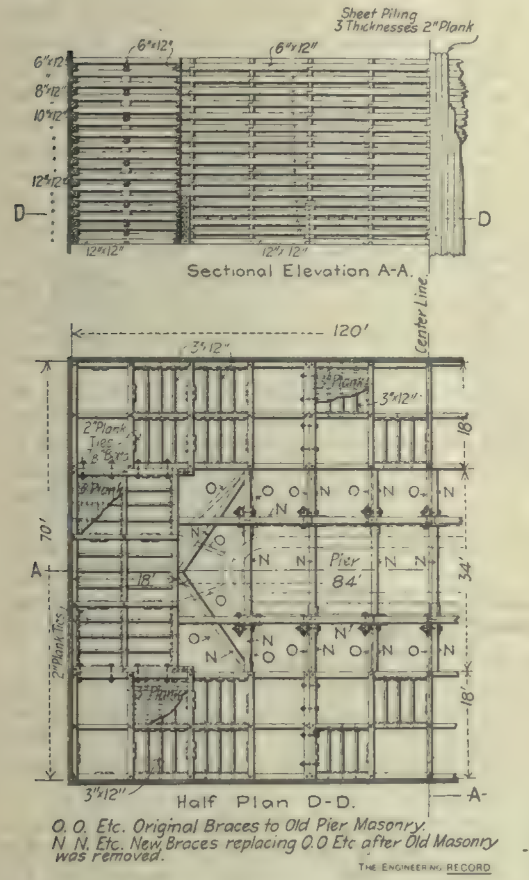
In May, 1899, a new contract for rebuilding the pier was awarded to the Central Contracting Company, New York, which acquired the right to operate a quarry near Chain Bridge for the stone required for the new masonry. The stone is very hard and brittle and, having no regular line of cleavage, proved to be very difficult to cut. An average force of 35 men worked eight hours a day for six months to cut 235 cubic yards and as this amount of stone exhausted the quarry, the remaining 230 yards which were needed were purchased from that provided for the work by the previous contractor. The cost of quarrying and cutting this stone was fully three times as great is it would have been to deliver on the work an equal amount of cut granite from Maine. On account of the irregular cleavage, fully two-thirds of the stone quarried was destroyed in cutting, and a large percentage of the remainder was rejected or recut, because of the presence of seams and veins characteristic of the gneiss specified.

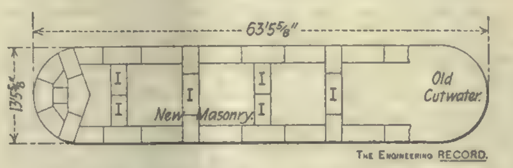
In April, 1900, the requisite amount of stone having been secured with great difficulty, preparations were commenced to pump out the old cofferdam. Repairs were made on the cribs, sheet piling and false work trusses, but when the pumps were started, many leaks were discovered. These proved to be so numerous and troublesome that it would probably have been quicker and cheaper in the end to have built a new cofferdam, or at least to have driven a complete new set of sheet piling at once. The bottom of the crib and its walls were examined by a diver who patched up many leaks, and a large amount of ashes and cinders was dumped around the outside of the cribs and proved very effective in filling bottom leaks. Where leaks were discovered in the pile joints, vertical troughs made of a 10-inch plank and two fillers from 1 to 2 inches thick, were spiked on the outside over the joint and filled with ashes, rammed hard with a gas pipe. Eventually these patches were applied to a large proportion of the joints. Difficulty was experienced in locating the leaks where the piles were of double thickness, but some indications of their positions were obtained by boring holes through the inside piles and noting the flow through them.

At low tide the water had an average depth of 23 feet, the mean tide was 3 feet, making a maximum head of over 28 feet, and as the current was at times swift, the work was difficult. Pumping was commenced with two 8-inch centrifugal pumps, one 6-inch single Blake pump, and one 5-inch duplex Snow pump, but their combined discharge was inadequate to lower the water in the cofferdam more than 15 or 20 feet. The leakage increased very rapidly as the inside pressure decreased, and a 12-inch Worthington duplex pump was added, all the suction pipes were run down into a well excavated in the upstream end of the cofferdam, and the cofferdam was pumped out in eight hours by the Worthington, Blake, and one centrifugal pump working together. As the work progressed, the leaks were so much reduced that the water could be kept out by one 8-inch centrifugal pump working less than three-fourths of the time.

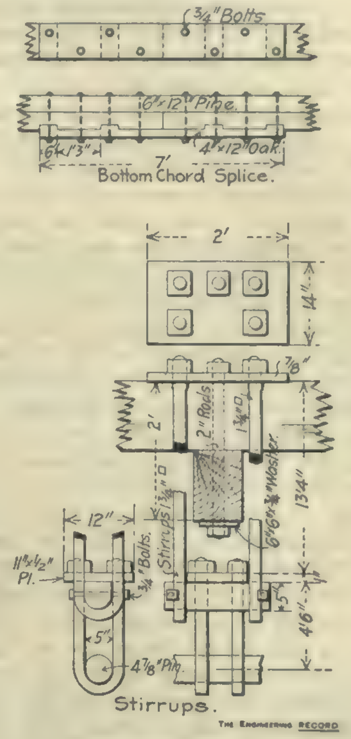
It was found impracticable to lift the ends of the spans by screwing up the nuts on the tops of the suspenders at the apex of each falsework truss, so they were lifted by hydraulic jacks and then the nuts followed up tight. Barriers were built in the roadway to restrict the traffic over the pier to a narrow space in the middle of the bridge and the old masonry was removed by derricks set on the cribs on both sides of the bridge. The previous contractors had braced the sides of the cribs to the masonry with four tiers of horizontal struts set by divers. These were wedged up before the water was pumped out, and as fast as they were displaced by the removal of the old masonry they were replaced by braces reaching from side to side of the cofferdam, each made in two pieces with the joints staggered in the horizontal and vertical rows. There were eight tiers of both longitudinal and transverse braces in a height of 28 feet from the bottom of the cofferdam, those in the middle being only a little more than 2 feet apart in the clear. The braces were 8 x 8, 10 x 10, 12 x 12 and 12 x 14 inches in cross-section, increasing in size from the top down. They were bolted together at intersections and butt joints were made on the centers of intersections and spliced with pairs of side planks spiked on, the tiers of braces being separated and supported by vertical posts bolted to both sets at intersections. These posts just stood on the projecting pier footing, and when that was removed, were carried by inclined braces from the sides of the cribs.

The stability of the dam was determined graphically and analytically, and the following data were determined: Volume of timber in dam, 430,000 feet, board measure; weight in water of timber, minus 878,009 pounds; approximate weight in water of stone ballast in cofferdam, 1,974,375 pounds; weight of cofferdam and ballast in excess of weight required to sink it, 1,096,366 pounds; moment of stability of section of cofferdam braced by one vertical row of transverse braces, 308,358 foot-pounds; overturning moment of water pressure on same section, 3,093,214 foot-pounds; resultant moment, 2,784,856 foot-pounds; net pressure, equals resultant moment divided by one-third head, 270,374 pounds. No allowance was made for the stiffness of the side and ends of the cofferdam, acting as girders, nor for the weight of the falsework and superstructure. From these data the net compression in each brace was computed. The braces were considered as columns 16½ feet long, and being figured with a factor of safety of from 6 to 9, the fiber strains per square inch were computed to vary from 143 to 479 pounds, for 8 x 8, 8 x 8, 8 x 10, 8 x 10, 8 x 12, 8 x 12, 10 x 12 and 10 x 12-inch timbers in the sucessive tiers from the top down. At the request of the Government engineers these sizes were increased to the dimensions before stated, corresponding approximately to a factor of safety of 10.

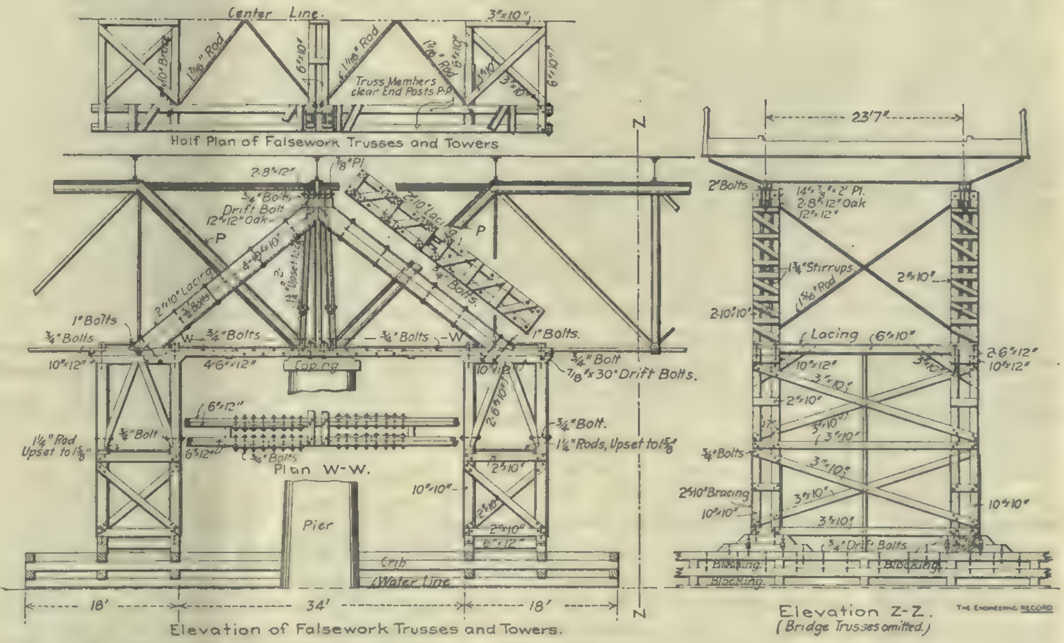




Arrangement of Interior Headers.



Falsework Details.



FALSEWORK, CRIB AND BRACING, AQUEDUCT BRIDGE, GEORGETOWN, D. C.

All of the old pier masonry was removed and was found to have been built on riprap deposited on the mud above the surface of the rock, and for a height of 12 feet was of poor quality with but few traces of mortar. The surface of the rock was found rough at the downstream end of the pier and smooth at the upstream end, and at the upper end was covered with about 4 feet of sand and gravel. It was all sound and hard, without springs, and, after the projecting points were cut off, was covered with rammed concrete 4 feet in minimum thickness.

Although the cofferdam was kept pumped out all the time it was impossible to prevent the leakage of a large quantity of water under the bottom, which flowed in a rapid stream over the sloping surface of the rock to the sump at the upstream end. Small sections of the bottom were enclosed by walls of sand bags and puddle, and were bailed out and kept dry until concreted. All the face stones in each course were dimensioned, numbered, and arranged to correspond with the accompanying plan, the downstream end being filled solid with cut stones in alternate courses only, and the upstream end being bonded into the granite masonary laid in 1895, which was left undisturbed. The heart of the pier was built of heavy rubble masonry. At every second or third course transverse struts were braced between the face stones and the inner walls of the cofferdam. These were spaced to bear, when possible, against the headers, and in order to prevent any thrust on the green heart masonry, the contractors were required to set opposite them sets of "interior headers," marked I, I, in the plan, which were cut stones with lead poured in their vertical end joints. The masonry was handled by a 40-foot boom derrick at each end of the cofferdam, and a force of about 30 men was employed about nine months on the pier and cofferdam.

After the masonry was completed and the cofferdam braces were removed there was no perceptible deflection of the sides of the cribs before the interior was filled with water, and after the ballast had all been removed from its pockets, the cofferdam failed to float. This makes its removal more difficult than was anticipated and it is intended to attach large scows to it at low tide, lift it free of the bottom and take it to pieces while suspended from them.

The bridge was built under the direction of Major Wm. Turnbull, U. S. Corps of Topographical Engineers. The repairs of 1889 were made under the direction of Mr. C. B. Hunt, M. Am. Soc. C. E., and those of 1894-5 were made under the direction of Major C. E. L. B. Davis, Corps of Engineers, U. S. A.; Mr. John B. Duncklee, principal assistant engineer, and Mr. L. R. Grabill, assistant engineer and inspector. The final repairs were made under the direction of Col. C. J. Allen, Corps of Engineers, U. S. A., with Mr. John Meigs as Government inspector.

The Sewerage System of Berlin, Germany, had 25,087 house connections in the city proper and 1,099 in the suburbs at the close of the fiscal year 1898-99. The system is on the radial system, the sewage being pumped from the various districts or sectors to seven tracts for its disposal by land treatment. One of these tracts, Buch, was not ready for use at the end of the fiscal year for which the figures are given. The sewage amounted to 30.9 gallons per capita daily while the average water supply of the city was only 20.6 gallons. The excess was due to rain, well and river water, and solids in the sewage, according to the report, which ignores the possibility of leakage into the sewers. The sediment removed from the sewers and sandpits amounted to 18,406 cubic yards.

The Latest Bill for Purchasing the London Water Companies' Plants.

Late last month a bill was introduced in Parliament aiming to purchase the property of the London water companies and consolidate its management in a single public authority. Although the most reliable reports on the chances of the bill's passage are all strongly negative, it is nevertheless interesting to note from the "Journal of Gas Lighting," the only paper received to date from London giving any account of the provisions of the bill, that the proposed terms for paying the companies for their property are liberal to a degree that will cause a shiver of horror in the marrow of those professional municipal traders who are telling the people of the United States that Great Britain knows how to deal with public utility services and corporations in the only right way.

Briefly stated, it is proposed to pay the holders of the stock and bonds of the existing companies in new water stock of a value which will assure them the same income they now receive. In case any of the present company stock is not yielding the full amount of dividends it is authorized to pay, the holders are to receive an additional sum to be fixed, in the absence of private agreement, by an arbitrator appointed by the president of the Institution of Civil Engineers. Every director of the various companies who has served three years or more, immediately before the transfer of the properties, is to receive a life annuity equal to his average salary or fees during the period of his service. All the present officers are to remain in service unless their positions are abolished by the new authority.

This new authority is to be called a Water Council and will consist of a chairman drawing a salary of £3,000; a vice-chairman at £1,500, a deputy chairman at £500 and sixty-eight members. All work, except the borrowing of money and the promotion of bills will, however, be in charge of an executive committee of ten, each paid £250. The duties of the new council embrace the improvement of the existing works, the extension of the constant supply system throughout the district, the making and enforcement of regulations to prevent waste, and the conveyance of water to, and distribution within, the district "without regard to the source whence it is derived."

The payment to the companies for their properties is to be made in new stock, as before stated, which will bear 3¼ per cent. interest. To provide funds for operating the plants until the water revenues begin to come in, the council is authorized to borrow £500,000 from the Bank of England, and £1,000,000 additional stock may be issued for any purpose to which capital is properly applicable. In case the revenues are insufficient to meet the fixed charges, the amount may be raised by contributions from the constituent authorities.

A Hydrant Gauge that is extensively used in London is described in a paper by Mr. E. S. Prentice published by the Institution of Civil Engineers. The new London hydrants are of the flush type and water is usually drawn from them through a portable standpipe coupled to the outlet. The upper end is bent over to discharge in a horizontal direction. The gauge consists of a pipe coupled to this horizontal branch of the standpipe and fitted near its outer end with a Pitot tube. The inlet to the tube is fixed at a point half the radius of the pipe from the shell, and the pressures are transmitted through a bent pipe to a Bourdon pressure gauge. The scale of the latter is graduated to show discharges as well as pressures, and a large number of experiments indicate that the readings are accurate within about 5 per cent.

A Very Heavy Rainfall occurred in New York on July 5. During 2 hours and 39 minutes the precipitation was 2.06 inches, and during one 5-minute period it was 0.38 inch. Serious damage was done in many places, the worst result being at a Brooklyn church. This had a flimsy two-brick side wall carried down perhaps 10 feet below the surface of a paved alley, about 15 feet wide, between it and the heavy wall of a schoolhouse. A small drain led the rainfall on the alley into the street sewer, but was totally inadequate to carry off the water on this occasion. The water passed into the earth below the alley through cracks between the paving and walls and possibly through the joints of the drain. In this way the earth became very soft and exerted such a pressure on the wall of the church that the latter burst into the basement for a length of about 50 feet.

Effect of Different Methods of Molding Upon the Strength of Cement.

A paper by Prof. Ira O. Baker in the "Technograph."

It is well known that there is a considerable variation in the tensile strength of any particular cement mortar as obtained by different observers. Part of this variation is inevitable. The strength of hydraulic cement depends so largely upon the details of the method of testing that undetected variations in manipulation will make an appreciable difference in the results. Therefore it is important to eliminate as far as possible any variation in the method of testing the cement.

The amount of water used in mixing the test specimen materially affects the strength obtained; but recently it has become the practice in reporting results of experiments to state the percentage of water used, which practically eliminates this source of error. Of course different cements require different amounts of water according to the variation in composition, fineness, freshness, etc.; but a statement of the amount of water employed shows the condition under which the particular cement was tested.

The quality of the sand employed has a very marked influence upon the strength, but for some time it has been the custom of careful experimenters to employ only standard sand, either German natural sand or artificially crushed quartz having a standard degree of fineness.

The amount of force employed in pressing the mortar into the molds also has a very marked influence. Ordinarily the mortar is pressed in by hands and it is impossible to describe the intensity of the force employed. To eliminate this source of error, it has long been the practice in Continental Europe, particularly in Germany, to use an automatic machine in compacting the mortar in the briquette mold. In this country another machine for the same purpose has been lately put upon the market. The writer has recently made a series of experiments to compare these three methods of filling the molds. The results are stated in Table I. All the tests were made by Mr. O. L. Gearhart, a former student of the author, who spent practically all of his time during the three past working seasons testing cement. He is a careful, methodical, observing, conscientious experimenter. In several cases results obtained by him by hand molding in the ordinary course of business have been compared with those obtained by other operators, and apparently his results are fairly representative of the usual methods of hand molding.

Table I.—Effect of Different Methods of Molding on the Tensile Strength of Cement Mortar.

Method of Molding.	Neat Mortar with 16 2/3% of Water.			1 Part Cement to 3 Parts Standard German Sand with 6½% of Water			1 Part Cement to 3 Parts Standard Crushed Quartz with 6½% of Water.		
	1 day.	7 days.	30 days.	1 day.	7 days.	30 days.	1 day.	7 days.	30 days.
	Pounds per Square Inch								
Hand	258	342	470	74	104	225	63	92	213
Böhme Hammer	388	514	575	84	162	194	86	168	324
Olsen Press	232	312	563	33	68	90	50	92	132
	Relative Strengths in percentages								
Hand	67	67	82	89	64	116	73	55	66
Böhme Hammer	100	100	100	100	100	100	100	100	100
Olsen Press	61	61	98	39	42	47	58	55	42

The Böhme hammer is the standard German machine, and consists of an arrangement by which the mortar is compacted by 150 blows of a hammer weighing 2 kilogrammes upon a plunger sliding in a guide placed upon the mold.

The Olsen press consists of a plunger, driven by a screw and a hand wheel, working in a guide below the mold. The power applied is measured by a finger revolving in front of a graduated dial. The briquettes were molded under a pressure of 4,000 pounds applied to the broad side of the American Society of Civil Engineers form of briquette. The pressure was applied gradually to permit the air to escape, and was maintained at the maximum pressure, say, half a minute after the air ceased to escape. The escape of air is indicated by a gradual decrease of the pressure. The immediate purpose of the tests was to standardize this press. A pressure of 4,000 pounds was adopted as being a convenient number (equal to one revolution of the finger on the dial) and as being about as much as the machine would safely bear.

The cement was one that had been in the laboratory some months, and was supposed to be a representative Portland. The sand needs no description farther than stated in the table. The percentage of water employed for neat cement was that adopted by the operator as giving the plasticity usually employed by him, and is about an average of the quantity ordinarily used by him with other cements. The resulting mortar is not at all jelly-like, and water, or rather moisture, flushes to the surface only after vigorous troweling. The percentage of water for the mixture of sand and cement was chosen as giving apparently the same plasticity for the mixture as for the neat mortar.

Lines 4, 5 and 6 of the table are given to aid in studying the relative effects of the different methods of molding. The mean of the percentages in lines 4 and 6 for all ages is shown in Table II.

Table II.—Strength of Hand-Molded and Press-Molded Briquettes in percentages of the Strength of Hammer-Molded Briquettes.

Method.	Neat.	Sand.	Quartz.	All.
Hand	73	90	65	76
Press	73	43	25	73

From Table II. it appears that hand-molded and also press-molded briquettes are only about three-fourths as strong as hammer-molded briquettes. Table II. also shows that, for this operator, hand molding was substantially the same as press molding with a pressure of 4,000 pounds. Three months after making the above tests the same operator with another cement made a series of briquettes in which the strength of the hand-molded specimens was 78 per cent. as strong as those molded with the Böhme hammer apparatus. Apparently then this operator's personal equation with reference to the Böhme apparatus is 77 per cent., or in round numbers, three-fourths; and with reference to the Olsen press is 76 ÷ 73 = 104 per cent., or in round numbers unity.

The hammer apparatus gives the greater strength, but it requires a longer time to mold a briquette than by hand or with the press.

About 35 minutes are required to mold six briquettes with the Böhme hammer, 20 minutes with the Olsen press and 15 minutes by hand. The hand-made specimens were finished with the trowel on both sides; those from the press and the hammer were finished with the trowel only on the top. With a quick-setting cement there is danger with the hammer apparatus and also with the press, of encroaching upon the time of the initial set, before completing the last briquette of a set. The amount of skill required is practically the same in all three methods. There was not much, if any, difference in the uniformity of the results. This particular cement was rather quick-setting, and hence part of the variation with the hammer apparatus may have been due to an encroachment upon the time of initial set. However, in a later series with a slow-setting cement, the three methods of molding gave about equal variations.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXVIII, PARIS, BRIDGES OVER THE SEINE.

A general view of the City Island looking upstream, showing several of the Seine bridges, the first as mean a structure as one would expect to find in a mill village. The second, however, is the beautiful Pont Neuf, one of the best bridges in Europe. It was built in 1578–1604 and remodeled in 1852.

Effects of Splicing and Riveting.

Extracts from a paper by Mr. Geo. S. Morison before the Western Society of Engineers.

The three features which govern the use of steel or iron as structural materials are: The modulus of elasticity (for which it is better to substitute a coefficient of elongation), the elastic limit, and the ultimate strength. Of these, the first determines the behavior of the metal under proper working strains. The two latter determine the limit which must be put on such working strains, which may generally be taken at from one-third to two-thirds of the elastic limit, and from one-sixth to one-third of the ultimate strength. In tension members the passing of the elastic limit, or, more properly, of the yield point, represents such a distortion of the structure of which these members form a part as to be virtually its destruction. In compression members, a passing of the elastic limit usually means a distortion, which introduces rapidly accelerating tensile strains which soon destroy the member; the ultimate strength, which is not rupture but absolute crippling, being little above the observed elastic limit. There is evidence that repeated tensile strains below the elastic limit will gradually weaken the material; there is no evidence that compression, which tends to compact instead of loosen, has any similar effect. The yield point is generally higher in compression than in tension members, and structures would be more correctly proportioned if based on the yield point for both classes of strains. Furthermore, in the judgment of the writer, in short compression members, a less factor of safety can be used than in tension members. This means larger unit stresses in short compression members than in tension members. The writer believes that many important structures are loaded with unnecessary metal in compression members, and that stronger structures could be built with the same amount of metal if a portion were taken from the compression and placed in the tension members.

In compression members the ultimate crippling is determined by other than compressive strains, the actual stress in a member after it passes the elastic limit being of a complicated character. In a solid, unspliced tension member the strains are of the simplest character conceivable. As soon as splices and irregularities are introduced this simplicity disappears, and complications, whose effects can only be determined by experiment, are introduced. Any such features qualify the ability of the member to change its shape; the coefficient of elongation, the yield point, and the ultimate strength are dependent upon this ability to change shape. The primer of testing recognizes the need of a sufficiently long minimum section to allow the test specimen to draw down at point of fracture, a short minimum section giving much higher results than a long one, the difference increasing with the ductility of the metal. On this principle, a hole bored in a bar, while reducing its cross-section reduces its ultimate aggregate strength to some degree, but materially less than the reduction of the section; the opportunity for the bar to draw down at the point of fracture is reduced, but stretching would occur and be accompanied by an elongation of the hole; if the hole is filled with a rivet, resistance to the elongation of the hole is introduced and this would have some further effect. In the writer's practice a case occurred in which it seemed expedient to splice an adjustable tension member by riveting or bolting splice bars on each side. Fortunately the structure had been so proportioned that the unit stress on this member was very low; but before advising this method of splicing, it seemed best to make some actual tests on bars spliced in substantially the manner proposed.

Four bars of soft steel were constructed by the American Bridge Company at its Pencoyd works, two of which were solid bars and two of which were cut in the center and spliced. In both of the spliced bars the holes were reamed. In one of them the splices were riveted on, and in the other they were fastened with close fitting turned bolts. The bars were all made of the same steel. These four bars were all broken in the Government testing machine at the U. S. arsenal at Watertown, Mass., in January, 1901.

The solid bars broke in the body of the bar under strains averaging 56,915 pounds per square inch, one of them showing a total elongation of 14.7 per cent. and a reduction of area at fracture of 53.5 per cent., and the other a total elongation of 18 per cent. and a reduction of area at fracture of 54.7 per cent. Each of the spliced bars broke in the rivet or bolt hole nearest to one of the heads, and showed comparatively small elongation but a large reduction at point of fracture, the elongations being respectively 3.6 and 3.7 per cent., and the reductions 45.6 and 43.5 per cent. The metal showed signs of over-straining and had begun to draw down opposite the rivet or bolt at the other end of the splice. All this was to be expected, as the full strain was taken here on the section of the bar reduced by the hole. The net section of the riveted bar at the rivet holes, which were 0.94 inch in diameter, was 76.5 per cent. of the full section of the bar. The net section of the bolted bar at the bolt holes, which were 0.87 inch in diameter, was 78.25 per cent. of the full section of the bar.

The mean ultimate strength of the spliced bars was 46,870 pounds measured on the original section of the unspliced bar, or 82 per cent. of the mean ultimate strength of the solid bars. The mean elastic limit of the unspliced bars, according to the official reports, was 28,500 pounds, and that of the only spliced bar reported (the riveted bar) was 25,000 pounds, or 88 per cent. of that of the solid bars. A study of the elongations as plotted would seem to indicate that the yield point of the solid bars was practically 30,000 pounds and of the spliced bars 26,000 pounds, or 87 per cent. that of the solid. All unit stresses are referred to the original section of the bar without allowance for reduction by holes or increase by metal in splices. But the average section of the spliced bars at the hole where the fracture occurred was 23 per cent. less than that of the solid bar, so that the actual stress per square inch where the fracture occurred was 6.4 per cent. more in the spliced bar than in the solid bar. The yield point was about 12 per cent. greater. This result is in accordance with those obtained in testing short specimens of ductile metal as compared with specimens of sufficient length to allow full contraction to occur. On the other hand, the form of these test bars allowed a considerable contraction to occur at the rivet or bolt hole where they broke. These results are summarized in the following table:

		Stresses per Square Inch, lbs.				
Number.	Bar.	Ultimate.	Elastic Limit.	Yield Point.	Elongation	Reduction.
11,397	Solid	57,730	28,000	……	14.7%	53.5%
11,400	Solid	56,100	29,000	……	18	54.7
Q	Average	56,915	28,500	30,000	16.6	54.1
11,398	Riveted	45,640	25,000	……	3.6	45.6
11,399	Bolted	48,100	……	……	3.7	43.5
R	Average	46,870	25,000	26,000	3.6	44.5
11,398	Net Section	59,662	32,680	……	….	….
11,399	Net Section	61,472	……	……	….	….
S	Average	60,567	……	33,592	….	….
	R ÷ Q	82.2	87.7	86.7	….	….
	S ÷ Q	106.4	……	112	….	….

This table shows that the ultimate strength of the spliced bars was about 18 per cent. and the elastic limit about 12 per cent. less than that of the solid bars.

A study of the plotted elongations shows that below a stress of 26,000 pounds per square inch, the elongations of the riveted bar were a little less than that of the solid bars, this difference evidently being due to the relief in the center of the bar given by the increased section of the splices. On the other hand, the bolted bar shows a slightly greater elongation than the solid bars, this difference probably being due to the fact that the bolts, though tight, were not an absolute fit, and a slight movement took place around them. The bolts admitted of two motions on each side of the splice. The total difference of elongation between the riveted bar and the bolted bar under 20,000 pounds stress was 0.06 inch. This would have been explained by a play in the bolt holes of 0.15 inch.

A study of the plotted curves shows some instructive general results. Up to a 26,000-pound stress the action of all the bars was practically the same, and if we exclude the bolted bar, the action may be said to be identical. After passing the yield point the action of the bars was practically the same until an elongation of 2 inches, or 1.25 per cent. of the gauged length, was reached. Above this the elongation of the spliced bars was considerably less than that of the solid bars, the difference being due to the larger section of the spliced portion of the bar.

In spite of the reductions in the elastic limit and ultimate strength, the action of the spliced bars was identical with the unspliced bars under all stresses which would be considered within permissible working limits on an actual structure.

On the basis of behavior under working stresses we should be justified in working the spliced bar up to the gross strain that we should put on a solid bar. On the basis of elastic limit we should be justified in working the spliced bar up to seven-eighths the gross strain we should put on a solid bar. On the basis of ultimate strength we should be justified in working the spliced bar up to nearly five-sixths the gross strain we should put on a solid bar. On the basis of net sections, after deducting for rivet or bolt holes, we should be justified in working the spliced bar up to a unit stress from 6 to 11 per cent. greater than we should put on a solid bar.

A further general conclusion to be drawn is that in proportioning solid beams, like plate girders, it is more correct to use the gross section than the net section. Care should be taken so to arrange the rivet holes as to cut away the material as little as possible, and the limiting strain should be determined after a fair consideration of how much the actual section is reduced; but if the actual net section is reduced 10 per cent. by rivet holes, it is perfectly safe to reduce the permissible gross section strain only 5 per cent. The writer believes the only proper way to proportion plate girders is to treat them as solid beams, and to determine the strain in extreme fibers by using the moment of inertia of the entire beam including the web. Not only is this practice theoretically correct, but it has the decided practical advantage of discouraging the use of thin metal in the webs, thereby producing a girder which is not only well adapted to use, but which will suffer least injury from abuse. Assuming 10,000 pounds as the strain which would be put on the extreme fibers of such girder if it were a solid rolled beam, it would in almost every instance be possible to design a built beam in which the strain on extreme fibers should be allowed to reach 9,500 pounds per square inch as calculated on the gross section.

Bacterial Sewage Disposal in England.

Late last year the City Council of Toronto authorized Mr. C. H. Rust, the city engineer, to make a personal examination of the bacterial methods of sewage disposal in England, in order to report on their availability for Toronto. He visited the Abbey Mills works of the London main drainage system and the plants at Sutton, Exeter, Hampton, Croydon, Leicester, Birmingham, Oswestry, Manchester, Sheffield, Leeds, Carlisle, Glasgow and Barrhead. On his return he submitted four propositions for the disposal of the Toronto sewage, as follows:

System.	First cost.	Annual cost.
Intercepting sewer …………	$1,750,000	$17,000
Septic tank system, 1………	2,385,000	76,000
Septic tank system, 2………	2,540,000	37,000
Septic tank system, 3………	1,880,000	40,000

The first system is recommended on account of its financial advantages and the difficulty of procuring land for disposal works at a reasonable cost. Mr. Rust states, however, that a bacterial system of disposal for the city would be thoroughly efficient and satisfactory, and his conclusions on this subject, deduced from the experience and investigations of the cities and towns mentioned, are given as follows:

The chemical precipitation of sewage, which has been extensively adopted in England, has proved to be unsatisfactory and very expensive in operation and construction. It only prepares the sewage for purification, a work now much more efficiently done by the septic tank. The purification of sewage by bacterial action, after years of experiments, seems to be the only method which, at present, gives promise of successful application. At the works I visited, in every instance the effluent was clear and satisfactory, and there appeared to be no danger of after-putrefaction. The operation of the bacteria beds in winter in England, where, of course, the climate is much milder than in this country (Canada) does not appear to be seriously affected, but I think before any extensive system of bacteria beds is contructed here (Toronto), it would be advisable to conduct some experiments in the winter to ascertain definitely their practicability during our severe winter.

In addition to the treatment by the ordinary Dibdin contact beds, experiments have been made with continuous filters, such as the Whittaker and Bryant, and the Stoddard filters, which are capable of dealing with a much greater amount of sewage than the ordinary Dibdin contact bed, the patentees claiming that as much as 3,000,000 to 8,000,000 (imperial) gallons of sewage per acre per day can be treated. The only city at present, I believe, where a continuous filter is in operation on a large scale is at Accrington. I saw a small one in use at Leeds and one at Manchester, but I am of opinion that the climatic conditions in this country are such as to prohibit their use here. If it were not for this drawback there is no doubt that for small towns this kind of filter would be advantageous.

The lifetime of contact beds is not yet definitely known. The choking of the beds managed unskillfully would probably be rapid, and it has not yet been proved that this can in any case be entirely prevented. In some places tne beds have been in use five or six years and their efficiency has decreased in some cases as much as 33 per cent. within a short time after they were put in operation, but after that no further decrease was noticed. It is probable after being a few years in use that the surface of the beds would have to be replaced with fresh material. If some arrangement could be made, however, so that all the sewage could be freed from sludge before being put on the beds, there is no doubt that they could dispose of a great deal more sewage, and their efficiency would be maintained for a much longer period. At Bradford, where the sewage is difficult to deal with on account of the manufacturing refuse contained therein, the contact beds have, I understand, gradually filled up. In other places there has also been some trouble with the sludge accumulating on the surface. As I have just explained, this would be obviated if the sludge could be prevented from reaching the beds, or by having a larger capacity for detritus or septic tanks.

The septic tank is no doubt the most satisfactory method of getting rid of the sludge nuisance, and has an advantage in the small area of land required. In the so-called Exeter system it has been the practice to make the tank practically air-tight, but engineers generally are of the opinion that this is not now necessary, the septic action being found to be just as satisfactory without a cover, but it would probably be found advisable in this country, owing to climatic conditions, to have a roof of some description over the tanks. The question of the capacity of the tanks is another important subject upon which there has been some difference of opinion. The Exeter Syndicate, I understand, in preparing plans, provided for a capacity equal to 1¼ days' supply of sewage. Other engineers in designing plans have had this capacity considerably reduced, considering it only necessary to provide for 24 hours' flow, and in some cases I found the capacity even less than this. In dealing with the sewage of large cities this is a matter to be carefully considered, as the first cost of constructing these tanks is very high. As Toronto sewage is much less polluted than English sewage, the tanks could probably be reduced here to a minimum, i. e., worked at a high rate of flow.

Municipal authorities in England have been much hampered by the stringent requirements of the Local Government Board. In addition to treating the sewage in septic tanks and contact beds, the municipalities are compelled to provide a sufficient area of land to further treat the effluent, and in the case of Hampton, where the sewage is treated on three sets of beds, the Corporation was compelled to purchase twenty acres of land for this purpose, and then it was found that the effluent after passing through the land had actually deteriorated in quality. Consequently this practice was discontinued. It appears to me from the result of these inquiries, that although the Local Government Board insists upon these requirements, it does not appear to exercise any further supervision unless complaints are received as to the character of the effluent. The Government in 1898 appointed a Royal Commission which is thoroughly investigating the biological method of sewage disposal, but it is anticipated it will be a considerable time before the inquiry is concluded.

Another matter to be considered is whether these methods, while successful in purifying domestic sewage on a small scale, would be equally effective in dealing with sewage from large manufacturing towns. There is no doubt that preliminary sedimentation is necessary to prevent the beds from choking. This will more particularly apply in the case where the combined system is in force, because during heavy rains large quantities of road detritus, straw, etc., are washed down from the streets, and it has been found to be very difficult to deal with this class of material in filters.

One result of the bacterial treatment is the removal of that portion of the sewage which would become readily offensive if it were allowed to pass into fresh water, but it has been further found by experiments that in the treatment of raw sewage on bacteria beds, especially from manufacturing cities, a preliminary settlement is absolutely necessary to prevent the beds from becoming choked.

It has been urged by those advocating the bacteria treatment of sewage that the annual cost of maintaining bacteria beds would be very low. This may be true in the case of the small plants that have recently been installed, but as yet there has been no experience in large cities in treating the whole of the sewage by bacteria beds.

In connection with the disposal of sludge, statements have been made that by this method the sludge will be practically nil. This has been proved to be an error, and in large cities having a daily flow of 20,000,000 to 30,000,000 gallons, including storm water, there will probably be from 20 to 25 tons of sludge per day to be disposed of.

There is also to be considered the question of the renewal of the upper layer of material every few years, the washing of the beds, the opening and shutting of the valves, tank cleaning, the pressing and disposing of the sludge, management, etc. So that in all probability the annual cost for large cities would be between 20 and 30 cents per capita. This is only a rough estimate based on conversations with engineers when in England. I have no doubt that the uncertainty as to the annual cost and the lifetime of the beds has resulted in many engineers hesitating to recommend the bacterial treatment for large cities. Although there is a great deal of information available as to the first cost of constructing bacteria beds and septic tanks, there are very few actual data as to the annual cost and the lifetime of the beds, especially for large cities.

This information can only be obtained by actual tests extending over a period of seven or eight years, and there is no doubt that if the works now being carried out at Manchester show, after this period, that the annual cost is within reasonable limits, and the results obtained are satisfactory, a large number of cities which now hesitate to finally adopt this system will abandon their present method in favor of the biological. The system must, of course, be applied with due regard to the requirements of the district, and must be carefully supervised in order to make it a success.

For cities where a considerable amount of sewage has to be disposed of, the first cost is very large, and this will apply more particularly to American cities, where a great deal more water is used per capita than in English towns. Sewage schemes involving a large expenditure have always met with a very different attitude from that which the citizens assume toward improvements which appear at once to benefit the people, and from which a revenue is derived.

The material used in bacteria beds most approved by engineers is clinkers, and in large cities considerable difficulty will be experienced in procuring a sufficient quantity of this material. Coke, which at first seemed to meet all requirements, has been found to gradually break up after being some time in contact with the sewage, but, generally speaking, those who have had charge of sewage disposal works under the biological system state that any material such as clinkers, coke, coarse-screened gravel or broken stone, would be satisfactory. If a high degree of purity is not required, one contact would probably be found sufficient. The method recommended in England, for large cities especially, is first a septic tank and then one contact. In small towns, however, small settling tanks and two contact beds have been used successfully.

The Drainage of the Valley of Mexico.

A paper by Mr. John B. Body, published by the Institution of Civil Engineers.

The valley of Mexico is more or less elliptical in configuration, and occupies an area of about 2,700 square miles. It is completely closed in by mountains on all sides; on the east side rise the extinct volcanoes Popocatepetl, 17,717 feet, and Ixtaccihuatl, 15,584 feet in height; at the south end is Ajusco, 13,616 feet in height, and on the west it is bounded by a range of mountains attaining a height of about 11,000 feet above sea-level. Toward the north there is a very sharp depression in the mountains, and at this point, ever since the sixteenth century, it has been proposed to give an outlet to the pent-up waters which collect in the low-lying lakes around the City of Mexico, and have, at several periods, produced disastrous effects by inundating the city, which, although 7,350 feet above sea-level, is built in almost the lowest part of the valley.

The first systematic attempt to drain the waters of the valley was made in the year 1607, when Enrico Martinez drove a tunnel through the low depression of the mountains at Nochistongo, the northern extremity of the valley. This tunnel had a cross-section measuring 13 feet 9 inches by 11 feet 6 inches and a length of 4.1 miles, and was completed in the almost incredibly short time of 11 months; this, however, is explained by the fact that many thousands of Indians were employed throughout the whole of the time, working in a great number of shafts, and that the soil offered no great resistance. Unfortunately the great urgency of the Spanish Government to get the work finished did not allow time to line the tunnel with masonry, and consequently, very soon after the first torrential rains passed through, the whole work collapsed and the tunnel was left in this condition until the city was again inundated in the year 1629, continuing flooded for five consecutive years. The chronicles of the time record that 30,000 people perished during one month. At this time the Court at Madrid ordered that the site of the city be changed to a higher level on the east side of the valley; this project was not accepted in

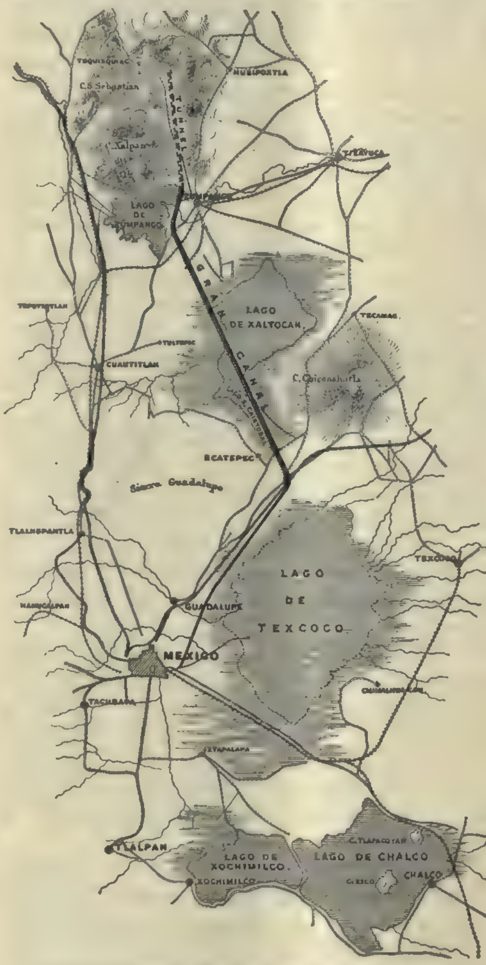
Mexico, as the city property was valued at £10,400,000, and the proprietors believed that an effective drainage could be obtained for the sum of £625,000. The subject was again studied, and in the year 1637 the project of converting the tunnel into an open cutting was accepted, but was not completed until the year 1789; the depth of this cutting is about 197 feet, the slopes being, on an average, at an angle of 45 degrees. This cutting now serves to carry off the water of the most important river of the valley, removing one of the chief sources of danger from flood. The tunnel and cutting are estimated to have cost £1,300,000, and the lives of innumerable Indians who were forced to work as slaves. The bottom of the cutting being 29 feet 6 inches above the level of Lake Texcoco, which is only 3 miles distant from the city gates, all this work proved practically useless, as the danger of the lake rising and flooding the city during the seasons of heavy rain remained a menace to the inhabitants.

On the completion of the Nochistongo cutting there followed in succession, the War of Independence and revolutions among the people, and nothing further was done until the Government in 1856 appointed a commission to reconsider the whole subject; the commission then offered a premium of £2,500 for the best project for effectually draining the valley, so that the city might be forever free of danger from floods. Six projects were presented, that of Francisco de Garay being accepted. This was a proposal to carry off the surplus waters of these lakes, and the sewage of the City of Mexico by means of a canal starting from the extreme southeast end of the city, and passing through Lakes Texcoco, San Cristobal, Xaltocan and Zumpango, and then through the mountains by a tunnel leading to the Arroyo of Ametlac, about 7 miles east of the Nochistongo cutting.

The Civil War and the French occupation again prevented the prompt commencement of these works, until, in the year 1866, the Emperor Maximilian, seeing the great necessity for the undertaking, ordered that the works be at once commenced, and they were actively continued until the year 1867, when the empire fell. During the period 1868-1881, the execution of the works was intermittent, in consequence of civil wars. In 1885 the Government appointed a new commission, when £83,000 per annum was placed at its disposal to continue the work; and in addition, a loan of £2,400,000 was raised in London by the municipality, to be devoted to the work. The commission, not being satisfied with the progress made under administration, and seeing the absolute necessity of completing the work as soon as possible, sought to give the whole undertaking into the hands of competent contractors. The contract for the tunnel was taken by Messrs. Read & Campbell of London, and that for the canal by an American dredging company; the latter contract was rescinded in 1889 on account of the slow progress made, and was given to Messrs. S. Pearson & Son of Westminster, by whom the canal has since been completed.

The objects of the works, as carried out, are, first, to control the level of the lakes and waters of the valley; and second, to receive the sewage of the city of Mexico, and carry it outside the valley. The works consist of a canal, commencing at the San Lazaro gate of the city, and having a total length of 29½ miles. For the first 12½ miles it runs between the Guadalupe Hills and Lake Texcoco in a northeast direction, with a width at the bottom of 16 feet 5 inches, and an average depth of 29 feet 6 inches. This section is only intended to take the water and sewerage of the city. The canal is connected with Lake Texcoco, the lowest lake in the valley, by means of sluices, and, passing through Lakes San Cristobal, Xaltocan and Zumpango, controls the water-level of all these lakes. For the remaining 17 miles, the canal runs in a northerly direction. As far as the junction with the tunnel, the width at the bottom is 21 feet 4 inches, the depth varying between 33 feet and 72 feet; this section is calculated to carry off 640 cubic feet of water per second. The canal has a total fall of 29 feet 1½ inch, or 1 in 5,348, with uniform side slopes of 1 to 1, except in a few places where slips occurred owing to bad ground. The total excavation exceeded 15,696,000 cubic yards, of which 9,400,000 cubic yards were excavated by dredgers, and 6,300,000 cubic yards were excavated by hand labor, Figure 3. The work was commenced in January, 1890, and was practically finished in June, 1896.

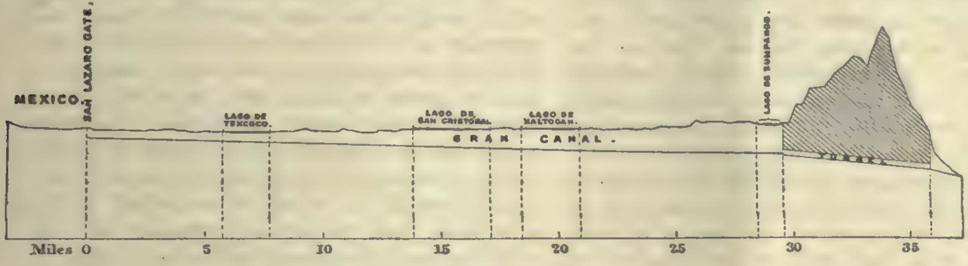
Excavation by hand-labor.—The excavation, to a depth sufficient to float the dredgers, was done by hand-labor, as was also the trimming of the slopes when the dredging was finished and the water let out of the canal. This work was done by Indians by task-work, the earth being removed to a distance of about 100 feet, in a rough net or basket carried on the back and supported by a strap from the head, each man carrying and digging alternately. The Indians execute all kinds of earthwork very satisfactorily, provided that sufficient care is taken to keep the work to proper line and level. A reference-line was set out on the benching, with permanent pegs, 50 meters (164 feet) apart, and at each kilometer (every twentieth peg) a masonry pillar was built, which served also as a bench-mark. The average height of the spoil-bank is about 13 feet, and the maximum height is 33 feet, the slopes being 2 to 1. A benching of about 26 feet in width is left on each side of the canal, and the spoil is deposited beyond.



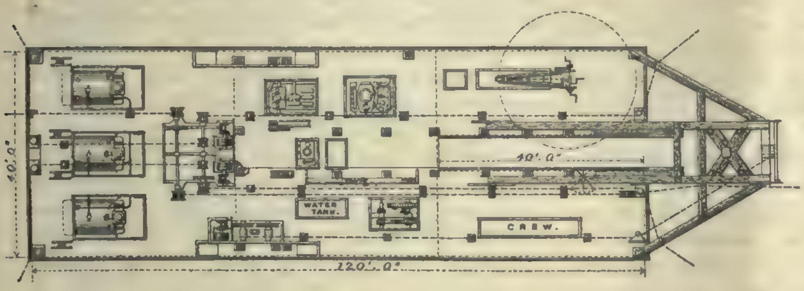
Map of the Mexican Drainage Canal.

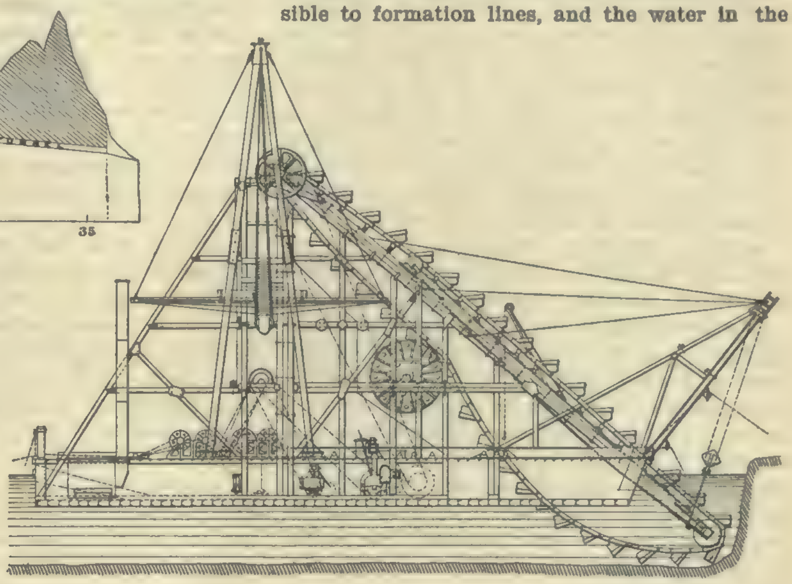
Excavation by dredgers.—About 900,000 cubic yards were excavated by two floating steam excavators of the steam navvy type, but these, being able to work only to a moderate depth below water, and being very costly machines in repairs and working, were replaced by five Couloir or long-chute dredgers, which performed the remainder of the dredging; the quantity excavated by these exceeded 8,500,000 cubic yards in 48 months, the greatest depth dredged being 53 feet 6 inches below water-level. These dredgers were built and engined by Messrs. Lobnitz of Renfrew, and were erected in Mexico in a temporary dock on the site of the canal, the hulls being floated out when completed, and the machinery and upper structure being put on from a wharf, also on the site of the canal. Four of the dredgers were of one size, with an upper structure of timber, the fifth being larger and having a steel upper structure. The hulls of the small dredgers were of iron, and measured 120 feet in length over all, 40 feet in extreme breadth, and 9 feet in moulded depth; they were fitted with a well, 7 feet in breadth and 40 feet in length. The dimensions of the hull of the larger dredger were 140 feet, 45 feet and 10 feet, in length, breadth and depth respectively. The well was 7 feet in breadth and 48 feet in length. The heights of the top tumblers above the deck were 56 feet and 74 feet 6 inches respectively. These delivered the excavation to spoil-banks, 165 feet, and in some exceptional cases 185 feet, from the center of the dredger, by means of steel chutes, 3 feet in diameter, connected to the hopper and suspended from the side shear-legs by wire-ropes, fitted with union screws to give an inclination varying between 1 in 5 and 1 in 20. A platform with a handrail was fitted along the whole length of the chutes, to enable men to promptly clear away any obstruction. Power was transmitted to the top tumbler by means of a pitch-chain, driven by a two-crank compound engine, having one high-pressure cylinder 14 inches in diameter and one low-pressure cylinder 28 inches in diameter, the stroke being 24 inches; this engine was designed to develop 150 indicated horse-power when running at 100 revolutions per minute, and to work constantly when necessary. It drove the top tumbler at the rate of 6 to 9 revolutions per minute, by means of gearing and a steel drive-chain passing round a pitch-wheel keyed on the top tumbler-shaft. The engine was also available for driving winches when necessary. An independent two-crank compound engine with one high-pressure cylinder 9 inches in diameter and one low-pressure cylinder 14 inches in diameter, the stroke being 12 inches, was used to drive manoeuvring winches, a ladder-hoist winch and tower-pumps. The corresponding engine in the larger dredger had cylinders 10 and 20 inches in diameter and a stroke of 15 inches. Tower-pumps were worked by this engine from a three-throw shaft. These were capable of discharging 600 cubic feet of water per minute into the chute through a pipe 12 inches in diameter, to facilitate the passage of the dredged material through the chute. The manoeuvring winches, placed in the stern of the dredger, were worked by means of belting from an overhead line of shafting connected with the main or auxiliary engine; levers were carried to the fore part of the dredger where the dredging-master could command a clear view of the buckets as they emerged from the water and so manoeuvre the dredger to the sights. Hoisting and lowering of the bucket-ladder was accomplished by means of chain tackle suspended from the shears. The purchase-gear consisted of four upper and four lower iron sheave-blocks, each 26 inches in diameter. The hoisting-chain was wound over two barrels driven by belting from the dredging or auxiliary engine, the barrels being under control of a strong friction-brake.

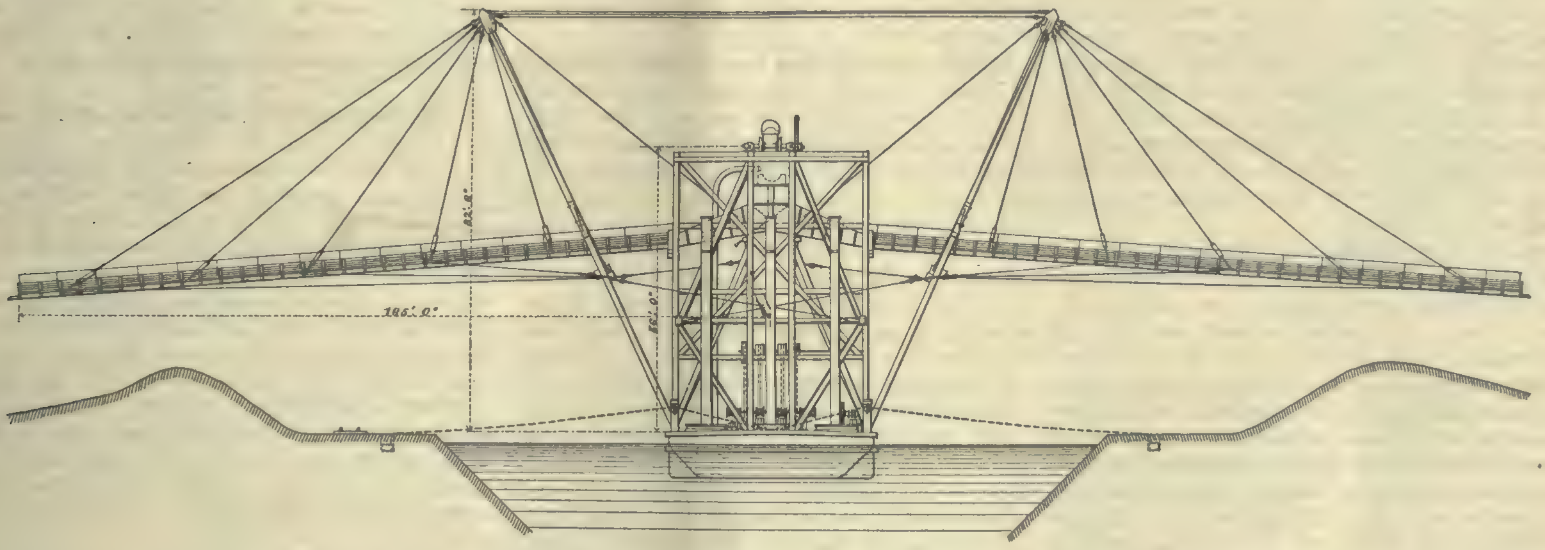
The bucket-ladders were of the box-girder type, built of 7/16-inch mild-steel plating, the sides being strongly united by cross web-plates



Profile of the Mexican Drainage Canal.







COULOIR OR LONG-CHUTE DREDGERS USED ON THE MEXICAN DRAINAGE CANAL.

6 feet apart, center to center; the upper and lower ends were fitted with strong brackets for the reception of the tumbler and suspension-shafts; the ladder could be raised or lowered on framing to suit the depth of dredging required, buckets and links being added or taken out if necessary. The ladders were 78 feet in length, 4 feet 6 inches in breadth, and 4 feet in depth over the plates. The sides were lined outside with 6-inch elm timber, strongly bolted through the side plating; this gave the ladders great additional strength. The necessary steam-power was supplied by three return-tube boilers, each 7 feet in diameter and 10 feet in length, arranged to work independently and having a total heating surface of 408 square feet, a grate-area of 19.6 square feet, and a working pressure of 75 pounds per square inch. The buckets were of 11 cubic feet capacity, with cast-steel backs ½ inch thick, the body being of 5/16-inch steel with ⅞-inch malleable-steel lips, and the bushes of ½-inch wrought manganese-steel in lugs; they were placed 3 feet 3 inches apart, center to center. In very sticky soil, buckets with hinged bottoms were used with great success, a cam being fitted to the top tumbler to lift these and throw the contents out. The bucket-links were made of three rolled-steel plates strongly riveted together, with ½-inch wrought manganese-steel bushes fitted at the ends for the bucket-pins. These were 2½ inches in diameter, of wrought manganese-steel, and were found to wear very well. The top tumbler was four-sided, with outside flanges, and was keyed to a shaft 12 inches in diameter, which also carried the chain-wheel. The bottom tumbler was six-sided, with inside and outside flanges, and was fitted onto a shaft 8 inches in diameter. A guide-wheel of special construction, 11 feet in diameter and 3 feet 9 inches in width, was fixed within the framing and below the ladder, to guide the bucket-chain and to take up the sag, thus enabling it to clear the well of the hull; the sides were of solid plating, with 1-inch steel wearing-plates over the surface where the buckets struck, packed underneath with timber 6 inches thick. The whole wheel was very strongly constructed to sustain the heavy blows of the buckets in their downward travel. A hand jib-crane to lift 2 tons was fixed in the bow of the dredger, for removing buckets, etc., for repairs, depositing them in barges alongside. Electric light was fitted throughout the dredgers to enable night-work to be carried on.

The greatest quantity dredged in a month, by one dredger, working day and night in soft soil, was 124,230 cubic yards. In hard soil the quantity varied greatly according to the hardness of the material, a fair average quantity being 90 cubic yards per hour. When dredging in hard soil it is necessary to keep the buckets well up to their work to prevent bumping into the face, which causes a backward and forward motion of the vessel. The most suitable depth of face for dredging, both in soft and hard soil, was found to be about 6 feet. For the first 14 miles of the canal, the soil consisted of a saponaceous marl throughout the whole depth of the cutting, and this soil continued to the end of the canal to a depth of 20 feet below the surface, the remainder of the excavation consisting of a hard material known in Mexico as "tepetate."

When dredging canals with a face above water-level, it is necessary to excavate side trenches, so that the hull of the dredger may be swung round to work at an angle, as without these the dredger is liable to work into a V-shaped corner. Faces up to 9 feet above water-level were dredged on this canal. The side moorings of the dredges consisted of two lengths of pitch pine, 8 feet in length and 12 x 6 inches in cross-section, wrapped round by a chain 1 inch in diameter and dropped into a trench about 4 feet in depth, made on the benching of the canal, the chain being connected by a shackle to the chain from the dredger; these served their purpose very well. The head anchor was also arranged in this manner and was kept about 500 feet ahead of the dredger. The stern mooring was an ordinary 1-ton iron anchor, let down to the bottom of the canal.

The Lidgerwood cableway.—The Couloir bucket-dredgers having bottomed up as closely as possible to formation lines, and the water in the canal having been lowered and the slopes trimmed to within about 6 feet of the bottom of the canal, it was decided to employ a Lidgerwood traveling cableway to aid hand-labor in excavating the material which the dredgers could not get at, and the soil which had in places slipped from the slopes, as the result of filtration from the lakes through the soft upper strata. At that time the quantity of water flowing in the canal amounted to 106 cubic feet per second; it was therefore found necessary to control the water by means of a series of timber sluice-dams, which held up the water during the day and enabled the natives to work in the bottom and finally clean up after the cableway, which was kept ahead of the hand-labor. The cableway consisted of two timber towers, one on each side of the canal, 350 feet apart, each running on three tracks of 4 feet 8½ inches gauge, the rails, weighing 65 pounds per yard, being laid in short lengths to facilitate handling when moving the towers ahead. The head tower was 65 feet in height, and carried, on the platform, the engines and dynamo for night-work; the tail tower, on the opposite bank, was only 35 feet in height. All the cables were of crucible steel; the main cable, 1¾-inch in diameter, on which the bucket-carriage traveled, passed over the top of each tower and was anchored at the rear end of the platform. The traversing and fall-ropes were ¾-inch in diameter, and the button-rope ½ inch in diameter, being used for retaining, by means of steel buttons, the fall-rope carriers at various distances from the head tower as the bucket carriage ran out to take a load. A two-cylinder engine, having cylinders 10 and 12 inches in diameter, drove the three friction-drums used for traversing the carriage from which the bucket was suspended, and for operating the Hayward bucket. The average depth below ground-level at which the bucket grabbed was about 50 feet, and the capacity of the bucket was 1 3/5 cubic yards. The average time occupied in making one round trip with the bucket, i.e., running out, lowering, grabbing, raising, running in and dumping, was less than 2 minutes, including stoppages and moving ahead, but a single round trip was frequently made in 1¼ minutes. The head tower was advanced by means of a small warping-barrel on the end of one of the drum-shafts, and the tail tower by a 7-ton hand winch, posts being sunk in the ground in each case at intervals ahead, in readiness for attaching the tackle. The cableway was worked day and night. A signal-boy standing on the edge of the benching communicated with the engine-driver by means of an electric bell and a code of signals. For working at night, a Jandus arc-lamp was suspended near the head tower, and a white screen hung on the further side of the bucket traversing carriage and traveling in and out with it, by reflecting the light enabled the driver to see the sheaves which operated the bucket. By means of this cableway 139,000 cubic yards of excavation were removed from the bottom of the canal. The total distance traveled by the cableway was 11¼ miles, but part of this distance was covered without excavating.

Extensive workshops were necessary for erecting the dredgers, and also for repairing and manufacturing parts which were subject to severe usage and needed constant renewal. A convenient point for these, and for the chief camp, was chosen at the fourteenth mile, about 1¼ mile from the Mexican Railway. Along the benching of the canal, for about 19 miles, there was constructed a 3-foot gauge railway, with 30-pound rails and timber sleepers, connected at the thirteenth mile with the Mexican and Hidalgo Railways, and at the end of the canal with a branch line to Zumpango and the tunnel. This line has since been taken over by the Government and is used for passenger service. One passenger-car, eight four-wheeled bogie-cars, and one six-wheeled coupled locomotive, served as rolling stock. Three aqueduct bridges serve to carry small rivers from the hills on the west side of the valley over the canal into Lake Texcoco; these are constructed with masonry abutments and iron troughs, 19 feet in width by 11 feet in depth over the span.

The work was carried out under the direction of Messrs. Luis Espinosa and Ysidro Diaz Lombardo, respectively director and resident engineer for the Mexican Government. The contractors were represented by Mr. Thomas L. Walsh who, from the commencement of the works until April, 1892, was assisted by Mr. J. V. Wilfrid Amor, acting as engineer, and thereafter by the author, who was succeeded by Mr. Arthur Colls shortly before the completion of the works.

The Expansion of Brick Pavements.

The blowing-up of several brick pavements in Kansas City, Mo., described in a note from City Engineer Waddell in this journal on July 20, is a phenomenon which is apparently extremely infrequent. Enquiry of the engineers in charge of the street work in many cities has failed to furnish any further information on the subject than is given in the following notes.

The experience in Cleveland is summarized by Mr. William J. Carter, chief engineer of the Department of Public Works, as follows: "We have had several of what you might call explosions on our brick pavements, due to excessive heat where a cement filler has been used in making the brick pavement one homogeneous mass. We have adopted a form of construction which we think will eliminate this kind of accident. We place a strip of wood between the curb and the first course of brick, allowing about one-half inch joint. After the pavement has been laid, thoroughly compacted and ready for grouting, this strip is removed and the joint filled with a tar filler. Streets treated in this manner have been freer from cracks than the streets laid in the old way. We have not had as yet enough experience with this kind of construction to warrant us in saying that we have eliminated the possibility of all such explosions or breakages in the future, and may have to adopt some other means to avoid this form of accident."

At Terre Haute, Ind., the experience of City Engineer Ralph H. Sparks is stated as follows: "There have been two of these explosions, the pavement bulging up at the crown of intersecting streets. This has occurred only in extremely high temperatures. I attribute this to the expansion of the cement filler. However, there is room for investigation as to why this pavement would pass through nine years of service attended by about the same conditions and then do as stated."

In Columbus there has been no such explosion as those in Kansas City, which is due mainly to the use of grout filler on very few brick-paved streets, according to Mr. Julian Griggs, chief engineer of the Department of Public Improvements, who writes: "Some nine years ago a few streets were laid with grout filler over a foundation of 8 inches of broken stone, having its voids partly filled with sand. These streets have not been satisfactory on account of the gradual disappearance of the bedding sand into the interstices of the broken stone, thus leaving the pavement arched and without support, so that heavy loads broke the bonding of the brick, and caused it to settle irregularly and in patches. On one street, nearly a mile in length, there was a movement of the pavement at street intersection, due to expansion, which caused the pavement to rise about 6 or 8 inches, and necessitated the relaying of the brick at that point."

The latest report of such an explosion came from Trenton. In view of the note from the Street Commissioner, printed below, the following newspaper account of the incident is worth reading: "A brick pavement in front of St. Paul's Church in Spring Street exploded yesterday, making a report audible two blocks away. The pavement had been rising for two days and had reached a height of over two feet. Street Commissioner Ginder said the bricks were thrown about five feet in the air by the explosion. He found 200 of them scattered on the sidewalk, about 1,000 in all being displaced. The same phenomena, though less violent, have occurred in other streets recently and have been attributed to gas generated under the pavement by the heat and to the heat expansion of the bricks themselves." Mr. Ginder's letter on the incident reads as follows:

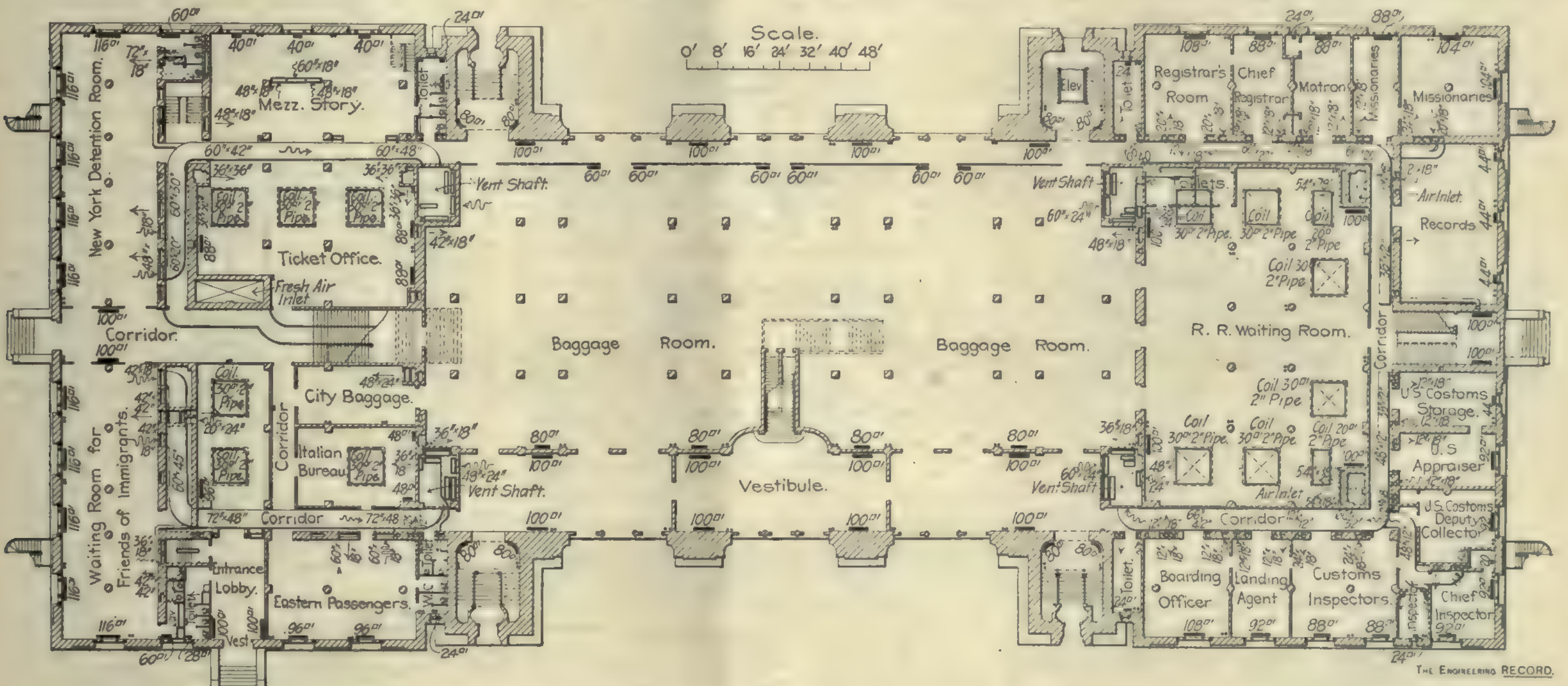
"This whole matter has been so completely exaggerated in the newspapers as to make it appear ridiculous to me. The accounts of the affair as written in the various papers would lead the public to believe that a regular volcanic eruption had taken place, or that a miniature earthquake, with its accompanying terrifying roar, had upturned the street and frightened the residents to distraction. The story, as it has been put in print, is nothing more or less than the fabrication of the fertile imagination of some aspiring reporters. The truth of the matter is this. It is the nature, or seems to be, of vitrified brick to expand by the heat. It has frequently been our experience that after a heated spell the brick expand; a cold snap follows, which contracts them; then a subsequent hot spell expanding them again causes them to rise to a crown head and finally fall apart. This crown head is one solid mass of pavement and generally holds together some time after rising. When in that condition, as a wagon passes over it, it undulates as a thin layer of ice when boys play the familiar game of 'tic-tac.' There is absolutely no explosion when the brick break, but a mere natural crumbling apart and disintegration of the mass, accompanied by no noise more than the ordinary breakage of such would cause. These expansions are rather a common occurrence than otherwise. We have had several of them this year, and many others in former years; and I cannot understand why so much interest and widespread discussion has been caused by the breaking of this particular pavement. If you write any account of the matter, I trust you will not present any of the many nonsensical theories which have been advanced as the cause by persons who are not qualified to give opinions on subjects of which they have had no knowledge or experience. The facts are as I have herein written them. The occurrences are frequent; the cause is natural; and there is positively nothing phenomenal in the whole affair except as given to the public in the ridiculous hyperbolical statements of the papers."

Central Heating Plant, Ellis Island, N.Y.—III.

In the last two issues of The Engineering Record were described the features of heating and ventilation in the buildings forming the landing station in New York Harbor for immigrants to the United States. The plant in its entirety is a central station one, and the very interesting power house and means of distribution throughout the grounds formed the basis of the first article. The apparatus in the different buildings of Ellis Island, which differ, some in general design and others in particulars, were taken up in these columns last week with the exception of the main building. The interesting features of this building's plant are given herewith.

The main building is a three-story structure and is the largest on the island, being 164 x 384 feet in ground plan. It is largely occupied by the transient immigrants, but it is also arranged for the offices of the administrative department of the island. In the former portions of the building, the design of the ventilation had to consider the various large rooms as densely peopled, while the offices were calculated on the basis of a stated number of hours of occupation for a limited number of people, and were designed rather to effect a stated number of changes of air in a given time. The building is thus divisible into two distinct parts and each is supplied by an independent system. Other than the fact that the provision for air supply is greater in the one case than in the other, however, they are quite similar. They are both distinguished in the use of large brick ducts carrying the discharge from fans which they surround as plenum chambers. As a result of this arrangement, the ducts connecting the flues to the brick ducts are comparatively quite short and there is less friction in the duct system and consequently better distribution of pressure throughout the system, which means more uniform circulation, than if the relatively longer tree-like system were used. The tempered air supply for ventilation is supplemented by direct radiation and is distributed by a combination plenum and exhaust system, pressure fans in the basement and exhaust fans in the attic.

The basement and first floor plans are shown in the accompanying drawings. The building has three distinct portions, the central and two ends. In each of the end parts there is a light court extending upward from the first-story ceiling and of a shape indicated by the series of square ceiling lights in each end of the first-floor plan. The second story entirely encloses the court but the third story only occupies the center part of the building and that portion of the end which is within the lines defined by the light court. One end of the building on the first floor is entered from the covered corridor from the restaurant and bath buildings and contains in this story the detention rooms for immigrants to New York, a ticket office and a room for eastern passengers. The whole of the central portion of the first floor is occupied as a baggage room. The other end of the building on the first floor contains a waiting room opening from the baggage room and around this on the outside of the building are the offices of the administrative department. In the second story the large space over the baggage room is used as a receiving room; the immigrant end of the building on this floor is given up to examination rooms chiefly, with waiting rooms for the excluded men and women and a dormitory for those awaiting discharge to New York. The administrative department has its principal offices on this floor. The third floor is devoted to dormitories and a gallery overlooking the large receiving room.



FIRST-FLOOR PLAN, MAIN BUILDING, ELLIS ISLAND, N. Y.

The scheme of air distribution for the building is as follows: The fresh air is admitted for each half of the building at the light court, at a point a short distance above the level of the first-story ceiling, and passes to the basement through fresh-air shafts. It is then taken by fans and forced through primary or tempering coils and distributed to the various rooms. The vitiated air is withdrawn by means of exhaust fans and for this purpose there are four large vent shafts built in the building from the basement upward at the four corners of the baggage room. A fan of the disk type is located in each of these and discharges directly upward into the atmosphere.

In the immigrant end of the building the fresh air passes down a shaft 6 x 18 feet in size, roofed over with a copper hood and provided with ornamental grills set in the openings and with a ⅝-inch mesh copper wire screen within the grills to keep out mice and birds. At the basement ceiling the shaft delivers into a settling chamber of the same cross-section as the shaft, with two pairs of circular openings in which the fans are set. The walls of the chamber are 16 inches thick and extend from concrete footings to the basement ceiling masonry. The fans are mounted in pairs on two shafts, which, however, are provided with a flanged coupling midway between each pair, so that they may be disconnected without trouble. The inlet side of each fan has a door of matched pine boards covered with tin plate.

The fans are all Baldwin centrifugal cone fans 90 inches in diameter and each designed to give 3,000,000 cubic feet of air per hour at a speed of 200 revolutions per minute and against a pressure of one ounce. They are driven by belt which pierces the brick settling chamber, the shaft of each pair arranged for connection to a 9 x 10-inch engine, which receives the medium-pressure steam, distributed from the boiler house at about 70 pounds pressure. The fans discharge two and two in opposite directions toward two pipe coil heaters in each case, one heater separated from the other by a thick partition wall, which fills in the space between the heaters, to prevent eddies between them or cold streams of air to get into the chamber beyond. Each heater is nearly 8 feet wide and connected independently to the steam and return piping. It has about 2,815 square feet of heating surface, which means, allowing 10 per cent. increase in the volume of the air delivered by the fan due to warming, that about 1,170 cubic feet of air are passed per hour per square foot of heating surface. Each heater is connected in five units of two sections each, and these, having a double row of staggered pipes, make the heater 10 pipes deep in the direction of air flow. Altogether the heaters are 78 inches high, supported on I-beams, which project above the concrete floor far enough to bring the top of the heater as close as practicable to the basement ceiling. Each unit of the heaters is connected with the piping with flange unions so it may be removed at any time without disturbing its neighbors, and the manifold of each unit is connected with a draw-off pipe to drain off water to prevent freezing.

The by-pass around the pair of heaters is at one side, as shown in the basement plan, the passage in each case being partitioned off from the heaters with sheet iron and provided with doors which are practically dampers, both at entrance and at exit. A line of vertical dampers is also provided across the front, or cold-air side, of each indirect heater, the dampers being about 2 feet in width and the full height of the opening and pivoted on a center rod which works at its lower end in a ball bearing to give as high a degree of balance as practicable. They are coupled together by rods and cranks to hold them all in the same relative position and so that they may all be opened or partly opened with the same movement. The masonry ducts in which the air is discharged from the fans and passes partly through and partly around the heaters, as the case may be, are for the most part 8 inches thick. The walls extend from the rough concrete basement bottom to the basement ceiling and the brickwork was laid in cement mortar consisting of 1 part hydraulic cement and 2 parts sand, and after completion was kalsomined with a mixture containing sufficient soap and alum to make the walls practically air tight.

An idea of the proportions of the apparatus may be obtained from considering a particular case. Taking the waiting room for friends of the New York immigrants, which is about 25 x 72 feet in plan, there are three large fresh-air openings which aggregate 24.5 square feet. On the basis of a velocity of 200 feet per minute through the gross area of the register face, the total delivery into the room would amount to about 5,000 cubic feet per minute. The total cubic contents of this room are about 35,000 cubic feet and there would thus be 8 1/3 changes of the air in an hour. At the rate of 30 cubic feet of air per minute per person, provision is thus made in the air supply for 167 persons which gives one person 10.8 square feet of floor area.

The fresh-air apparatus for the administrative offices of the building is quite similar, being smaller in proportions, as stated. The air is admitted likewise through the court but drops through two fresh-air inlets terminating at the basement ceiling level at two brick cold-air ducts. Each duct leads to a fan, the two mounted opposite each other on the same shaft which is driven by a belt from a 9 x 10-inch engine. The fans deliver into the same chamber and from this the air passes in opposite directions through a heater in each case, the heaters being of the same size as those on the other side of the building and supported and rigged as to dampers in the same manner. The brick duct beyond the heater in each case also serves as the mixing chamber for the tempered and cold air and as a plenum chamber supplying the flues in that part of the building through short connections.

The exhaust of the air is effected through the four shafts under the action of the fans, one in each shaft. In general the passage is upward except from the vent registers to the connecting ducts which are sometimes downward. For example, the registers in counters in the back part of the ticket office on the first floor open into short flues dropping into a duct in the basement, and, as shown on the first floor plan, there are large ducts over the corridors into which air feeds from the rooms nearby on both the first and second floors. Some of the vent outlets, as shown, open directly into the vent shafts, the outlet, however, being provided with a short flue which points upward a short distance in the shaft giving the outflowing air the proper direction and to prevent the possibility for a back flow from the shaft into the room. The fan in each case is of the propeller type, 7 feet in diameter and is driven by a direct-connected motor. This is fastened to a grating forming a floor across the vent shaft with the vertical shaft passing upward to the fan fitted into a second floor. The fan is located at one end of the shaft and the other end of the fan floor is provided with dampers which may be opened when the fans are shut off and the outflow of air through the shaft be allowed to take place under the plenum system alone. The fan shaft under the fan is provided with an umbrella device to protect the motor from snow and rain. At various points the ventilating register faces are fitted with a cast-iron hood about 10 or 12 inches above the floor, to act as a protection against throwing refuse, rags, debris, etc., into the registers and to draw the air off at the floor. The toilet room vents, it will be noticed, are connected to systems which are independent of the main air exhaust, this air collecting into various main ducts which lead to the nearest vent shaft which they pass upward to the top with high-pressure aspirating coils within.

The exhaust main and medium-pressure live steam main enter the building at one end, 10 and 6 inches in diameter, respectively, from the covered way. The exhaust main at that point receives a 5-inch exhaust main from the fan engines and return pumps, the auxiliary supply from the engines to be passed through a grease extractor, and the exhaust main then feeds into two 8-inch pipes extending in opposite directions around the outside basement wall, for the supply of the many steam risers in the building. The live steam main at its entrance into the building contains a cross, the straightaway outlet continuing into a live-steam main, 6 inches in diameter, extending down the center of the basement for the engines and primary heaters, while the side outlets feed into the main heating system, one side outlet of the cross being connected to the heating main through a reducing valve while the other is the open or by-pass connection.

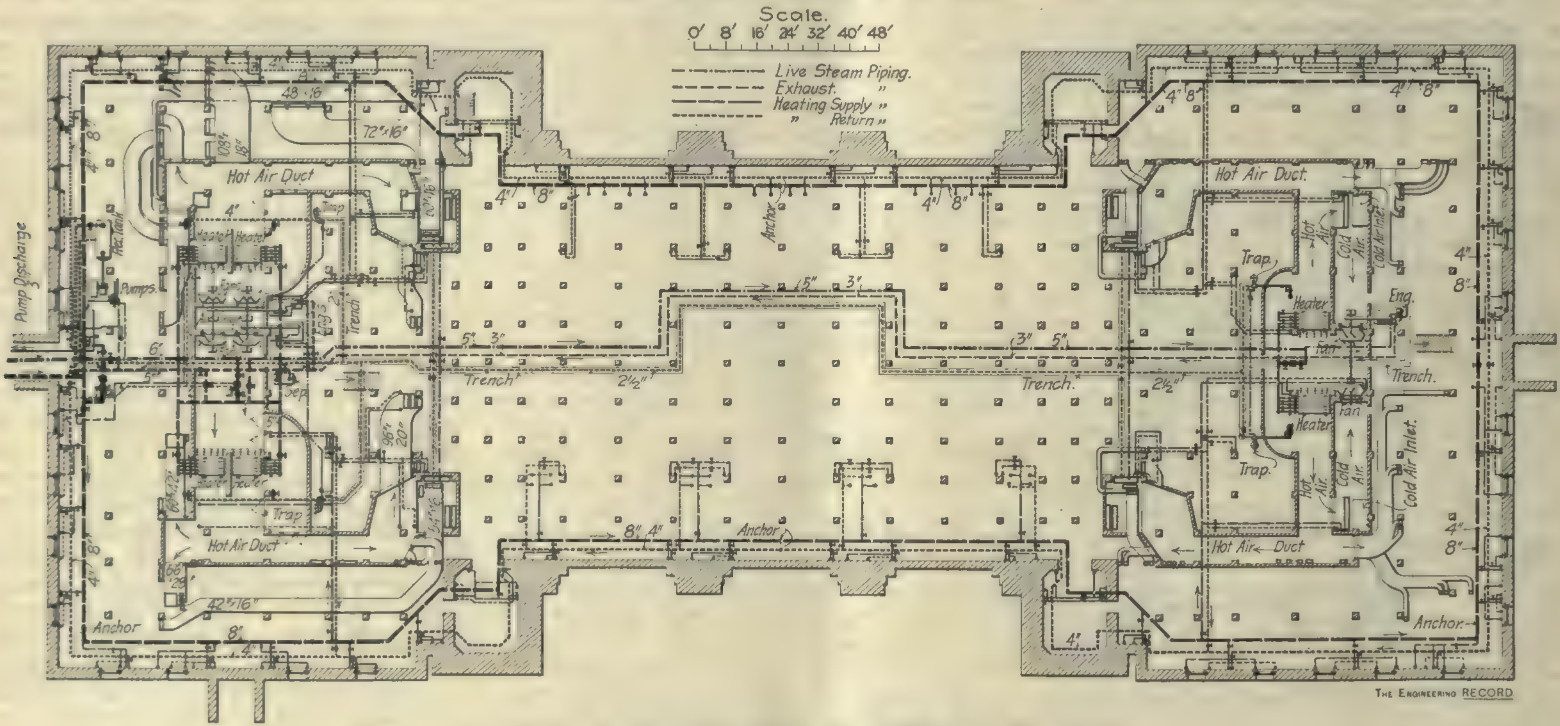
Following the live-steam main it will be seen that it supplies the return pumps and then the set of heaters for the immigrant end of the building. This connection is made overhead in the plenum chamber, where the piping had to be covered, and consists of a connection through a pressure-reducing valve with by-pass, feeding into a 6-inch pipe which supplies the heaters. This pipe to the heaters also receives a 5-inch connection of the exhaust from the fan engines. At the other end of the building, the live-steam main feeds the two heaters for that part of the building through a reducing valve without by-pass, a short shut-down of this apparatus being possible with the comparatively few people dependent on it, if the reducing valve should need attention or replacement.

The condensation of the heaters is handled by four traps, two for each end of the building, of the return type, having live-steam connection and discharging into a return pipe which is carried under the floor in a trench, and is discharged into a receiving tank. The tank is located near the entrance of the covered way and receives the water returned from the general heating system which flows into it by gravity. It is 3 feet 6 inches in diameter and 10 feet long.

The heating main, as stated, extends in opposite directions from the point of entrance of the exhaust main into the building and runs around the outside basement wall meeting at the far side of the basement and forming a complete loop or ring around the basement 8 inches in diameter throughout. Altogether there are nearly 700 feet of this main. In the middle of each long section of the loop and at the two front corners of the basement there is an anchor in the pipe. This arrangement thus allows considerable freedom of movement in the other corners while the changes due to expansion and contraction in the long sides of the loops, which, as stated, have an anchor in the middle, takes place in the offsets midway between anchor and corner.

On account of the limited height of the basement, the main steam pipe is run with a minimum pitch and at different points relays were inserted to bring the pipe to higher levels. At these points there is a drip pipe with stop valve and swinging check valve. Reliefs are also provided at the ends of branches. The return main is laid at the floor and also forms a ring around the entire basement, 4 inches in diameter throughout, pitching slightly toward the receiving tank. The opposite ends of the return ring meet near that point and the water flows in a 5-inch pipe into the tank. The water from the tank is pumped into the return main leading to the boiler house under the control of a pump governor. For this purpose there are two pumps of the duplex type, fed from the medium-pressure steam main with reducing pressure valve in the branch so as to operate the pumps at as low a pressure as possible. The direct radiation through the building is under automatic control and amounts to 16,135 square feet, chiefly in two-column radiators, 38 inches high. Coils are also placed under all skylights, composed of 2-inch pipe. Each radiator and coil has an automatic air valve with connecting air pipes which lead to a sink in the basement. The sink is connected by a galvanized-iron pipe to a soak hole, which was formed by making an excavation of about one cubic yard of sufficient depth to strike water and filling the hole with hard coke.

The buildings were planned by Messrs. Boring & Tilton, of New York, under the supervision of Mr. James Knox Taylor, supervising architect of the Treasury Department, and Mr. William J. Baldwin, of New York, is the consulting mechanical engineer for the plant. Messrs. G. A. Suter & Company were the contractors for the heating apparatus in the main building.



BASEMENT PLAN, MAIN BUILDING, ELLIS ISLAND, N. Y.

Trade Publications.

Publishers of pamphlets mentioned in the following notes will be glad to have The Engineering Record mentioned by its readers who apply for copies.

A fully-illustrated catalogue of derrick fittings just issued by the Dobbie Foundry & Machine Co., 38 Dey St., New York, is particularly interesting as showing the importance now attached to economy of material and freedom from carpenter work in framing such plant, as well as to strength. The last has always been more or less regarded, but fittings which will save framing, keep timber in good condition, and enable materials to be handled rapidly are playing an important part in the excellent contracting work of the present time. This catalogue describes bull wheels, complete derricks, derrick irons, grabs, guy tighteners, scale boxes, sheaves, wire rope and fittings.

Steel pressure blowers of many sizes are illustrated in a new pamphlet prepared by the Buffalo Forge Co., Buffalo, N. Y. A distinguishing feature of their construction is a solid peripheral shell to which the side plates are fitted tightly, a standard for the shaft of the blast-wheel being cast with each side plate for most types of the blower. The catalogue gives full dimensions of the various types and describes the fittings used with them when supplying blast to cupolas, furnaces, forge fires, sand blast machines and like plant.

An interesting sketch of the evolution of the briquetting press, written by B. C. White and illustrated by twelve engravings, has been published by the Henry S. Mould Co., Pittsburg. Beginning with designs prepared in 1896 for a machine for mixing and briquetting the flue dust of a blast furnace, it traces the development of various types of presses for different materials down to the present time.

Polyphase induction motors for constant speed are described in detail in a new circular issued by the Westinghouse Electric & Manufacturing Co. These motors are built for two and three-phase currents with 3,000, 3,600 and 7,200 alternations per minute, although they can be wound for other frequencies. The standard voltages are 200 and 400 volts for sizes up to 200 horse-power and 400 volts for those above, but the motors can be wound if desired for lower or higher voltages. Moreover, where the motor is to be used for cranes, elevators and other places where variable speed is desirable, slight changes in construction enable the machine to answer the requirements. The circular is well illustrated and provided with full tables of dimensions.

The industrial agent of the Lackawanna Railroad, Mr. Wm. B. Hunter, 26 Exchange Place, New York, has compiled a useful manual of the raw materials, shipping facilities, taxes, cost of labor and power, real estate values and any special inducements offered to manufacturers in the places on its system. Anyone contemplating erecting an industrial plant in this region will find the book of assistance in his search for a site.

The B. F. Sturtevant Co., Boston, has issued a new (fourth) edition of its 50-page illustrated catalogue of vertical and horizontal engines of various high-speed types ranging in capacity from 2 to 250 horse-power. Dimensions are given in considerable detail, and there is a useful table of horse-power constants per revolution for different mean effective pressures.

A few weeks ago the Twentieth Century Corliss engine of the Lane & Bodley Co., Cincinnati, was illustrated in these pages. A full description of its details and of the Columbian Corliss type has just appeared in a well-illustrated pamphlet which the builders are now distributing.

Personal and Obituary Notes.

Mr. Samuel A. Buchanan, of Kenton, has been elected city engineer of Bellefontaine, Ohio.

Mr. Philip H. Weber has been re-elected city engineer of Canton, Ohio, for a two-year term.

Mr. William Osborne, of Monmouth, Ill., has been appointed chief engineer and roadmaster of the Rock Island & Peoria R. R.

Mr. Charles Hart has been appointed superintendent of the Youngstown blast furnaces of the Republic Iron & Steel Co.

Mr. L. T. Haney, surveyor of Alexandria county, Va., has been appointed civil and mining engineer of the works of the Lackawanna Coal & Iron Co. at Vintondale, Pa.

Mr. Clarence Thompson has resigned the duties of chief draftsman of the American Bridge Co. works at Groton to accept a similar position with the National Bridge Co., Owego, N. Y.

Lieut.-Col. Oswald H. Ernst, Corps of Engineers, U. S. A., will report as engineer officer, Department of the Lakes, as well as engineer of the Northwest division, mentioned last week. Capt. Thos. H. Rees has been placed in command of one of the companies of the 1st Battalion of Engineers. Capt. Herbert Deakyne is to have charge of the St. Augustine office, and will be succeeded as secretary of the California Debris Commission by Lieut. Robert P. Johnston.

Col. Wm. H. Laing, superintendent of the Racine, Wis., Water Co., died in that city on August 5. Fourteen years ago he assumed the difficult duties of caring for the interests of this company in a community which was particularly disposed to criticism. He managed them well and his tact several times found a way to overcome difficulties which seemed insuperable at first. His abilities were well recognized by the American Water-Works Association, to which he contributed several papers and discussions, and for some years he was chairman of its finance committee.

Prof. Arthur L. Rice of the Pratt Institute has resigned his duties at that school to become the assistant to the secretary of the American Society of Mechanical Engineers. He was graduated from the Worcester Polytechnic Institute in 1891 and took some years of post-graduate work in electricity there and at Cornell. His development of the courses in mechanics and applied electricity at Pratt Institute has made him well known among instructors in such work. He will have charge of the development of the Society's library, its employment bureau and the arrangements for the winter reunions, besides relieving the secretary of routine duties.

Mr. Morris Knowles, Assoc. M. Am. Soc. C. E., has been appointed engineer in charge of the water filtration work at Pittsburg in place of Mr. William F. Miller, resigned. Mr. Knowles was graduated from the Massachusetts Institute of Technology in 1887 and has since then been mainly engaged professionally in water-works design and construction, and politically also, for he was for some years a member of the Water Board of Lawrence, Mass., where one of the first American sand filters was built. He has been connected with the East Jersey Water Company and the filtration investigations at Pittsburg and Philadelphia, and his appointment is one reflecting credit on the judgment of Mr. E. M. Bigelow, the director of public works.

Special Suction Pipe Arrangements were made necessary in a Brooklyn, N. Y., high-service pumping station during a shortage of water last spring. The low pressure in the distribution system from which the pumps obtain their supply was the source of great difficulty in the operation of the station and made it necessary to substitute light valve springs in the air chamber for the heavy ones previously used and to install a vacuum pump for the removal of the air which collected near the suction connections; this has operated very satisfactorily.

A Semi-Portable Engine and Boiler with Superheater, built by R. Wolf of Magdeburg, was recently tested by Professor L. Lewicke of Dresden, the results being given in the "Zeitschrift" of the Society of German Engineers. The boiler was of the cylindrical internally fired type, having fire-tubes leading from the firebox to a cylindrical shell lying partly inside the boiler, in which the superheater was placed, the latter consisting of a single branch of heavy wrought iron pipe coiled in a succession of flat spirals. The steam passing through these spirals was superheated by the hot gases on their way to the stack just beyond. The boiler heating surface was 332 square feet, the superheater surface 215 square feet and the grate 10 square feet. The engines were mounted on the boiler and were cross-compound condensing, having cylinders 9½ x 17¾ x 19 inches stroke, with a jet condenser and air and feed pumps driven from the flywheel shaft. On a seven-hours' test with steam at 176 pounds pressure heated to 626 degrees Fahr., the engine making 171 turns a minute, the brake horse-power was 107, and the indicated horse-power 116. Under these conditions the boiler evaporated 8.56 pounds of water per pound of coal with feed water at 95 degrees Fahr. and the engine consumed 10.6 pounds of water per indicated horse-power per hour. The coal per brake horse-power per hour was 1.35 pounds, and the thermal efficiency of the whole plant 18.9 per cent.

A New Masonry Caisson Construction for submerged foundations, recently patented by Capt. W. V. Judson, Corps of Engineers, U. S. A., consists essentially of a reinforced concrete shell with interior air spaces giving buoyancy enough for ready handling in the water. It can thus be built, launched and sunk more easily than large blocks of masonry can be built in place. Two types are sketched in the patent, in one of which the air chambers are designed to give enough buoyancy to float the caisson, and water or ballast is required to sink it in place on the natural or prepared foundation. In the other case the caisson is made heavy enough to sink. Obviously such caissons can be made with a great range of shape, dimensions and strength by proper proportions of the concrete walls and their steel reinforcement rods and can be made stable by filling them with sand or other suitable cheap materials. Mr. Edwin Thacher, M. Am. Soc. C. E., is associated with Captain Judson in introducing the use of these caissons for dock work, etc., and they have recently submitted a design for a dock front at Cleveland, on a pile and rip-rap foundation in about 20 feet of water. There is a lower tier of caissons 14 feet wide, 20 feet long and 12 feet high, with concrete-steel walls, top and bottom from 8 to 12 inches thick and three interior transverse partitions. There are vertical projections and grooves in the middles of the end walls to form joints between adjacent caissons, and 30 x 30-inch openings are left in the top of each chamber to enable them to be filled with sand after having been sunk by the admission of water through holes in the sides. On top of these caissons and flush with the front face, is a second course 10½ feet wide, 9 feet high and 20 feet long. These are similar to those in the lower course, and their tops are just above water level and support a solid concrete wall 5 feet high, built in place.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Governor's Island, N. Y.—Bids are wanted Aug. 28 for sinking an artesian well, as advertised in The Engineering Record.

Adrian, Mich.—Bids are wanted Aug. 13 for furnishing about 114 tons of 4-in. and 6-in. cast-iron water pipe with special castings for same; also for 29 gates and boxes, 10 hydrants, also for trenching, pipe-laying, etc., of about 8,000 ft. of 4-in. and 6-in. pipe. Frederick C. Bowerfind, Treas. Bd. of Guardians of the State Industrial Home for Girls.

Caldwell, N. J.—Boro. Clk. John J. Van Orden writes that on July 23 a vote was taken in favor of the issue of $20,000 bonds for water-works.

Minneapolis, Minn.—The City Council on Aug. 2 voted to award the contract for two 15,000,000-gal. pumps to the Holly Manufacturing Co., of Lockport, N. Y., for $200,800.

Lebanon, Ind.—City Engr. John W. Fulwider writes that the contract for a reservoir water well has been awarded to Kersey Bros., of Lebanon, Ind., at $3,475 for well 35 ft. deep, $125 for each additional ft.

Grand Meadow, Minn.—Recorder John Hudson writes that the proposition to construct water-works at a cost of about $5,500 will be voted upon Aug. 12.

San Jose, Cal.—Bids are wanted Sept. 2 for boring an artesian well upon the grounds of the Agnew State Hospital. T. S. Montgomery, Secy.

Batavia, Ill.—Bids are wanted Aug. 19 for furnishing pipe, hydrants, boxes, etc., also for labor necessary to make water main extensions. Geo. H. Burnett, City Clk.

Montreal, Que.—Bids are wanted Aug. 13 for furnishing and delivering water-works supplies for 1901, including special castings, lead pipe, meters, brass castings, etc. L. I. David, City Clk.

Candor, N. Y.—Village Clk. H. F. Booth writes that action will probably soon be taken on the proposition to construct water-works.

Danville, Va.—Clk. of the Council R. Beydon writes that the city proposes to lay new water mains, under the supervision of City Engr. Capt. C. A. Ballou. Estimated cost, $7,000.

Lansing, Ia.—City Clk. N. A. Nelson writes that it is proposed to construct water-works, but no action has as yet been taken.

St. Charles, Mo.—Richard H. Phillips, of St. Louis, has been appointed Consulting Engineer in charge of construction of municipal water-works plant at St. Charles. Carr Edwards, City Engr.; C. A. Stookey, of Belleville, Ill., contractor for the works, will begin construction at once.

Kahoka, Mo.—City Clk. Geo. W. Henry writes that on July 31 a vote was taken in favor of the issue of $12,800 bonds for water-works.

Matawan, N. J.—Boro. Clk. Wm. A. Rodgers writes that on Aug. 6 a vote was taken in favor of issuing $36,000 bonds for water-works.

Columbus Grove, O.—City Clk. Chas. Killen writes that it was voted Aug. 5 to issue $30,000 bonds for water-works.

Portage, Wis.—City Clk. Fred F. Goss writes that the city voted on July 31 to purchase the water plant. Price, $42,500.

Evansville, Wis.—City Clk. J. H. Potter writes that on July 31 a vote was taken in favor of granting to John H. Brown, of Chicago, Ill., a franchise to construct water-works and an electric light plant.

Springfield, O.—R. A. Boyd, Secy. of the Water-Works Trustees, writes that it is proposed to secure an additional water supply, but definite action has not yet been taken. F. A. Cook, of Toledo, O., Engr. in charge.

Minneapolis, Minn.—It is stated that bids are wanted Aug. 30 for 45 tons cast iron work, 72 tons structural work, 259 lbs. brass, sluice gates 36 x 48 in., etc. L. A. Lydiard, City Clk.

Hamilton, O.—Press reports state that the Department of Public Works proposes to install at once a 5,000,000-gal. pump.

Asheville, N. C.—C. T. Rawls, Chmn. Water Com., writes that a vote will be taken on the issue of $200,000 bonds for a gravity system of water-works. B. M. Lee, of Asheville, Engr.

Baird, Tex.—Press reports state that $4,500 bonds have been issued for water-works improvements.

Moline, Ill.—Bids are wanted Aug. 15 for constructing a 12-in. water main in several streets. Henry G. Paddock, Secy. Bd. Local Improv.

Sugar City, Colo.—A vote has been taken in favor of the issue of water-works bonds.

Wilmington, O.—Local press reports state that the Council will soon let contracts for the construction of water-works.

Westerly, R. I.—Local press reports state that this town has voted to have a water system at Watch Hill. Cost, $100,000.

Orange, N. J.—Bids are wanted Aug. 19 for the purchase of $90,000 water-works bonds.

Weatherford, Tex.—J. S. Thatcher, of Dallas, is preparing plans for water-works, to cost $45,000.

Carbondale, Ill.—The Carbondale Water-Works Co. has been incorporated with a capital stock of $40,000; incorporators, John H. Barton, John L. Kimmel, and Arthur Bayston.

Woodland, Minn.—Press reports state that water-works are to be constructed at an estimated cost of $26,000. Address, Woodland Water & Light Commrs.

Richmond, Utah.—The Richmond Water-works Co. has filed articles of incorporation. Capital stock, $6,000. Charles Z. Harris, Pres.; William Hendricks, Vice-Pres.; Jas. I. Shepard, Treas. and Sec'y.

Appleton, Wis.—Contracts for a municipal water-works plant will probably soon be let.

Austin, Minn.—The Water-Works Committee has passed a resolution recommending that an additional well be drilled to a depth of 250 ft.

Ishpeming, Mich.—Press reports state that this city proposes to put in meters throughout the water system.

Harrison, Ark.—Press reports state that C. A. Reese, of Fayetteville, Ark., has been engaged to make surveys with specifications and estimates for $50,000 water-works and sewerage systems.

Ft. Monroe, Va.—See "Government Work."

Troy, N. Y.—Bids are wanted Aug. 15 for $135,000 additional water-works bonds. Leroy Rickerson, Comptroller.

Dowagiac, Mich.—The Board of Public Works has under consideration the installation of a new pumping system at the city pumping station.

Waynesville, Mo.—It is proposed to issue $5,000 bonds for water-works.

Joliet, Ill.—Local press reports state that this year's appropriation bill will contain an item of $30,000 for the improvement of the water supply.

Lynchburg, Va.—In a recent report on the question of water filtration for Lynchburg, Consulting Engineer W. T. Brooke, of Norfolk, concurred with City Engr. C. L. DeMott in the recommendation of a slow sand filter plant, which it is estimated would cost $31,570, yearly maintenance, $4,056; the total estimated cost of proposed improvements is about $96,000, of which $21,204 is for a reservoir and $34,000 for 17,000 ft. of 30-in. pipe.

Starke, Fla.—E. P. Duncan, City Secy., writes that it is proposed to construct water-works at an estimated cost of $18,000, but that wells will be put down before plans or specifications are made. Collier & Brown, of Atlanta, Ga., Engrs.

New Berlin, N. Y.—Bids are wanted Aug. 21 for repairs to the reservoir requiring about 250 cu. yds. of concrete. C. J. Pratt, Pres. Bd. of Water Commrs. E. F. Musson, of Norwich, N. Y., Engr.

Newark Valley, N. Y.—It is stated that water-works are to be constructed.

Evanston, Ill.—Bids are wanted Aug. 15 for constructing a water main and sewer in Dempster St. Frank W. Gerould, Bd. Local Improv.

Salt Lake City, Utah.—City Engr. L. C. Kelsey writes that the following bids opened July 26 for the construction of the City Creek Pipe Line, were rejected, and new bids will be opened Aug. 12:

Items and Quantities.	P. J. Moran.	N. P. Glann Co.	Keifer & Rush.	Green & Reeve Co.
Excavating, 9,500 cu. yds....	$.55	$.66	$.40	$.60
Backfilling, 6,500 cu. yds....	.17	.11¾	.15	.20
Furnish and lay C. I. pipe:				
24-in., 5,920 lin. ft...........	6.25	5.55	5.695	7.35
20-in., 845 lin. ft...........	5.40	4.50	4.57	5.45
16-in., 790 lin. ft...........	3.40	3.20	3.04	3.75
Valves: 24-in., 2...............	318.00	300.00	313.87	332.00
20-in., 1	168.00	200.00	203.62	172.00
16-in., 2	87.00	106.00	108.69	95.00
Special castings, 6,000 lbs....	.055	.03	.04	.06
Brick masonry, 30 cu. yds..	11.00	9.00	26.00	13.00
Concrete mas., 30 cu. yds..	9.50	9.00	18.50	10.50
Cut stone mas., 30 cu. yds..	28.00	15.00	25.00	32.00
Cement plaster, 500 sq. yds.	.33	.[illegible]	.65	.40
Totals	$53,507	$48,652	$48,451	$61,331

Enterprise, Ore.—The Big Sheep Creek Water Ditch Co. will construct and operate an irrigation ditch in Wallowa County, and supply water for irrigation and domestic use. Capital, $10,000. J. A. Burleigh, J. F. Burleigh and W. S. Burleigh are the incorporators.

SEWERAGE AND SEWAGE DISPOSAL.

Williamsport, Pa.—Bids are wanted Aug. 13 for an 18-in. storm sewer on Penn St., 320 ft. long, and for 8-in. house sewer 550 ft. long on Hepburn St. George D. Snyder, City Engr.; Theo. Corman, City Clk.

Celina, O.—J. L. Pulskamp, Secy. of the Sewer Com., writes that the contract for the preparation of plans, specifications, etc., for sewerage and a sewage disposal plant has been awarded to John P. Force, of Columbus, O., for $625.

Little Falls, N. Y.—City Engr. E. Ten Eyck Lansing writes that two sewer extensions will be made this summer, ½ mile of vitrified pipe.

Baltimore, Md.—The City Engineer is about to build a 26-ft. brick arch on Boston St., at Harford Run sewer terminus, 70 ft. long. Estimated cost, $7,000.

Alton, Ill.—City Engr. E. E. Rutledge writes that plans are being prepared for a 10-ft. brick sewer 1,250 ft. long, estimated cost $25,000; also that petitions are being signed for sewers on Main and Bluff Sts.

Columbus, O.—The propositions to issue $2,500,000 sewer bonds and $200,000 electric light bonds were both defeated at the election held Aug. 3.

Bangor, Me.—The Supt. of Sewers is to enter at once on the construction of a brick trunk sewer, running from the present sewer at the Poor Farm up to the Barkesville District, so called; size, 4½ ft.; cost, $10,000.

Youngstown, O.—Bids are wanted Aug. 24 for the construction of a sewer in Wick Ave., Central Square and Market St. C. E. Cross, Clk. of City Commrs.

Akron, O.—City Engr. John W. Payne writes that the contract for constructing 3,066 ft. of 8 and 10-in. pipe sewer, with 3 manholes, in District No. 9, has been awarded to Chas. O'Neil, of Akron, for $4,955. Average depth of excavation, 21 ft.

Cincinnati, O.—Bids are wanted Aug. 19 for constructing sewer and drains in Laurel alley. Robt. Allison, Pres. Bd. Pub. Service.

Dayton, O.—Bids are wanted Sept. 3 for furnishing materials and constructing sanitary lateral sewers in part of Sewer Districts Nos. 4 and 5. Estimated quantities: 18,440 lin. ft. 8-in. sewer pipe, 2,710 lin. ft. 10-in. and 3,660 lin. ft. 12-in. Robt. H. Ferguson, City Comptroller.

Indianapolis, Ind.—Bids are wanted Aug. 16 for constructing sewers in portions of Tuxedo and 28th Sts. Albert Sahm, Chmn. Bd. Pub. Wks.

Irvington, Ind.—It is stated that bids are wanted Aug. 17 for constructing sewers in 5 streets. Simeon Frazier, Town Clk.

Camden, N. J.—A press report states that bids are wanted Aug. 20 for the construction of a number of sewers.

Albany, N. Y.—Local press reports state that plans are being prepared by the City Engineer and the engineers of the N. Y. C. R. R. for an intercepting sewer to extend from North Ferry St. to the southern line of the city.

Wyanotte, Mich.—The Common Council has passed a resolution ordering the Board of Public Works to prepare plans and specifications for a complete system of sewers.

Sandy Hill, N. Y.—The Village Board of Trustees has sold $62,000 sewer bonds.

Harrison, Ark.—See "Water."

Springfield, O.—The Board of Public Affairs has under consideration the proposition to construct a trunk sewer in the southwestern part of the city.

Cedar Rapids, Ia.—The City Council has ordered the construction of sanitary sewers in several streets.

Akron, O.—Bids are wanted Aug. 17 for the construction of a sewer on Vine St. Chas. H. Isbell, Clk. Bd. of City Commrs.

Milwaukee, Wis.—Bids are wanted Aug. 14 for the construction of a tunnel 12 ft. in diameter, being section No. 3 of the Kinnikinnic River Flushing Works Tunnel. Chas. J. Poetsch, Chmn. Bd. of Pub. Wks.

Glenville, O.—Bids are wanted Sept. 2 for the construction of storm water sewers in St. Clair St. and Gravel Road. Ira C. Farley, Village Clk.

Sharon, Pa.—Press reports state that a $93,000 sewer contract has been awarded to Wm. McIntyre, Sr., of Sharon.

Bowling Green, O.—Bids are wanted Aug. 28 for constructing cylindrical pipe sewers. Alex. Williamson, Clk.

Bids opened July 24 by the Drainage Commission of New Orleans for Lined and Covered Canals; the Quantities are given on the Lines with the Names of the Sections.

*Awarded contract.	Excavation; cu. yds.	Haul over 500 ft., per 1,000 ft.; cu. yds.	Brickw'k, Port. cem. mortar; cu. yds.	Concrete Steel Covers. 6-ft.; sq. yds.	8-ft.; sq. yds.	10-ft.; sq. yds.	12-ft.; sq. yds.	14-ft.; sq. yds.	Shell conc 1:3 Port. cement mortar; cu. yds.	Cem. plaster, ¾ in.; sq. yds.	Cypress foundat'n plank; M. ft.	Vitrified Clay Pipe. 36-in. lin. ft.	24-in. lin. ft.	18-in. lin. ft.	15-in. lin. ft.
Third St. System	43,000	23,000	4,500	2,400	1,700	3,000	100	100	3,300	6,700	370	6,000	800	600	450
Nash & Dowdle	$0.74	$0.14	$8.48	$2.12	$2.52	$2.90	$3.25	$3.65	$6.41	$0.65	$18.00	$3.29	$1.20	$0.79	$0.56
U. S. Construction Co.	.87	.10	8.20	2.33	2.75	3.12	3.48	3.87	6.70	.70	20.00	3.75	1.25	.68	.49
National Cont'g Co.*	.78	.085	8.40	2.30	2.80	3.15	3.70	4.10	7.20	.60	15.00	4.30	1.39	.80	.59
Nashville System	55,000	16,000	6,000	4,200	1,000	1,300	3,000	100	4,500	9,000	500	5,000	700	1,400	300
Nash & Dowdle*	$.74	$.14	$8.48	$2.12	$2.52	$2.90	$3.25	$3.65	$6.41	$.65	$18.00	$3.29	$1.20	$.79	$.56
U. S. Construction Co.	.87	.25	8.25	2.33	2.75	3.12	3.48	3.87	6.70	.70	20.00	3.75	1.20	.68	.49
National Cont'g Co.	.78	.085	8.70	2.30	2.80	3.20	3.60	4.15	6.70	.62	15.00	4.30	1.40	.80	.56
St. Bernard System	47,000	30,000	5,800	4,000	900	4,000	300	200	4,000	9,000	464	2,800	1,200	300	500
Nash & Dowdle	$.74	$.14	$8.48	$2.12	$2.52	$2.90	$3.25	$3.65	$6.41	$.65	$18.00	$3.29	$1.20	$.79	$.56
United Eng. & Con'g Co.	1.10	.10	9.25	1.95	2.45	2.45	2.95	3.45	6.75	.65	20.00	3.50	1.00	.60	.45
U. S. Construction Co.	.87	.12	8.20	2.33	2.75	3.12	3.48	3.87	6.70	.70	20.00	3.75	1.25	.68	.49
National Cont'g Co.*	.75	.08	8.05	2.20	2.65	3.00	3.55	3.90	6.90	.60	15.00	4.15	1.28	.77	.56
Algiers System	25,000	7,000	3,000	1,000	200	200	100	100	2,100	4,500	250	1,800	200	900	200
Nash & Dowdle	$.74	$.14	$8.98	$2.18	$2.60	$2.97	$3.33	$3.72	$6.99	$.74	$21.00	$3.33	$1.25	$.85	$.60
Jno. McCoy, N. Orleans*	.53	.06	9.54	2.33	2.75	3.12	3.48	3.87	5.90	.54	17.00	4.45	1.29	.79	.60
U. S. Construction Co.	.87	.25	8.75	2.33	2.75	3.12	3.48	3.87	7.35	.70	21.00	4.00	1.30	.73	.52
National Cont'g Co.	.85	.10	10.00	2.40	3.00	3.35	3.60	4.00	7.10	.65	18.00	5.00	1.50	.90	.65
Lowerline System	53,000	20,000	6,100	4,000	3,200	100	100	100	4,800	10,000	530	4,000	600	2,000	400
Nash & Dowdle*	$.74	$.14	$8.48	$2.12	$2.52	$2.90	$3.25	$3.65	$6.41	$.65	$18.00	$3.29	$1.20	$.79	$.56
U. S. Const'n Co.	.90	.12	8.25	2.33	2.75	3.12	3.48	3.87	6.70	.70	20.00	3.75	1.20	.68	.49
National Cont'g Co.	.80	.09	9.00	2.38	3.00	3.30	3.60	4.15	6.95	.62	17.00	4.50	1.40	.80	.60

*Awarded contract.	Vitrified Clay Pipe. 12-in. lin. ft.	8-in. lin. ft.	6-in. lin. ft.	Oyster shells in place, cu. yds.	Cinders in place, cu. yds.	Old curb reset, sq. ft.	L'ke shells in place, cu. yds.	Cypress curb, M. ft.	Stone curb, sq. ft.	Pavement taken up and relaid. Asphalt, sq. yds.	Brick, sq. yds.	Gravel, sq. yds.	Square block, sq. yds.	Cobble stone, sq. yds.	Total.
Third St. System	300	1,600	1,100	750	600	8,400	100	50	500	600	100	6,000	100	100	
Nash & Dowdle	$0.40	$0.20	$0.14	$1.60	$1.80	$0.24	$1.65	$24.00	$0.40	$3.15	$1.70	$0.55	$0.75	$0.20	$183,226
U. S. Construction Co.	.43	.25	.20	1.40	1.25	.12	2.50	27.00	.57	3.00	2.20	1.50	.75	.65	190,303
National Cont'g Co.*	.41	.24	.18	1.20	1.05	.16	2.35	25.00	.60	3.00	1.70	.50	.90	.20	180,877
Nashville System	300	1,100	1,500	1,000	400	200	200	80	200	300	100	3,800	100	100	
Nash & Dowdle*	$.40	$.20	$.14	$1.60	$1.80	$.24	$1.65	$24.00	$.40	$3.15	$1.70	$.55	$.75	$.20	$194,416
U. S. Construction Co.	.43	.25	.20	1.40	1.25	.12	2.25	27.00	.57	3.00	2.00	1.50	.75	.65	216,200
National Cont'g Co.	.40	.23	.17	1.60	1.70	.17	2.15	26.00	.60	3.00	1.60	.50	.85	.20	202,650
St. Bernard System	300	600	1,800	1,000	800	17,000	500	20	1,000	100	800	100	4,500	7,000	
Nash & Dowdle	$.40	$.20	$.14	$1.60	$10.80	$.24	$1.65	$24.00	$.40	$3.15	$1.70	$.55	$.75	$.20	$187,450
United Eng. & Con'g Co.	.35	.25	.15	1.30	1.30	.12	1.90	25.00	.65	3.00	1.50	1.25	.25	.25	200,770
U. S. Construction Co.	.43	.25	.20	1.40	1.25	.12	2.50	27.00	.57	3.00	2.20	1.50	.75	.65	197,746
National Cont'g Co.*	.40	.23	.17	1.20	.95	.15	2.00	25.00	.50	2.40	1.45	.60	.75	.13	180,616
Algiers System	200	500	700	500	150	100	100	40	100	100	100	100	100	100	
Nash & Dowdle	$.49	$.29	$.19	$2.00	$2.00	$.29	$2.00	$25.00	$.65	$4.25	$1.95	$.75	$.95	$.30	$85,577
Jno. McCoy, N. Orleans*	.43	.24	.18	1.45	1.17	.08	1.92	30.00	.45	3.00	2.50	1.35	.50	.30	78,561
U. S. Construction Co.	.43	.25	.20	1.40	1.35	.12	2.50	28.00	.60	3.00	2.20	1.50	.75	.65	91,301
National Cont'g Co.	.45	.25	.20	1.65	1.75	.16	2.10	25.00	.60	2.50	1.60	.60	.85	.20	92,959
Lowerline System	400	1,500	1,800	1,100	350	200	200	100	200	250	100	400	100	100	
Nash & Dowdle*	$.40	$.20	$.14	$1.60	$1.80	$.24	$1.65	$24.00	$.40	$3.15	$1.70	$.55	$.75	$.20	$183,797
U. S. Const'n Co.	.43	.25	20	1.40	1.25	.12	2.25	27.00	.57	3.00	2.20	1.50	.75	.65	196,911
National Cont'g Co.	.40	.23	.17	1.65	1.75	.16	2.20	25.00	.60	3.00	1.60	.60	.85	.20	197,961

New Orleans, La.—Bids were opened July 24 by the Drainage Commission, as follows:

For St. Bernard No. 3 pumping station, Nash & Dowdle, Chicago, $197,364 with Morris pumps and $196,364 with Root pumps; United Engineering & Contracting Co., New York City, $182,265; United States Construction Co., Milwaukee, $173,170, and National Contracting Co., New York City, $180,005. The bid of the U. S. Constn. Co., which received the award July 30, is given in detail in the accompanying table:

St. Bernard Pumping Station, No. 3, New Orleans.	
Excavation, 8,000 cu. yds.	$.56
Refilling, 1,000 cu. yds.	.50
Dry filling, as sand, old mortar, 200 cu. yds.	1.25
Haul to spoil bank per 1,000 ft., 500 cu. yds.	.30
Plant complete above floor line	111,100.00
Transmission line	11,900.00
Brick masonry, 1,500 cu. yds.	8.10
Shell concrete, 500 cu. yds.	7.20
Cement paving, ¾-in., 600 sq. yds.	.65
Stone-Concrete-expanded metal slabs:	
6 inches thick, 100 sq. yds.	2.25
4 inches thick, 100 sq. yds.	1.75
Rolled steel, 5 tons	58.00
Buckle plates, 1 ton	80.00
Wrought iron, 1 ton	80.00
Cast iron, 2 tons	70.00
Yellow pine, 200 M. ft.	23.00
Sheet piling, 120 M. ft.	30.00
Yellow-pine piling, 80,000 lin. ft.	.24
Vitrified clay pipe, 8-in., 100 lin. ft.	.25
Vitrified clay pipe, 6-in., 100 lin. ft.	.20
Vitrified clay pipe, 4-in., 100 lin. ft.	.15
Stone filling, 50 cu. yds.	2.50
Oyster shells, 50 cu. yds.	1.50

For lined and covered canals, 5 to 14 ft. wide and 6 to 10 ft. deep, namely: Third St. system, 8,000 lin. ft. of canals; Nashville Ave. system, 10,000 lin. ft. of canals; St. Bernard system, 10,000 lin. ft.; Algiers system, 4,000 ft.; Lowerline and Leonidas system, 12,000 lin. ft., given in detail in the large table herewith.

For open and unlined canals in Algiers system, as follows:

Items.	John J. Keegan.*	Nash & Dowdle.	U. S. Const'n Co.
Excavation, 45,000 cu. yds.	$.265	$.99	$.47
Haul within 3,000 ft., 10,000 cu. yds.	.14	.20	.25
Yellow pine, 25 M. ft.	22.50	37.50	30.00
Total	$13,888	$47,488	$24,400

*Awarded contract.

Waycross, Ga.—The City Council has ordered the Water-Works Commissioners to proceed with the extension of the sewers to the Satilla River in compliance with the mandate of the Supreme Court.

Brooklyn, N. Y.—The Board of Public Improvements has authorized the construction of sewers in numerous streets of Ft. Hamilton.

Newburyport, Mass.—The City Council Committee on Finance has voted authorizing the issue of $55,000 sewer bonds.

El Paso, Tex.—The question of providing for the destruction or purification of the city sewage is before the Sanitary Committee.

Pasadena, Cal.—City Engineer Allin is about to prepare estimates of the cost of an outfall sewer system for the east side of the city.

Niagara Falls, N. Y.—The total cost of constructing sewers for which application and recommendation have been made would be about $200,000.

Lexington, Ky.—The estimated cost of constructing tne proposed tunnel sewer from the C. & O. freight depot west to the tunnel under the Palace Hotel is $4,000.

Scio, O.—It is proposed to construct a sewer system at a cost of $11,000.

Oil City, Pa.—See "Paving and Roadmaking."

Garrett, Ill.—The Drainage Commissioners of Drainage District By User No. 1 will receive bids Aug. 24 for constructing about 18,567 ft. of from 24 to 8-in. tile drains. John F. Adolph, Clk. Commrs.

Coldwater, Mich.—Press reports state that this city is to have a complete sewerage system.

Freeport, Ill.—The Council has passed an ordinance providing for a storm sewer on Taylor Ave. Estimated cost, $5,772.

Belleville, N. J.—James Owen has been appointed consulting engineer to report on the question of sewerage.

Webster City, Ia.—City Clk. P. M. Banks writes that bids received Aug. 5 for the construction of 2.500 ft. of 18-in. pipe sewer in Second St. have been rejected; new bids will be received Aug. 19.

Plattsburg, N. Y.—Horace Andrews, 51 State St., Albany, N. Y., Engr. of the Plattsburg Improvement Committee, writes that the following bids were opened Aug. 1 (bidders all of Plattsburg), for constructing about 3 miles of sewers, together with a submerged outlet into Lake Champlain: * Contract awarded. † Brick sewers are circular, 4 inches thick, of vitrified paving bricks. ** Prices are for pipes furnished and laid complete. Average depth, 8.74 ft.; maximum, 16.3 ft. †† Y branch prices include 2 ft. of pipe with branch.

Bidders.	†1 ring br. sewer. 38-in., 2,010 ft.	30-in., 1,340 ft.	27-in., 1,230 ft.	8-in. outlet, 1,000 ft.	24-in. d. s. vit. pipe, 612 ft.	**Vit. pipe. 15-in., 4,790 ft.	12-in., 1,900 ft.	10-in., 2,690 ft.	8-in., 20 ft.	6-in., 400 ft.	††Y branches. 24-in., 15.	15-in., 233.	12-in., 24.	10-in., 143.	Storm-water overflow.	Manholes, 27.	Lampholes, 6.	Rec. basins. 24.	Total.
*W. H. Brewster	$3.10	$2.62	$2.47	$1.30	$1.77	$1.05	$.95	$.68	$.45	$.45	$5.25	$3.10	$2.00	$1.30	$100	$47	$9.00	$27	$27,122
M. J. Fitzpatrick	3.15	2.56	2.53	3.21	2.04	1.32	.82	.61	.35	.31	6.01	2.31	1.61	1.15	100	54	14.50	60	30,901
H. H. Rogers	2.40	2.20	2.10	4.50	2.00	1.35	1.15	.75	.65	.50	7.00	4.10	3.35	2.50	150	50	15.00	70	31,729
McQuillan & Pennington	4.00	3.25	3.00	2.50	2.50	1.20	1.00	.90	.65	.50	6.00	2.20	1.75	1.50	200	50	10.00	65	34,426

Boston, Mass.—The following bids were opened Aug. 6 by the Metropolitan Water & Sewerage Board for section 30, Neponset Valley sewer, West Roxbury, Newton and Brookline: A, H. P. Nawn, Boston, Mass., $100,454; B, H. A. Hanscom Co., Boston, Mass., $52,040; C, F. W. McCusker & Co., Waltham, Mass., $33,027; D, Thomas J. Kelley, Brookline, Mass., $30,811. Detail bids for above work were as follows:

Bidders.	Earth excav. and refill. 2,356 lin. ft. 24-in. br. sewer.	2,652 lin. ft. 18-in. pipe sew'r.	1,710 lin. ft. 15-in. pipe sew'r.	Brick mas'ry. 100 cu. yds. American.	250 cu. yds. Portland.	1,000 cu. yds. con. mas'ry, Port.	20 M. ft. B. M. sp. lum. in trench.	3,500 lin. ft. sp'ce piles.	500 c. y. r'k exc. in tr'ch.
A	$14.00	$10.00	$10.00	$18	$20	$10.00	$50	$0.30	$10
B	5.00	5.00	5.00	16	18	8.00	40	0.30	5
C	2.75	2.75	3.00	14	15	5.50	30	0.25	[illegible]
D	2.50	2.75	2.75	15	18	5.00	20	0.15	2

Sheboygan, Wis.—City Engr. C. U. Boley writes that the following bids for sewer construction were opened Aug. 5:

Bidders.	492 lin. ft. pipe sewer, 48-in.	1,700 lin. ft. 48-in. brick sewer.	800 lin. ft. 15-in. pipe sewer.	840 lin. ft. 10-in. pipe sewer.	17 manholes.	Totals.
Jas. H. Roche, Chicago, Ill.	$12.00	$3.43	$1.00	$.80	$27	$13,666
C. Ackerman, Sheboygan	11.00	3.75	1.05	.80	24	13,707
R. Nommenson, Sheboygan	11.00	4.00	.90	.75	22	13,936
Harding & Nelson, Racine, Wis.	11.50	4.50	.85	.70	35	15,171
Jas. Cape & Sons, Racine, Wis.	12.00	4.00	1.00	.80	30	14,686
Reichart Const. Co., Racine	11.50	4.20	.85	.70	28	14,542
*Jas. Healy, Morgan Park, Ill.	12.00	3.25	1.25	.65	30	13,485

*Contract awarded.

South Omaha, Neb.—Local press reports state that the total estimated cost of constructing the proposed sewer to the river is $120,000.

Evanston, Ill.—See "Water."

Houston, Tex.—All bids opened July 29 for the Hardy St. brick drain, estimated to cost about $50,000, have been rejected.

Bozeman, Mont.—Engr. in Charge S. H. Crookes, of Livingston, Mont., writes that the following bids were opened Aug. 1 for sewer construction in District No. 3, the work to include 12,000 ft. of 10 to 6-in. pipe sewers, 22 manholes and 4 flush tanks; average depth of trench, 10 ft., to be excavated in gravel: James Ryan, Butte, Mont., $12,059; E. C. Culley, Livingston, Mont., $14,490; T. R. Hinds, Butte, Mont., $14,796; Nicholas Hughes, Butte, Mont., $17,846; Jas. Kennedy, Butte, Mont., $15,748; Devitt & Walsh, Bozeman, Mont., $14,719.

New York, N. Y.—The following bids were opened Aug. 7 by Jas. Kane, Commr. of Sewers, for a sewer in Hoe St., Boro. of Bronx: J. S. Rogers, $11,681; Jno. C. Rodgers, Jr., $11,843; P. F. Brennan, $11,394; Jno. J. McQuade, $10,753; Watson Vredenburgh, Jr., 225 W. 139th St., $10,327; A. X. Phelan, $11,626. The detailed bid of Watson Vredenburg, Jr., who received the contract, is as follows: $8.92 per lin. ft. for 284, 384 and 524 lin. ft. of 18, 15 and 12-in. vitrified pipe sewer; 50 cts. each for 320 spurs; $50 each for 12 manholes; $150 each for 2 receiving basins and $30 per M. ft. for 5 M. ft. timber.

BRIDGES.

Deer Park, N. Y.—The Town Board reports in favor of rebuilding King St. bridge.

Plato, Ill.—Bids are wanted Aug. 17 for the substructure and superstructure of a 252-ft. highway bridge on stone masonry. For specifications address the Town Clerk of Watseka, Ill., or Ira O. Baker, of Champaign, Ill., Engineer.

Saginaw, Mich.—City Engr. H. E. Terry writes that it is proposed to build a bridge at Genesee Ave., but that the matter is not yet decided. Estimated cost of bridge if built, $200,000.

Milwaukee, Wis.—The Citizens' Harbor Committe of Ten recommends in 1st report, which has been adopted, that the Muskego Ave. bridge and the C. M. & St. P. Ry. bridge east of West Water St., be replaced by bascule bridges and that provision for 24-ft. depth be made in the erection of same. An ordinance for $100,000 bond issue for West Water St. will be introduced at special meeting. Mayor Rose in a communication to the Common Council recomends the expenditure of $250,000 after Jan. 1st next for harbor improvements, out of which 2 more bascule bridges may be erected and dredging done to the amount of $75,000.

Doylestown, Pa.—It is stated that bids are wanted Aug. 29 by the Board of County Commissioners for a bridge to be built in Tullytown over Martin's Creek.

La Moure, N. D.—Bids are wanted Sept. 3 for building two combination or steel bridges across James River, one bridge to have a 75-ft. span resting on 4 tubular steel casing, the other bridge to have a 126-ft span resting on 4 tubular steel casing. C. J. Allister, Co. Aud.

Towanda, Pa.—Bids are wanted Aug. 13 for the superstructure of four highway bridges. H. M. Spalding, Co. Commr.

Dublin, Ga.—Geo. H. Crafts, Atlanta, is reported to have contract, in amount $10,436, for a steel bridge over Oconee River.

Greeneville, Tenn.—The American Steel Co., Cincinnati, O., according to local reports, has received the contract for 3, and O. J. Cope, of Chattanooga, the contract for 4, iron bridges, for which $37,000 has been appropriated.

Sunnyside, N. J.—The Board of Freeholders of Hunterdon County is said to have authorized the construction of a 128-ft. bridge.

Worcester, Mass.—The $10,000 James St. bridge contract has, according to press reports, been awarded to the Eastern Bridge & Structural Co., of Worcester.

Philadelphia, Pa.—The Board of Supervisors has approved the plan of the Pennsylvania Railroad bridge to replace one at 52d St.

Elkton, Md.—Bids received for building a bridge across Sassafras River are reported as follows: American Bridge Co., $10,122; King Bridge Co., $7,850; York Bridge Co., York, Pa., awarded contract, $7,779.

Almonte, Ont.—It is stated that Keating, of Ottawa, and McCuaig, of Arnprior, have received the contract for a $13,000 stone bridge.

Miami, O.—The Toledo Bridge Co. is reported to have received the contract for a 1,400-ton bridge for the Toledo Terminal R. R.

Toledo, O.—M. Rabbitt & Sons were lowest bidders for rebuilding Cherry St. bridge ice breakers and center pier protection, amount as reported, $9,419.46.

Fort Dodge, Ia.—Press reports state that the Chicago Great Western R. R. bridge across Des Moines River, which is to be about 3,000 ft. long, will be built this fall.

McKittrick, Mo.—It is reported that the County Court of Montgomery County is considering the erection of a 140-ft. span steel bridge. T. L. Cardwell, County Surveyor, New Florence, Mo.

Niagara, Wis.—The Marinette County Supervisors are reported to have decided to build the $12,000 bridge between this place and Quinnesec, Mich.

Springfield, Mo.—The County Court has reported favorably on a 144-ft. bridge over James River, to cost about $5,600.

Anderson, Ind.—The Wabash Bridge & Iron Co., Wabash, Ind., is reported to have the contract for a $30,000 steel bridge for the Big Four R. R. across White River.

Sault Ste. Marie, Mich.—It is stated that the Board of Public Works wants estimates for constructing an iron bridge across the power canal at Bingham Ave.

South Omaha, Neb.—The Union Pacific R. R. and the Union Stock Yards are considering the construction of an $80,000 viaduct at O St.

St. Clairsville, O.—Bids with plans and specifications are wanted Aug. 26 for furnishing material and constructing a steel bridge superstructure over Wheeling Creek at Maynard, bridge to be 100 ft. span, roadway 16 ft. wide. M. Aldredge, Co. Aud.

Indianapolis, Ind.—It is stated that bids are wanted Aug. 15 for constructing a bridge over Crooked Creek near North Augusta and a bridge over Dog Run at Munters Farm. Harry B. Smith, County Aud.

Syracuse, N. Y.—Bids are wanted Aug. 12 for constructing a bridge over Onondaga Creek, at Brighton Ave. Robt. H. Jones, Clk. Bd. of Contract & Supply.

Decatur, Ill.—The Macon County Board is said to have granted a petition for two bridges.

Athens, O.—Bids are wanted Aug. 23 for one stone pier and two stone abutments at Six Ford, York Township. W. F. Scott, Co. Aud.

Kempton, Pa.—A new county bridge is to be erected near this place; Alfred Gunkle, County Commr.

Toledo, O.—Bids will be received at the office of R. D. Potter, Supt. & Harbor Master, until Sept. 3 for furnishing material and rebuilding the south abutment at Lafayette St. bridge.

Olivia, Minn.—It is stated that bids are wanted Aug. 15 for constructing a steel bridge 139 ft. long across Minnesota River at Morton. J. T. Brooks, Co. Aud.

Murphysboro, Ill.—The township commissioners and bridge committee have chosen a site for a $5,000 bridge; Henry Arbeiter, member of com.

West Superior, Wis.—An 800-ft. bridge on the Eastern Railway of Minnesota over St. Louis River, is reported collapsed.

Plainfield, N. J.—Wm. Westphal has been made chairman of a committee to look after construction of a bridge over Cedar Brook on Netherwood Ave.

Ft. Worth, Tex.—The Council has authorized letting the contract for a steel viaduct across the Texas & Pacific Ry. tracks to L. S. Leversedge & Co., of this place.

No. Henderson, Ill.—It is reported that the Mercer County Board proposes to erect a bridge in this place. Address Jno. Brady, Aledo.

Ogden, Utah.—The County Commrs. have, it is reported, decided to rebuild a steel bridge recently destroyed.

Utica, N. Y.—The following bids were received for bridges over Mohawk River, *a*, at Genesee St.; *b*, at Park Ave.: Penn Bridge Co., Beaver Falls, Pa., *a*, $35,500; *b*, $23,500; Owego Bridge Co., *a*, 12 plans, $27,800 to $45,000; *b*, 6 plans, $15,000 to $25,000; American Bridge Co., *a* and *b* together, $65,000; Canton, O., Bridge Co., *a*, $35,250; *b*, $23,600; Berlin Construction Co., of Conn. and N. Y., *a*, $36,000; *b*, $22,000.

PAVING AND ROADMAKING.

Indianapolis, Ind.—Bids are wanted Aug. 16 for paving a portion of Sciota St. with brick. Albert Sahm, Chmn. Bd. Pub. Wks.

Sheraden, Pa.—Bids will be received by Trimble & Miller, Boro. Engrs., 430 4th Ave., Aug. 16, for grading, curbing, paving and otherwise improving 4 streets.

Green Bay, Wis.—It is stated that bids are wanted Aug. 26 for paving certain streets.

Wapakoneta, O.—City Engr. Samuel Craig writes that the contract for paving Auglaize St. has been awarded to David A. Onkst, of Dayton, at 70 cts. per sq. yd. for brick; total amount of contract, $10,504.

Palestine, Tex.—City Sec'y C. A. Sterne writes that it is proposed to expend $40,000 for street paving. Material not yet decided upon.

Swissvale, Pa.—Boro. Engr. C. B. Judd, Park Bldg., Pittsburg, writes that the contract for paving Delaware Ave. has been awarded to Sweeney & Houston, of Pittsburg, as follows: 2,700 lin. ft. grading at 64 cts.; 1,750 cu. yds. grading at 65 cts.; 3,700 sq. yds. paving at $1.54; 100 cu. yds. broken stone at $3; total, $8,864.

Windber, Pa.—Frank Lowry, of Windber, has received the contract for paving a number of streets with white vitrified brick; reported price, $1.73 per sq. yd.; total, $24,000.

Marquette, Mich.—The Street Committee has been authorized to prepare specifications for brick paving.

Reno, Nev.—It is stated that bids are wanted Aug. 20 for grading and paving in Commercial Row. W. A. Fogg, Clk.

Youngstown, O.—Bids are wanted Aug. 24 for paving portions of three streets. C. E. Cross, Clk. of City Commrs.

Iowa City, Ia.—Bids are wanted Aug. 16 for paving portions of College and Summit Sts., in all, 3,407 ft., new curbing of stone, 4,720 ft., old curbing reset, 3,911 cu. yds. grading and 18,809 sq. yds. brick paving; bids will also be received at the same time for paving a portion of Market St., 3,970 ft. new curbing of stone, 12,290 sq. yds. brick paving, etc. Chas. S. Magowan, City Engr. J. W. Holland, City Clk.

New Haven, Conn.—Bids are wanted Aug. 15 for paving Church St. from Chapel to Elm Sts. with Trinidad asphalt. C. W. Kelly, City Engr.

Lowell, Mass.—The Common Council has voted to borrow about $118,000, of which $26,000 will be used for macadamizing and $55,000 for smooth paving.

Maryville, O.—The lowest bid received for paving West 6th St. with brick is stated to have been from Evan Evans, of Cincinnati, at $2.91 per ft.; total, $8,000.

Cedar Rapids, Ia.—Bids are wanted Aug. 15 for paving with asphalt to a width of 30 ft., with necessary curbing, on 8th Ave., from 12th to 22d St. P. M. Plumb, Mayor; S. N. Parsons, Engr.

Connecticut.—The following towns have each appropriated $9,000 for road improvements: Canaan, Enfield, Greenwich, Watertown, Darien, Winchester, Bristol, Westbrook, Westport, Vernon and Stamford.

Sheboygan, Wis.—City Engr. C. U. Boley writes that 12,567 sq. yds. of granite top macadam pavement is to be laid (9-in. limestone, 3-in. granite top), with 5,488 lin. ft. of stone curbing, etc.

Oklahoma, Okla. Ter.—Press reports state that on Aug. 3 the Council let the contract for paving the business portion of the city with brick to F. L. Kramer, with 10-year guarantee at $1.85 per sq. yd.

Laporte, Ind.—The County Commissioners are stated to have awarded a contract to A. Runyan & Co., of Bedford, for the construction of 21 miles of macadamized roads in Center and Springfield townships, for $88,675.

Independence, Mo.—Colyer Bros., of Independence, are stated to have received 2 contracts for the construction of macadam roads, in all about 5 miles, at $1.03½ and $1.05 per cu. yd.

Indianapolis, Ind.—The contract for the Meridian St. pavement from Fall Creek to 34th St. is stated to have been awarded to the Hoosier Construction Co. at $6.04 per lin. ft. The contract provides for a combination curb and gutter.

Grand Rapids, Mich.—The contract for paving a portion of North Division St. with asphalt block is stated to have been awarded to H. Vander Veen, of Grand Rapids, for $11,920.

Moline, Ill.—Separate bids are wanted Aug. 15 for paving as follows: 20th St., 3,650 sq. yds. asphalt and brick, estimated cost $10,162; 22d St., 3,420 sq. yds. asphalt and brick, estimated cost $9,824; 2d Ave., 3,193 sq. yds. brick, estimated cost, $5,243; alley between 4th and 5th Aves. brick, 4,163 sq. yds., estimated cost $6,389. Henry G. Paddock, Secy., and P. H. Wessel, Pres., Bd. of Local Imp.

Leechburg, Pa.—Bids are wanted Aug. 14 for the following material and work: 1,400 lin. ft. of curbing, 126,000 vit. curbing brick, 2,900 ft. of 8-in. and 620 ft. 12-in. sewer pipe (all f. o. b. Leechburg); 700 cu. yds. grading, 2,111 sq. yds. brick paving, laying 3,520 ft. 8- and 12-in. pipe sewer, and material and labor for 7 manholes and 5 flush tanks. John H. Hill, Boro. Secy.; Wilson & Smith, of Sharpsburg, Pa., Engrs.

Wilkesbarre, Pa.—Bids are wanted Aug. 14 for furnishing and placing curb in North and South Main and Scott Sts.; bids are also wanted until the same date for brick paving with Clearfield repressed blocks on two sections of Main St. D. W. Jones, Joint Chmn. Street Com.; Fred H. Gates, City Clk.

Muscatine, Ia.—Bids are wanted Aug. 13 for about 22,000 sq. yds. brick paving. Jas. J. Ryan, City Engr.

Freeport, Ill.—The Council has pased an ordinance providing for the paving of Stephenson St. 17,995 yds. with brick. Estimated cost, $31,106.

Syracuse, N. Y.—The Board of Contract & Supply will on August 12 award to the Syracuse Improvement Co. the contract for resurfacing James St. for $13,832. Price bid for asphalt was 98 cts. per sq. yd.

Des Moines, Ia.—Bids are wanted Aug. 28 for paving Brattleboro and 29th Sts. with brick. G. A. Eberhart, Chmn. Bd. Pub. Wks.

Oil City, Pa.—Bids are wanted Aug. 12 for paving and curbing State St. and for a sewer on Wilson Ave. S. W. Barnhart, Controller.

Williamsport, Pa.—Bids are wanted Aug. 13 for 3,540 sq. yds of brick paving on Penn St. Geo. D. Snyder, City Engr.; Theo. Corman, City Clk.

Marion, Ia.—Mayor J. M. Plumb writes that 9 blocks are to be paved with asphalt, bids will be opened Sept. 15. S. N. Parsons, Engr.

Cambridge, O.—Bids are wanted Aug. 31 for improving Seventh St., approximate estimates 1,615 sq. yds. of block paving, 848 lin. ft. straight curb, etc. O. M. Hoge, City Engr.

Baltimore, Md.—Bids are wanted Aug. 14 for grading, paving and curbing a portion of Bayard St. with asphalt block. Thos. G. Hayes, Pres. Bd. of Awards; B. T. Fendall, City Engr.

Vailsburg N. J.—Bids are wanted Aug. 26 for the improvement of several streets by grading, curbing and the construction of artificial stone walks, in all 47,902 sq. ft. of stone walks. Thos. Connelly, Mayor; Eugene A. McMurray, Boro. Engr., 22 Clinton St., Newark, N. J.

Louisville, Ky.—The contract for paving Broadway (12,276 sq. yds. resurfacing with asphalt) has been awarded to the Green River Asphalt Co., of Louisville, at $1.44 per sq. yd.

Camden, N. J.—The Parkside Land Co. is considering the macadamizing of about 3 miles of streets, with vitrified brick gutters, curbing and shade trees.

Cape May, N. J.—The Board of Freeholders has appointed a committee to prepare specifications and plans and secure bids for a county road to be built to Five-Mile Beach connecting with the mainland the resorts of Anglesea, Wildwood and Holly Beach.

Bloomfield, Conn.—See "Public Buildings."

Woonsocket, R. I.—Contracts will soon be let for macadamizing 1½ miles of street. Frank H. Mills, City Engr.

Bay City, Mich.—A portion of Lincoln Ave is to be paved with brick.

Auburn, N. Y.—City Surveyor D. F. Austin writes that the contract for about 12,000 yds. of asphalt paving has been awarded to the Barber Asphalt Paving Co., at $1.97 per yd.

Pontiac, Mich.—The contract for paving Pike St. is stated to have been awarded to Lennane Bros., of Detroit, at $12.208.

Fredonia, N. Y.—Paving bonds amounting to $14,000 were sold Aug. 6.

New York, N. Y.—Bids are wanted Aug. 20 for repaving with asphalt block on concrete foundation, a portion of 27th St., work to include 4,530 sq. yds. of paving, 2,070 lin. ft. new curb, etc.; also for asphalt paving on Varick St., using present pavement relaid as foundation, work to include 14,350 sq. yds. of old stone pavement relaid, 14,100 sq. yds. paving, 5,540 lin. ft. new curbstone, etc.; also for paving a portion of Freeman St. with asphalt on concrete foundation, work to include 6,925 sq. yds. of paving, 1,410 cu. yds. concrete, 1,000 lin. ft. new curb, etc. Jas. P. Keating, Commr. of Highways.

Brooklyn, N. Y.—Bids are wanted Aug. 20 for paving with granite block on concrete foundation, a portion of Georgia Ave., work to include 3,021 sq. yds. paving, 1,738 lin. ft. new curb, 8,375 sq. ft. new flagstone, etc. Jas. P. Keating, Commr. of Highways, New York City.

Elwood, Ind.—Bids are wanted Aug. 23 for building a joint gravel road on the county line of Tipton and Madison Counties. Estimated cost, $12,000.

Oshkosh, Wis.—Bids are wanted Aug. 26 for brick paving on Church St. Frank Monahan, Chmn. Bd. of Pub. Wks.

Des Moines, Ia.—Bids are wanted Aug. 26 for about 3,625 sq. yds. of 1½ in. asphalt paving on W. 26th St. Separate bids will also be received at the same time for curbing with Portland cement on W. 2d St., 1,150 lin. ft., and on W. 29th St., 558 lin. ft. G. A. Eberhart, Chmn. Bd. of Pub. Wks.

Madison, Wis.—Bids are wanted Aug. 28 for the improvement of Murray St. O. S. Norsman, City Clk.

Ashtabula, O.—Bids are wanted Aug. 31 for improving High St. by paving approximately 2,388 sq. yds. with shale paving block, grading, draining and curbing. Frank W. Wagner, City Clk.

Mason City, Ia.—Bids are wanted Aug. 15 for grading, curbing and paving with asphalt portions of Marna and 5th Sts. W. P. Fitch, City Clk.

Jersey City, N. J.—Bids are wanted Aug. 13 for improving a portion of Sanford Pl., the estimated quantities include 3,750 cu. yds. of earth excavation, 5,400 sq. yds. of Belgian paving, 3.150 lin. ft. of curbstone and 12,350 ft. of flagging. Geo. T. Bouton, Clk. Bd. of Street & Water Commrs.

Napoleon, O.—Village Engr. C. N. Schwab writes that the contract for paving, for which bids were opened July 26, has been awarded to Hennessey & Co., of Troy, O., as follows: Excavation, 996 cu. yds., at 25 cts.; curbing, 5 x 24 48 in., 720 ft., at 55 cts.; curb, 5 x 21 x48 in., 780 ft., at 50 cts.; headers, 4 x 15 x 24 in., 108 ft., 25 cts.; crushed stone, 826 cu. yds, $1.05; iron inlets, 7 each $10; 6-in. sewer pipe, 140 ft., 25 cts.; 3-in. common tile, 1,550 ft., 4 cts.; catch basins, 7, each $35; paving brick, Bolen's brown granite, 3,278 sq. yds., 96 cts.; Buckeye grout filler, 3,278 sq. yds., 17 cts.; total, $6,100.

Newark, N. J.—Local press reports state that the following bids were opened Aug. 1 for paving on five streets: A, Barber Asphalt Paving Co. at $1.80 and $1.85 per yd. for asphalt alone.; B, Essex Asphalt & Contracting Co., $1.75 in each street for asphalt alone. Fourth St., 4,600 ft.: A, $8,672; B, $8,985; South Tenth St., 10,600 ft.: A, $19.750; B, $20,508; Clayton St., 1,500 ft.: A, $3,023; B, $3,107; Second St., 7,500 ft.: A, $13,976; B, $14.465; South Ninth St., 6,400 ft.: A, $12,058; B, $12,410. B. M. & J. F. Shanley bid on South Tenth St. as follows: Mack block, $2.34 a yd.; Clearfield block, $2.29 a yd.; new 20-in. curbing, 58 cts.; new 16-in. curbing, 57 cts.; old 20-in. curbing, 22 cts.; old 16-in. curbing, 20 cts.; basins, etc., $110; total, $26,844 for Mack block and $26,314 for Clearfield.

Milwaukee, Wis.—Bids are wanted Aug. 13 for paving Johnson St. with brick on a concrete foundation. Bids will be received Aug. 12 for paving several streets with asphalt. Chas. J. Poetsch, Chmn. Bd. of Pub. Wks.

Sioux City, Ia.—City Engr. J. M. Lewis writes that the contract for 1,150 sq. yds of brick paving has been awarded to Hansen Bros., of Sioux City, at $1.97; M. L. Flinn, of Sioux City, bid $2.04 per sq. yd. for 3,600 sq. yds of asphalt, but this contract has not yet been awarded.

Salt Lake City, Utah.—The following bids are reported opened by the Bd. of Pub. Wks., for asphalt paving: Alcatraz Asphalt Pav'g Co., San Francisco, $140,230, for Alcatraz XX asphaltum, and $152,580 for Trinidad or Bermudez asphalt; N. P. Glann Const'n Co., $183,100 for Trinidad asphaltum; City Street Improvm't Co., $157,970 for Santa Cruz asphaltum. The work will include 13,000 cu. yds. grading; 10,500 ft. curbing; 11,500 sq. yds. stone block pav't; 32,000 sq. yds. asphalt pavement; 2,000 sq. ft. crosswalks and 1,000 lin. ft. concrete gutter.

Coshocton, O.—The folowing bids for grading, curbing and paving 7th St. were opened July 29 by F. F. Wagner, Village Clk.:

Items and Quantities.	The Gen. Const. Co., Bellaire.	T. H. Burrell & Co., Coshocton.	G. B. Herrington & Son, Mansfield.	Rolston & Steyle, Mt. Vernon.	J. N. Kissner, Coshocton.
Excav., 5,200 cu. yds.	$.20	$.20	$.20	$.30	$.19
Grav. found., 2,025 c. y.	.40	.33	.40	.30	.35
Paving, 9,100 sq. yds.	.92	.95	.99	1.06	.71
Curbing, 4,300 lin. ft.	.36	.35	.25	.36	.35
Headers, 320 lin. ft...	.15	.20	.30	.16	.16
Filler, 9,100 sq. yds...	...	.16	...	...	.14
Totals	$11,846	$13,406	$12,488	$13,441	$11,084

Michigan City, Ind.—City Engr. H. M. Miles writes that the following bids were opened July 30 for paving Washington St. with asphalt: Bidders: A, Ind. Bermudas Asph. Co.; B, Jos. J. Duffy & Co.; C, Ayers Asph. Paving Co.; D, R. F. Conway & Co.; E, Barber Asph. Paving Co.; F, Western Const. Co.

Bidders.	Paving 20,100 yds., includ. gutter.	Stone curb., 10,750 ft.	Comb. curb., and gutter, 10,750 ft.	Grading, 5,500 yds.	—Totals.—	
					With stone curb.	With comb. curb and gutter.
A	$1.86	$.40	$.63	$.30	$43,336	$41,367
B	1.78	.32	.51½	.17½	40,181	38,026
C	1.89	.42	.67	.32	44,264	42,438
D	1.62	.35	.45	.01	36,380	33,586
E	1.89	.42	.63	.35	44,429	42,173
F	1.81	.38	.60	.29	42,061	40,104

Oneonta, N. Y.—City Engr. O. A. Miller writes that the following bids were opened July 30 for paving: Bidders: A, Park Paving Co., Rochester, Pa. (awarded); B, John J. Conners, Philadelphia, Pa.; C, F. H. Dumary, of Albany, and J. P. Butts, of Oneonta; D, Russell R. Stuart and J. W. Bustin, of Syracuse; E, Grannis & Fuller, Syracuse; F, Abbot-Gamble Construction Co., New York; G, J. J. Mooney, Troy:

Bidders. Kind of brick.	Paving.		*Curb set.			
	Outside R. R. 27,000 sq. yds.	Inside R. R. 6,300 sq. yds.	Old, 6,500 ft.	New, 7,800 ft.	Maintenance, guarantee.	Total.
A—Park......	$1.82	$2.32	$.12	$.28	$3,000	$69,720
B—Mack......	1.99	2.44	.288	.242	900	73,759
C—Catskill...	1.93	2.05	.30	.304	50	69,396
D—Mack.....	2.28	3.22	.34	.24	330	86,258
E—Mack......	2.15	2.53	.70	.35	340	81,609
E—Ferris.....	1.65	2.21	.70	.35	340	66,093
F—Mack......	2.49	3.06	.515	.515	850	94,857
G—Mack.....	2.19	2.34	.329	.25	350	78,312

*All curb to be furnished by the city.

POWER PLANTS, GAS AND ELECTRICITY.

Tacoma, Wash.—Chas. H. Sayre is stated to have received the contract for the power house of the Snopuamie Falls Power Co., to be erected at Commerce and 19th Sts., from plans of G. W. Cullard, Fidelity Bldg. Cost of power plant, including machinery, will be about $50,000.

Evansville, Wis.—See "Water."

Columbus, O.—See "Sewerage and Sewage Disposal."

Grand Island, Neb.—The City Electric Light & Ice Co., of Grand Island, is stated to have been incorporated to manufacture gas, electricity and ice; capital $200,000. Incorporators: John S. Knox, G. H. Payne and others.

Norfolk, Neb.—It is reported that the citizens on July 29 voted to issue $16,000 bonds for an electric light plant.

Paulsboro, N. J.—M. J. Peall is stated to have petitioned the Council for a franchise for a gas plant.

North Platte, Neb.—The North Platte Electric Light, Heat & Power Co. has been incorporated by J. Henry, Fredk. C. Adams and Chas. M. Brown.

Dover, N. H.—The Cocheco Mfg. Co. is about to erect a power plant on Main St. to run its plant during the dry season.

West Bay City, Mich.—This city wishes to purchase a 500-H.-P. compound Corliss engine for its electric light plant.

San Rafael, Cal.—The California Central Gas & Electric Co. has petitioned the Supervisors of Marion County for a franchise to erect poles and string wires throughout the county. Bids for the above franchise will be received Sept. 3.

West Salem, Wis.—The Neshonec Electric Lighting Co. is reported to have been formed at La Crosse, with a capital of $100,000, to purchase electric light plant and water power at West Salem and extend the wires to Bangor, a distance of about 12 miles. E. C. Swarthout, of La Crosse, is reported interested.

Toledo, Ill.—The Andrae & Sons Co., of Milwaukee, Wis., is stated to have received the contract for constructing an electric light plant, for $4,100.

Yellville, Ark.—The Yellville Electric Light & Power Co. has been incorporated with a capital of $50,000. Incorporators: W. F. Cleveland, John F. Pitt and others.

Caledonia, Wis.—The Council is reported to be considering the construction of a lighting plant.

Poughkeepsie, N. Y.—The Consolidated Electric Light, Heat & Power Co. has been organized with a capital of $200,000 to manufacture and use electricity and gas for light, heat and power purposes in Poughkeepsie. Directors: Jas. W. Hinkley and Silas Hinkley, of Poughkeepsie; Wm. K. Roy, of Wappingers Falls, and others.

Batavia, N. Y.—The Village Trustees are stated to have granted the Alden Natural Gas & Fuel Co. a franchise to pipe its gas through the streets.

Charlestown, W. Va.—C. H. Emig, of Hanover, Pa., writes that it is proposed to form a company to develop the water power near Charlestown, in order to operate the electric light plant by hydraulic power. Probable cost, about $10,000.

Centerville, Ia.—It is stated that the Citizens Electric Light & Gas Co. contemplates installing a steam heating system.

Colusa, Cal.—The Colusa Gas & Electric Co. has been incorporated by John Martin, Fred H. Pierson and others, with a capital of $100,000.

El Paso, Tex.—Local press reports state that bids will be received about Sept. 20 for lighting the city for a term of 2, 5 and 10 years with from 100 to 150 arc lights.

Harrisonburg, Va.—The Council on Aug. 6 is stated to have voted to submit at a special election the question of installing an electric light plant, according to plans prepared by Thorburn Reid, 120 Liberty St., New York, N. Y.

Black River Falls, Wis.—A press report states that the Black River Falls Co. is making extensive arrangements for the development of the water power at Black River Falls. The plan is to put in a system of dams to increase the water fall.

Washington, D. C.—See "Government Work."

Southampton, N. Y.—The Suffolk Light, Heat & Power Co. has been incorporated with $25,000 capital stock by Philip Tillinghast and H. N. Stinert, of New York, and B. C. Chiff, Brooklyn.

Chatham, N. J.—Hewitt & Warden, of Newburg, N. Y., have received the contract for constructing the electric light plant for $10,950, not including the building, which was awarded to H. Sturgiss, of Madison, N. J., for $2,100.

ELECTRIC RAILWAYS.

Garnavillo, Ia.—The Garnavillo & Guttenberg R. R. Co. is reported to have been formed to construct an electric road between these towns. T. J. Kraslinski, Secy.

Springfield, O.—The Board of Public Affairs has adopted an ordinance granting Harry Frey a franchise for his interurban road from Springfield to Hillsboro.

Lexington, Ky.—The Fayette County Commissioners are stated to have granted the Georgetown & Lexington Traction Co. right of way for an electric railway to the Scott County line.

Upper Sandusky, O.—The Wyandot County Commissioners are stated to have granted Dr. O. C. Stutz a right of way to construct an electric railway from this city to the county line, beyond Sycamore.

Chelan, Wash.—The Chelan County Commissioners are stated to have granted the Chelan Transportation & Smelting Co. a franchise to construct an electric railway from the foot of Lake Chelan to the Columbia River, a distance of 4 miles.

Sheboygan, Wis.—The Sheboygan & Elkhart Lake Ry. & Electric Co. has been organized with a capital of $200,000 to construct an electric railway from Sheboygan to Elkhart Lake, 22 miles in length. John M. Seamann, Pres., Sheboygan.

Batavia, N. Y.—The State R. R. Commissioners are stated to have granted a franchise to the proposed Genesee & Orleans Electric Ry. Co. from Batavia to Point Breeze.

White Plains, N. Y.—The New York & Stamford Ry. Co. is stated to have been formed here, with a capital of $500,000. The company is a consolidation of the Larchmont and Port Chester Electric companies, which now operate from Larchmont to Port Chester. The company is now building a road to Greenwich, and as soon as the line is completed the road will be extended to Stamford and to Boston.

Findlay, O.—It is stated that the Findlay & Southern Electric R. R. Co. will construct a line to connect Mt. Victory, Somersville, Broadway, Marysville, Plain City and Columbus.

Bucyrus, O.—The County Commissioners are stated to have granted the Buckeye Traction Co. a franchise to construct an electric railway from Bucyrus to Sulphur Springs, New Washington, and on east to Huron County.

Bowling Green, O.—Riggs & Sherman of Toledo are stated to have been appointed engineers and superintendents of construction for the Lake Erie, Bowling Green & Napoleon electric line. It is reported that the lines between Pemberville and Bowling Green and Weston and Bowling Green are to be constructed first.

Parkersburg, W. Va.—The Parkersburg & Interurban R. R. Co. has been incorporated to construct and operate an electric line in Parkersburg and Wood County, and a direct line to Marietta; capital, $500,000. Incorporators: P. D. Neal, John S. Camden and others.

Chattanooga, Tenn.—The Cumberland Coal & Timber Co., of which Ralph E. Alderich, of Detroit, Mich., is president, owning a large tract of land in Warren and adjoining counties in this State, has been merged in the Tennessee Co. of Cleveland, O., and capitalized at $5,000,000. The new company proposes to at once construct an electric road from Nashville to Chattanooga.

New Orleans, La.—The New Orleans & Pontchartrain Ry. Co. has been organized with a capital of $350,000 to operate and maintain railroads in the parishes of Orleans, Jefferson and St. Bernard and elsewhere in the State. Geo. S. Kausler, Pres.

Uxbridge, Mass.—Taylor & Tylee, of Worcester, are stated to have received the contract for constructing the entire system of the Uxbridge & Blackstone St. Ry. Co. Length of proposed line will be about 44 miles.

Lima, O.—The County Commissioners are stated to have granted a franchise to the Defiance, Ottawa, Kenton & Columbus Interurban Ry. Co. N. E. Matthews, of Ottawa, O., is reported interested.

Tiffin, O.—The Tiffin & Southern Ry. Co., of Toledo, has been incorporated with a capital of $10,000, to construct and operate an electric railway from Tiffin to Upper Sandusky. Incorporators: Allen Smalley, Chas. Stayer and others.

El Paso, Tex.—The Council is stated to have granted the Sante Fe St. Ry. Co. permission to extend its line.

Westboro, Mass.—The Westboro & Hopkinton St. Ry. Co. has been incorporated, with a capital of $40,000, to operate through Westboro and Hopkinton, about 6½ miles in length. Incorporators: H. C. Garfield, W. E. Ball and others.

Ft. Plain, N. Y.—The Village Trustees are stated to have granted a franchise to the Mohawk River Traction Co.

Youngstown, O.—The Stark County Electric Ry. Co. is stated to have petitioned the County Commissioners for a franchise for a single track railway through a portion of Mahoning County.

Waterbury, Conn.—The Connecticut Ry. & Lighting Co. is stated to have received permission to construct an electric railway from Waterbury, through Prospect and Cheshire, to Mt. Carmel.

Olean, N. Y.—There is talk of extending the Olean St. Ry. a distance of about 12 miles, through portions of Cattaraugus and Allegheny Counties; cost of building and equipment reported to be about $155,000. F. Mason, Ch. Engr., Olean.

Clinton, N. Y.—The Utica Suburban R. R. Co. is stated to have received a franchise to construct an electric railway from Clinton to New Hartford.

Westfield, Mass.—The Selectmen are stated to have granted a franchise to the Woronoco St. Ry. Co. to construct a line through Broad, West Silver and South Maple Sts. Nelson Ruiter, Ch. Engr., Westfield.

Bay City, Mich.—The Council is stated to have granted the Detroit, Pontiac, Lapeer & Northern Electric Ry. Co. a franchise over Trumbull and 2d Sts.

Petersburg, Va.—The Council is stated to have passed an ordinance granting permission to the Richmond & Petersburg Electric Ry. Co. to enter the city.

Bluffton, O.—The Council is stated to have granted the Western Electric Ry. Co. a franchise to construct a line through the village.

Kansas City, Kan.—Wm. Lakeman has petitioned the County Commissioners for a franchise to construct an electric railroad from a point on the line of Johnson County through Wyandotte County to the city limits of Rosedale.

Pottstown, Pa.—A charter has been granted to the Ringing Rocks Traction Co. to construct a trolley line from the northern limits of Pottstown to connect with the Ringing Rocks road to Boyertown, a distance of about 9 miles; capital, $45,000. Directors: Cyrus Q. Guldin, Reading; A. K. Shaner, Pottstown, and others.

Pittsburg, Pa.—Bids are wanted Sept. 4 for the power house and sub-station equipments for the Pittsburg, McKeesport & Connellsville Ry. Co., as advertised in The Engineering Record.

Bids will be received Aug. 15 for approximately 12 miles of grading together with necessary masonry of above company's road, between Uniontown and Leckrone, also 7 miles of grading and masonry between Uniontown and Fairchance. M. R. McAdoo, Gen. Mgr.

Metuchen, N. J.—The Council is stated to have granted a franchise to the Raritan Traction Co.

Rochester, N. Y.—The contract for constructing the power house for the Citizens' Light & Power Co. is reported to have been awarded to A. Friederick & Sons. Cost of the plant equipped will be about $2,000,000.

Harrisburg, Pa.—A number of Charters have again been granted to street railway companies throughout the State of Pennsylvania as a result of recent legislation. A complete list of said incorporations can doubtless be obtained by application to the Secretary of State.

RAILROADS

New Castle, Ky.—The Cumberland & Ohio Valley R. R. Co. has been incorporated, with a capital of $500,000, to construct and maintain a railroad from New Castle, Ky., to Shelbyville, Taylorsville, Bloomfield, Springfield, Lebanon, Campbellsville and Greensburg, the entire distance being about 100 miles. Incorporators: Peter Arlund and Thos. B. Leonard, of Louisville, and others.

Vicksburg, Miss.—It is stated that Major S. Winery, Ch. Engr. Vicksburg & Southeastern Ry., will at once begin a preliminary survey for the construction of a railroad from Vicksburg to Hattiesburg, about 125 miles in length.

Danville, Ark.—A charter is stated to have been granted to the Danville, Fourche Valley & Southern R. R. Co. to construct a line from Danville to Cobb's Ferry, on the Arkansas River, a distance of about 15 miles.

Brush, Colo.—It is stated that the Burlington & Missouri River R. R. Co. of Nebraska will extend its line from Brush to Pueblo, a distance of about 170 miles. G. W. Holdredge, Gen. Mgr., Omaha, Neb.

Richmond, Va.—Bids are wanted Aug. 20 for grading 2 miles of railroad between Chester and Port Walthall, on the Atlantic Coast Line R. R., the work embracing about 140,000 cu. yds. of excavating, of which 55,000 yds. is to be borrowed. E. T. D. Myers, Gen. Supt.

Glenfield, N. Y.—The Glenfield & Western R. R. Co. has been incorporated with a capital of $150,000, to operate a steam railroad of standard gauge, 15 miles long, from Glenfield to the n. e. corner of the Bennett tract in Lewis County. Directors: Alanson S. Page, Oswego; Chas. E. Campbell, New York; Jas. A. Outterson, Carthage, and others.

Arkinda, Ark.—Bids are wanted by the Choctaw Construction Co., Aug. 26, for grading, masonry and bridging on the extension of the Arkansas & Choctaw Ry., from Arkinda, Ark., through the southern portion of Ind. Ter., via Goodland, Durant, Ardmore and Sugden, to Wichita Falls, Tex. Bids will be received for the entire line, or for sections from 10 to 50 miles in length, at the office of John Scullin, Pres., 915 Security Bldg., St. Louis, Mo. Bids will also be received at the same time for about 900,000 cross-ties for use on said road.

Weatherford, Tex.—Bids are wanted Aug. 17 for the grading, masonry and bridging of the Weatherford, Mineral Wells & Northwestern Ry. from a point about 2 miles north of Mineral Wells, Tex., to Graham, Tex., a distance of about 45 miles. L. M. Fouts, Pres., Weatherford.

Wheeling, W. Va.—The contract for grading, masonry and trestling of the Pan Handle Traction Co.'s line from Wheeling to Wellsburg has been let to Stringer & Hallock, of Wheeling, for $190,000, work to be commenced Aug. 15. The Cambria Steel Co., Johnstown, Pa., has the contract for 70-lb. rails in 60-ft. lengths.

Salamanca, N. Y.—Chas. W. Buchholz, Ch. Engr. of the Erie R. R. Co., 21 Cortlandt St., New York City, writes that on Aug. 1 contracts for the elimination of the grade crossing at Main St., Salamanca (bids opened June 5), were awarded as follows: To Fred Miller, of Salamanca, for substructural work, and to American Bridge Co. for superstructure.

Orange, N. J.—The Delaware, Lackawanna & Western R. R. Co. is reported to have under consideration the abolishment of grade crossings in this city. W. K. McFarlin, Ch. Engr., Hoboken.

Sault St. Marie, Mich.—The Soo-Detrour R. R. Co. is reported to have been organized to construct a railway from the Soo to Detour, a distance of 51 miles. W. H. Hitchcock, Pres., Chicago, Ill. F. H. Taylor, Vice-Pres., Pickford, Mich.

Cooperstown, N. Y.—The Cooperstown & Mohawk Valley R. R. Co. is stated to have petitioned the State R. R. Commissioners for permission to construct a steam road 10 miles in length from Cooperstown to Springfield Center.

Santa Ana, Cal.—The Santa Ana & Long Beach Ry. Co. has been incorporated, with a capital of $250,000, to construct a standard-gauge railroad between Santa Ana and Long Beach, a distance of 25 miles. Directors: C. F. Mansur, Santa Ana; P. A. Stanton, Los Angeles, and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Jeffersonville, Ga.—The Manley Mfg. Co., of Atlanta, is stated to have received the contract for erecting a court house and jail for $25,000.

St. Joseph, Mo.—The Board of Managers of the State Hospital for Insane No. 2 is stated to have rejected all bids Aug. 2 for the new buildings to be erected at that institution. New bids will be received.

Rutland, Vt.—John F. Germain, 13 Liberty Ave., is stated to have received the contract for repairing the city hall for $24,765.

Charlotte, N. C.—The plans of Wheeler, McMichael & Co. are stated to have been accepted for the Carnegie Library, to cost $20,000.

Durham, N. C.—It is stated that a site has been purchased for the erection of a $40,000 city hall.

Joplin, Mo.—Andrew Carnegie is stated to have offered this city $40,000 for a public library.

Olivia, Minn.—Bids are wanted Aug. 15 for $50,000 bonds, issued for the purpose of erecting and furnishing a court house for Renville County. J. T. Brooks, Co. Aud.

Denver, Colo.—Philip Funke is stated to have received the contract for the erection of a new wing at the county hospital, for $50,000.

Goshen, Ind.—Patton, Fisher & Miller, 115 Monroe St., Chicago, Ill., are stated to be preparing plans for the Carnegie Library, to cost $25,000.

Calumet, Mich.—C. K. Shand, of Calumet, is stated to have prepared plans for a stone church and parochial residence for the R. C. congregation of this place, to cost $30,000.

Montreal, Que.—Andrew Carnegie is stated to have offered this city $150,000 for a public library.

Detroit, Mich.—Bids are wanted Aug. 19 for the construction of the Aquarium and Horticultural Building on Belle Isle Park, also for constructing No. 1 greenhouse on Belle Isle Park. R. E. Bolger, Commr. of Parks & Boulevards.

Milwaukee, Wis.—Bids are wanted Aug. 23 for the purchase of $75,000 Milwaukee County Hospital bonds. Otis T. Hare, Co. Clk.

Findlay, O.—It is stated that bids will be received by the Building Committee Aug. 20 for the construction of a new building for the First M. E. Church. Rev. Habighorst, Pastor. Kramer & Harbester, of Findlay, Architects.

Patton, Cal.—Bids are wanted Aug. 26 for the erection of a ward building for the Southern California State Hospital. John Morton, Secy. Thos. A. Lewis, Pres.

Bloomfield, Conn.—At a town meeting held Aug. 3, $10,000 was appropriated for a town hall, and $9,000 for highway improvements.

Atlanta, Ga.—The Building Committee of the Central Congregational Church is reported to be considering plans for a new edifice, to cost about $50,000.

Lake Charles, La.—Bids are wanted Sept. 5 for remodeling and additions to the parish courthouse. Address the President of the Police Jury. Architects, J. Rieley Gordon Co., Dallas, Tex.

Bellevue, O.—Bids are wanted Aug. 31 for the construction of a public hall. M. J. Callahan, Village Clk.

New York, N. Y.—Commissioner Kearney is stated to have recommended the construction of 11 public bathhouses, the cost of which he roughly estimates at about $33,000. It is proposed to place 5 in Manhattan, 3 in Brooklyn, and one each in Bronx, Queens, and Richmond boroughs.

Asheville, N. C.—It is stated that bids are wanted Sept. 5 for the purchase for $50,000 bonds for a court house.

Bainbridge, Ga.—Bids are wanted Aug. 15 for the erection of a $30,000 court house. R. A. Lytle, Chmn. Bd. Commrs. Roads and Revenues.

Jacksonville, Fla.—P. D. Cassidey, Clk. of the Circuit Court, writes that on Aug. 1 a vote was taken in favor of issuing $100,000 bonds for the erection of a court house, jail, clerk's office, etc.

National Home, Wis.—Bids are wanted Aug. 20 for building nurses' quarters and chaplain's quarters at the National Home. J. E. Armitage, Treas.

National Military Home, Ind.—Bids are wanted Aug. 26 for barracks, dining room and kitchen combined, blacksmith shop and officers' quarters. Justin H. Chapman.

BUSINESS BUILDINGS.

Kansas City, Mo.—The Exposition Building is reported to have been destroyed by fire Aug. 5.

Washington, D. C.—It is stated that the house-furnishing establishment of W. B. Moses & Sons is to be enlarged by the erection of a 5-story addition, adjoining the present F St. store.

New York, N. Y.—Plans for a 20-story office building for the Cumberland Realty Co. to be erected on 22d and 23d Sts., B'way and 5th Ave., were filed Aug. 3 at the Department of Buildings by Architects D. H. Burnham & Co., Rookery Bldg., Chicago, Ill.; cost to be about $1,000,000.

Bristol, Tenn.—The Southern Ry. Co. is reported to be taking steps to erect a freight depot in Bristol. J. A. Dodson, Div. Supt., Chattanooga.

The Norfolk & Western Ry. Co. is reported to have under consideration the erection of a union passenger depot here, to cost about $100,000. L. E. Johnson, Gen. Mgr., Cincinnati.

Bridgeport, Conn.—Thos. P. Taylor, mfgr. of notions, writes that it is proposed to erect a 1-story building 150 ft. long by 50 ft. wide.

Madison, Wis.—It is stated that plans are being prepared for a vaudeville opera house to be erected on Doty and Pinckney Sts. for V. H. Surghnor.

Cincinnati, O.—The Barnett Carriage Co., Richmond and Carr Sts., will erect a 5-story building 80 x 150 ft. C. L. Barnett, Pres.

Pittsburg, Pa.—D. H. Burnham & Co., Rookery Bldg., Chicago, Ill., are stated to have prepared plans for a 3-story steel and terra cotta building to be erected on Wood and 6th St., for Henry W. Oliver; estimated cost, $150,000. It is reported that the Real Estate Trust Co. will let the contract for construction in about 2 weeks.

It is stated that a company, of which Thos. L. Pfarr, Jr., is the principal stockholder, is to erect a hotel to be known as the Hotel Shadyside on South Negley Ave. and Walnut St., to cost about $600,000. Architect, U. J. L. Peoples, Times Bldg.

The contract for the new court exchange building of the Central District Printing & Telegraph Co. is stated to have been awarded to Henry Shenk, 900 Lewis Blk., for about $75,000.

Vicksburg, Miss.—Press reports state that Jas. McCardle of Jackson, Miss., will build a $35,000 hotel here.

Chicago, Ill.—Wm. T. Branitzky, 167 Dearborn St., is reported to be preparing plant for a 3-story store, flat and hall building 124 x 85 ft., to be erected on Trumbull and Ogden Aves., at a cost of $30,000.

Hibbard, Spencer, Bartlett & Co. are stated to have decided to erect a 10-story warehouse 125 x 420 ft. on Water St., east of St. Clair, to cost about $500,000. Architects, Frost & Granger, 806 "The Temple."

Bay City, Mich.—It is stated that the Pere Marquette Ry. Co. will erect a passenger and freight depot here, to cost about $50,000. G. H. Kimball, Ch. Engr., Detroit.

Shamokin, Pa.—T. P. Reitmayer of Williamsport, is preparing plans for a 3-story hall to be built on Independence St. for the Knights of Columbus.

Pontiac, Mich.—Bids are wanted Aug. 15 for the erection of a basement and 3-story addition to the present factory of the Pontiac Buggy Co. Fisher Bros., Archts., Pontiac.

Wabash, Ind.—Plans are reported to have been approved for a station to be erected here by the Big Four to cost about $17,000. S. T. Blizard, Div. Supt., Wabash.

Birmingham, Ala.—The plans of Stone Bros., Ltd., of New Orleans, La., are stated to have been accepted for a 10-story office building to be erected on 1st Ave. and 20th St., to cost about $230,000.

Jacksonville, Fla.—The Dyal-Upchurch Investment Co. is about to build a 5-story brick and stone office building 76 x 105 at Bay and Main Sts. Architects, Golucke & Klutho. Cost, $75,000.

Jennings, La.—The plans of W. L. Stevens, of Baton Rouge, are stated to have been accepted for a building for the Citizens Bank, to cost about $20,000.

Massillon, O.—L. Holmes is reported interested in the erection of an opera house, to cost about $40,000.

Wichita, Kan.—Architect Dumont is stated to be preparing plans for a 3-story brick business building to be erected at 205 E. Douglas St. for W. C. Little and Miss Read.

STREET CLEANING AND GARBAGE DISPOSAL.

Braddock, Pa.—A special committee has been appointed by the Braddock Council to arrange with North Braddock, Rankin and Swissvale for a joint garbage furnace.

Hamilton, O.—Bids are wanted Aug. 22 for the purchase of $12,000 crematory bonds. M. O. Burns, City Clk.

Grand Rapids, Mich.—The Mayor has appointed a committee to investigate and report the probable cost of a garbage reduction plant and also the cost of a crematory that will dispose of night soil.

St. Louis, Mo.—The City Council has passed the bill authorizing the Board of Health to let a new 3-year contract for the reduction of city garbage.

Toronto, Ont.—Commissioner Coatsworth, in his report on handing over the city garbage crematories to Street Commissioner Jones, states that the furnaces will probably have to be rebuilt this coming winter.

Ottawa, Ont.—An offer for the establishment of a system of scavenging has been received at the city hall from R. C. W. Lett, who proposes to form the Ottawa Incinerator Co.

Minneapolis, Minn.—Health Commissioner Hall is investigating the various methods of garbage collection and disposal in several cities.

SCHOOLS.

Institute, W. Va.—Bids are wanted Aug. 21 for a 2-story brick Trades Building for the W. Va. Colored Institute. Address C. H. Payne, Sec'y Bd. of Regents, Huntington, W. Va.

Atlanta, Ga.—It is stated that plans are being prepared for a $25,000 science hall for Emory College.

Waltham, Mass.—Bids are wanted Aug. 14 for a ventilating and heating apparatus in a brick primary school on Chestnut St., Ward 5; separate bids are wanted for the electric work in said building. Address the Superintendent of Public Buildings.

Butte, Mont.—W. E. Walsh is stated to have received the contract to erect the Monroe School in South Butte, for $16,250.

St. Paul, Minn.—Contracts for erecting the 8th Ward school at Mackubin and Rondo Sts. are stated to have been awarded as follows: For the erection, to Timothy Reardon, 567 Temperance St., at $41,000; heating, to the Roberts-Goss Co., 357 Rosabel St., at $6,500, and for the plumbing, to M. J. O'Neil, 60 E. 6th St., at $4,910.

Ft. Collins, Colo.—It is stated that plans are being prepared for a 2-story white sandstone building 60 x 120 ft. for the department of physics and irrigation engineering, at the State Agricultural College, to cost $40,000.

New Haven, Conn.—Bids are wanted Aug. 30 for the erection of a high school on York Square. G. T. Hewlett, Clk. Bd. Educ.

Cambridge, Md.—Bids are wanted Aug. 13 for the construction of four schools. John G. Mills, Pres. Bd. School Commrs. of Dorchester County.

Hallowell, Me.—Bids are wanted Aug. 19 for a hot-water heating plant in the new dormitory at the Maine Industrial School for Girls. Andrew Hawes, Pres., Stroudwater, Me.

Indianapolis, Ind.—It is stated that bids are wanted Aug. 23 for a boiler house and steam heating apparatus for School No. 13. J. E. Cleland, Dir. Bd. School Commrs.

Wills Point, Tex.—It is stated that bids are wanted Aug. 15 for erecting a brick school. Architects, J. Rieley Gordon Co., Dallas.

Selma, Ala.—Bids are wanted Aug. 15 for erecting a school from plans of Ryan & Sons, of Birmingham. N. R. Nelson, Chmn. Bldg. Com.

New York, N. Y.—Bids are wanted by the Committee on Buildings, Board of Education, until Aug. 21 for ventilating, heating, electric wiring, etc., Wadleigh high school, and wiring, etc., school No. 184, Boro. of Manhattan; ventilating and heating new addition to school No. 133, Boro. of Bronx; for alterations, repairs, etc., to Balzer Hall, Boro. of Brooklyn; for erecting school No. 80, Boro. of Queens; and for erecting Richmond Boro. High School, and electric wiring, etc., school No. 18, Boro. of Richmond. Richard H. Adams, Chmn. Com.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted Aug. 15 for the erection of brick and frame buildings for the Weather Bureau, U. S. Dept. of Agriculture, at North Head, at Port Crescent and at Tatoosh Island, Wash. Jas. Wilson, Secy. of Agriculture.

Philadelphia, Pa.—Bids are wanted Aug. 15 at the Treasury Dept., Washington, D. C., for the installation of an electric elevator in the U. S. Appraisers' Stores Building at Philadelphia. Jas. Knox Taylor, Supervising Archt., Treas. Dept.

Governor's Island, N. Y.—See "Water."

Philadelphia, Pa.—Bids are wanted Aug. 31 for the construction of a brick and steel building 65 x 350 at the League Island Navy Yard. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Philadelphia, Pa.—Bids are wanted Aug. 30 for the construction of a 4-story fireproof storehouse (brick), at Schuylkill Arsenal; separate bids will be received for plumbing. Col. John V. Furey, Asst. Q. M. Gen., U. S. A.

New York, N. Y.—Bids are wanted Sept. 7 for the construction of a 3-story brick and steel building 100 x 300, for boat shop, at the New York Navy Yard. Mordecai T. Endicott, Ch. of Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Monroe, Va.—Bids are wanted Aug. 27 for sinking a tubular well 2,500 ft. deep. Address, C. P. Townley, Q. M.

Manila, P. I.—The contract for constructing a harbor at Manila has been awarded to The Atlantic Gulf & Pacific Co. of New York City. Approximate amount of contract, $1,950,000. Work to be done includes about 150,000 cu. yds. rip rap, 21,000 cu. yds. concrete, and rubble masonry in breakwaters, about 5,000,000 cu. yds. of dredging and a pile bulkhead 4,700 ft. long. Dredging in mud, sand and shells to a depth of 30 ft.

Washington, D. C.—Acting Secretary Ryan of the Department of the Interior on Aug. 7 approved the award of contract for additional buildings for the Government Hospital for the Insane to Horton & Hemenway, of Providence, R. I., for $910,000. This company's original bid for the construction of fifteen buildings was $1,351,082, but three buildings were omitted, which brought the contract within the amount of the appropriation available.

New York, N. Y.—The following bids were opened Aug. 3 at the Navy Department, Washington, D. C., for *a*, 100,000 cu. yds. of dredging and *b*, 20,000 cu. yds. of crib work, etc., at the New York Navy Yard. Bidders all of New York: R. G. Packard, *a* 23 7/10 cts. per yd.; *b* 21 4/10 cts. per yd.; W. H. Beard Dredging Co., *a* 21 cts., *b* 40 cts., Henry Dubois Sons Co., *a* 16 cts.; Morris & Cummings Dredging Co., *a* 26½ cts.; *b* 40 cts.

Boston, Mass.—The following bids were opened Aug. 3 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the installation of a central heating system at the Boston Navy Yard: Evans, Almiral & Co., New York, $33,900; F. A. Williams, New York, $30,962; Bradlee & Chatman, Boston, $32,700 and $34,800; N. Y. Steam Fitting Co., New York, $33,179 and $34,750; Fire Extinguisher Co., Providence, $27,600 and $23,850; Lynch & Woodward, Boston, $33,179 and $32,769.

Boston, Mass.—The following bids were opened Aug. 3 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the erection of buildings at the Boston Navy Yard: *a* Price for ship fitters' shop, complete, foundation to be concrete, water table and trimmings granite, roof covering slate; *b* same as item *a*, but with a roof covered with tile instead of slate; *c* price for metal workers' shop, complete, foundations to be concrete, water table and trimmings granite, roof covering slate; *d* same as item *c*, except with a roof covered with tile instead of slate; *e* combined price for ship fitters' shop and for metal workers' shop, if both buildings are awarded as one contract: L. L. Leach & Son, Chicago, *a* $159,000, *b* $162,000, *c* $165,000, *d* $168,000 *e* $324,000; Snare & Triest, New York, *a* $172,600, *b* $176,000, *c* $181,000, *d* $184,000, *e* $352,000; D. H. Hayes Co., Chicago, *a* $171,718, *b* $172,218, *c* $178,851, *d* $179,351, *e* $348,794; R. A. Griefen, Chicago, *a* $173,000, *b* $173,000, *c* $179,000, *d* $179,000, *e* $348,794; J. A. Colson, Boston, *a* $181,000, *b* $187,000, *c* $189,000, *d* $195,000, *e* $370,000; Mead, Mason & Co., Boston, *a* $174,900, *b* $178,700, *c* $181,487, *d* $186,567, *e* $355,000; Norcross Bros., Worcester, *a* $195,800, *b* $199,760, *c* $203,700, *d* $207,300, *e* $395,600; Penn Bridge Co., Beaver Falls, *a* $169,245, *b* $173,750, *c* $176,672, *d* $181,000, *e* $338,917; F. G. Coburn & Co., Melrose, Mass., *a* $160,000, *b* $163,400, *c* $167,500, *d* $170,500, *c* $327,500.

MISCELLANEOUS.

New Orleans, La.—The Lone Star & Crescent Oil Co. is applying to City Council for the privilege to erect an oil storage tank and to lay several miles of pipe line to supply fuel oil to consumers.

Boston, Mass.—Bids are wanted Aug. 13 for building about 1,500 ft. of concrete sea-wall and about 700 ft. of spur jetties at Stony Beach, in the town of Hull. Woodward Emery, Chmn. Bd. of Harbor & Land Commrs.

Philadelphia, Pa.—The Park Commission has asked for $1,107,940 to be expended in maintaining and improving Fairmont Park during 1902 Of this amount it is proposed to expend $210,000 for a speedway in the West Park, $100,000 for a bridge across Lansdowne glen, $30,000 to widen Wissahickon drive and $35,000 for a bridge at Allen's lane over Wissahickon.

Cleveland, O.—Bids are wanted August 14 for two stone jetties at Edgewater Park. Chas. P. Salen, Dir. of Pub. Wks.

La Crosse, Wis.—A. W. Pettibone is reported to have given to this city, for park purposes, the north half of Barron's Island, and $50,000 for maintenance of same.

Baltimore, Md.—The Baltimore Harbor Improvement Co. has awarded to Sanford & Brooks of Baltimore a contract for the construction of a bulkhead having a frontage of 250 ft. and a depth of 400 ft., the channel around the bulkhead to be dredged to the depth of 25 ft.

Oakland, Cal.—City Engineer Turner has submitted plans and estimates for the reconstruction of 12th St. dam; with macadam pavement and random stone restraining wall the cost would be $42,252; with asphalt pavement a concrete retaining wall and culvert of concrete, $76,770.

Alexandria, La.—The Red River, Atchafalaya & Bayou Boeuf Levee Board will receive bids Aug. 28 for constructing 14½ miles of drainage canal; 467,000 cu. yds. of earth excavation will be required. J. G. White, Pres. of Bd.

Raymond, Ill.—It is stated that bids are wanted Aug. 22 for a drainage system, to consist of about 17,000 ft. of 20 to 8-in. pipe, etc. J. W. Dappert, Engr., Taylorville.

NEW INDUSTRIAL PLANTS.

The Clairton, Pa., Brick & Mfg. Co. is erecting a brick plant having a daily output of 40,000 to 45,000 brick.

The Snoqualmie Falls Power Co., Seattle, Wash., will build in Tacoma a 50 x 100-ft. power station of 6,000 H.-P. The current will be brought 44 miles, from Snoqualmie Falls.

The Rushton Cotton Mills, Griffin, Ga., will build a 75 x 146-ft. addition, add another side to their engine and install another boiler.

The Krell-French Piano Co., Springfield, O., has purchased a 4-story and basement, 54 x 1,050-ft. building, and will equip it with new machinery to be run by motors. The plant will have an annual capacity of 15,000 pianos.

The Malted Food Co., Ltd., Battle Creek, Mich., will erect a 4-story, 125 x 60-ft. brick factory, having a 150-H.-P. engine and a 200-H.-P. boiler.

The La Harpe, Kan., Brick Co. has been incorporated by J. P. Chenault, Fort Scott, Kan.; A. J. Diescher, Pittsburg, Pa.; C. W. Graen, I. L. Graen and C. L. Evans, of La Harpe, Kan., and will build a plant having a daily capacity of 40,000 brick. A 125-H.-P. boiler and a 100-H.-P. engine will be installed.

The Citizens' Ice Co., Clarksburg, W. Va., will erect a 35-ton ice plant. W. E. Stathers, Pres.

The Koeppen Mould Works, Marion, Ind., will erect a 40 x 50-ft. branch factory in Terre Haute, Ind., and expect to use a 10-H.-P. gas engine.

The Fairmont, W. Va., Coal Co., will rebuild its coal plant, recently burned. It will have a daily capacity of 1,200 tons, with three tracks under tipple.

The United States Vapor Purifying & Disinfectant Steam Valve & General Mfg. Co., 123 Norman Ave., Greenpoint, Brooklyn, N. Y., has been incorporated with a capital of $100,000, and will erect a 50 x 200-ft. plant, three stories in front and one story in rear, to consist of a foundry and machine shop.

The New York Central & Hudson River R. R. will erect a 2,000,000-bush. concrete and steel grain elevator at Weehawken, N. J., which will be operated by 43 motors of 10 to 100 H.-P. Mechanical-draft dust collectors will be introduced.

For grain elevator at Montreal, Que., see Proposals.

The United States Sanitary Co., Arrott Power Bldg., Pittsburg, Pa., is building a new plant, and will install an electric power plant of about 200 H.-P., the generators to be driven by steam and gas engines.

Tate, Jones & Co., Inc., Pittsburg, Pa., engineers and machinists, will erect a new plant at Leetsdale, Pa.

The Southern Ice Co., Box 34, Somerset, Ky., contemplates erecting a 25-ton ice plant this fall.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Aug. 12.	Pipe line, Salt Lake City, Utah	Aug. 10
Aug. 12.	Raising dam, Glens Falls, N. Y. Adv., Eng. Record, Aug. 3.	Aug. 3
Aug. 13.	Excav. at reservoir, Waterbury, Conn Adv., Eng. Record, July 27 to Aug. 10.	July 27
Aug. 13.	Adrian, Mich	Aug. 10
Aug. 13.	Montreal, Que	Aug. 10
Aug. 14.	Tower, Redwood Falls, Minn	Aug. 3
Aug. 14.	Mains National Military Home, Kan	Aug. 3
Aug. 14.	West Springfield, Mass	Aug. 3
Aug. 15.	Knox, Ind	July 27
Aug. 15.	Main, Evanston, Ill	Aug. 10
Aug. 15.	Mains, Moline, Ill	Aug. 10
Aug. 16.	Greenwood, Miss	July 27
Aug 19.	Batavia Ill	Aug 10
Aug. 19.	Morton, Minn Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 21.	New Berlin, N. Y	Aug. 10
Aug. 23.	Lonaconing, Md	Aug. 3
Aug. 27.	Boston, Mass Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 27.	Well, Ft. Monroe, Va	Aug. 10
Aug. 28.	Governor's Island, N. Y Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 30.	Supplies, Minneapolis, Minn	Aug. 10
Sept. 2.	Artesian well, San Jose, Cal	Aug. 10
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 10.	Plans, Muskogee, Ind. Ter Adv., Eng. Record, Aug. 3.	Aug. 3
Sept. 18.	Soerabaya, Java	July 20
Oct. 1.	Burlington, Ia Adv., Eng Record June 29.	June 29
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
	SEWERAGE AND SEWAGE DISPOSAL.	
Aug. 12.	New Castle, Pa Adv., Eng. Record, July 20 to Aug. 10.	July 20
Aug. 12.	Indianapolis, Ind	Aug. 3
Aug. 12.	Fowler, Ind	Aug. 3
Aug. 12.	Oil City, Pa	Aug. 10
Aug. 13.	Huntington, Ind	July 20
Aug. 13	Cranford, N. J	Aug. 3
Aug. 13.	Williamsport, Pa	Aug. 10
Aug. 14	Tunnel, Milwaukee, Wis	Aug. 10
Aug. 15.	Bird Island, Minn	Aug. 3
Aug. 15.	Evanston, Ill	Aug. 10
Aug. 16.	Greenwood, Miss	July 27
Aug. 16.	Indianapolis, Ind	Aug. 10
Aug. 17.	Akron, O	Aug. 10
Aug. 17.	Irvington, Ind	Aug. 10
Aug. 19.	Cincinnati, O	Aug. 10
Aug. 19.	Webster City, Ia	Aug. 10
Aug. 20.	Camden, N. J	Aug. 10
Aug. 24.	Oshkosh, Wis	Aug. 3
Aug. 24.	Youngstown, O	Aug. 10
Aug. 24.	Tile drains, Garrett, Ill	Aug. 10
Aug. 28.	Elkhart, Ind	Aug. 3
Aug 28.	Bowling Green, O	Aug. 10
Aug. 31.	Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Sept. 2.	Glenville, O	Aug. 10
Sept. 3.	Dayton, O	Aug. 10
Sept. 25.	Havana Cuba Adv., Eng. Record, June 29 to July 20.	June 29
	BRIDGES.	
Aug. 12	Syracuse, N. Y	Aug. 10
Aug. 13.	Towanda, Pa	Aug. 10
Aug. 13.	Zanesville, O	July 20
Aug. 14.	Cleveland, O	July 27
Aug. 14	Absecon, N. J	July 27
Aug. 15.	Indianapolis, Ind	Aug. 10
Aug. 15.	Olivia, Minn	Aug. 10
Aug. 16.	Topeka, Kan	Aug. 3
Aug. 17.	Plato, Ill	Aug. 10
Aug. 19.	San Jose, Cal	Aug. 3
Aug. 19.	Rutland, Vt Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 22.	Summerville, Ga	Aug. 3
Aug. 23.	Woodsdale, O	Aug. 3
Aug 23.	Athens, O	Aug. 10
Aug. 24.	Terre Haute, Ind	Aug. 3
Aug. 26	Alexandria, La	Aug. 3
Aug. 26.	St. Clairsville, O	Aug. 10
Aug. 29.	Doylestown Pa	Aug. 10
Aug. 31.	Melan arch bridge, Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 31.	Steel arch girders, Washington, D. C Adv., Eng. Record, Aug. 10.	Aug 10
Sept. 2.	Vicksburg, Miss	Aug. 3
Sept 3.	Toledo, O	Aug. 10
Sept. 3.	Medo, Minn	Aug. 3
Sept. 3.	White Sulphur Springs, Mont	July 27
Sept. 3.	LaMoure, N. D	Aug. 10
Sept. 4.	Olivet, S. D	Aug. 3
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
	PAVING AND ROADMAKING.	
Aug. 12.	Milwaukee, Wis	Aug. 10
Aug. 12.	Oil City, Pa	Aug. 10
Aug. 13.	Waterbury, Conn	Aug. 3
Aug. 13.	Hammond, N. J	Aug. 3
Aug. 13.	Schenectady, N. Y	Aug. 3
Aug. 13.	Martinez, Cal	July 20
Aug. 13.	Huntington, Ind	July 20
Aug. 13.	Jersey City, N. J	Aug. 10
Aug. 13.	Milwaukee, Wis	Aug. 10
Aug. 13.	Williamsport, Pa	Aug. 10
Aug. 13.	Muscatine, Ia	Aug. 10
Aug. 14.	Wilkesbarre, Pa	Aug. 10
Aug. 14.	Leechburg, Pa	Aug. 10
Aug. 14.	Baltimore, Md	Aug. 10
Aug. 14.	Cleveland, O	July 27
Aug. 14.	East Newark, N. J	July 27
Aug. 15.	Wilmington, O	July 27
Aug. 15.	Tampa, Fla	July 27
Aug. 15.	Moscow, Idaho	Aug. 3
Aug. 15.	Mason City, Ia	Aug. 10
Aug. 15	Cedar Rapids, Ia	Aug. 10
Aug. 15.	New Haven, Conn	Aug. 10
Aug. 15.	Moline, Ill	Aug. 10
Aug 16.	Iowa City, Ia	Aug. 10
Aug. 16.	Wilmington, O	July 27
Aug. 16.	Sheraden, Pa	Aug. 10
Aug. 16.	Indianapolis, Ind	Aug. 10
Aug. 17.	Marion, O	July 27
Aug. 17.	Bellefontaine, O	Aug. 3
Aug. 17.	Evansville, Ind	Aug. 3
Aug. 19.	Houston, Tex	Aug. 3
Aug. 19.	Elyria, O	Aug. 3
Aug. 20.	New York, N. Y	Aug. 10
Aug. 20.	Brooklyn, N. Y	Aug. 10
Aug. 20.	Marinette, Wis	Aug. 3
Aug. 20.	Scottsburg, Ind	Aug. 3
Aug. 20	Reno, Nev	Aug. 10
Aug. 22.	Houston, Tex Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 23.	Cincinnati, O	July 27
Aug. 23	Elwood, Ind	Aug. 10
Aug. 24	Youngstown, O	Aug. 10
Aug. 26.	Des Moines, Ia	Aug. 10
Aug. 26.	Vailsburg, N. J	Aug. 10
Aug. 26.	Oshkosh, Wis	Aug. 10
Aug 26.	Green Bay, Wis	Aug 10
Aug. 28.	Madison, Wis	Aug. 10
Aug. 28.	Des Moines, Ia	Aug. 10
Aug 30.	Keokuk, Ia	Aug. 3
Aug 31.	Cleveland, O	Aug. 3
Aug. 31.	Cincinnati, O	Aug. 3
Aug. 31.	Ashtabula, O	Aug. 10
Aug. 31.	Cambridge, O	Aug. 10
Sept. 15.	Marion, Ia	Aug. 10
Sept. 25.	Havana, Cuba Adv., Eng. Record, June 29 to July 20.	June 29
	POWER, GAS AND ELECTRICITY.	
Aug. 15.	York Haven Pa	July 13
Aug. 15.	Chillicothe, Ill	July 27
Aug. 15.	Huntington, W. Va	July 27
Aug. 15.	Waverly, Tenn	Aug. 3
Aug. 15.	Riverside, Cal	Aug. 3
Aug. 16.	Indianapolis, Ind	Aug. 3
Aug. 16.	Greenwood, Miss	July 27
Aug. 24.	Renfrew, Ont	Aug. 3
Sept. 1.	Jacksonville, Cal	July 20
Sept. 3.	Franchise, San Rafael, Cal	Aug. 10
Sept. 9.	Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Sept. 20.	El Paso, Tex	Aug. 10
Sept. 21.	Steam generating equipment, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
	GOVERNMENT WORK.	
Aug. 12.	Rem. of wreck, Philadelphia, Pa Adv. Eng. Record, July 20 to Aug. 10.	July 20
Aug. 13.	Propelling machinery for dredge, Charleston, S. C Adv., Eng. Record, July 13 to 27, Aug. 10.	July 13
Aug. 13.	Pumping machinery for dredge, Charleston, S. C Adv., Eng. Record, July 13 to 27, Aug. 10.	July 13
Aug. 13.	Washington, D. C Adv. Eng. Record, July 20, 27.	July 20
Aug. 13.	Seattle, Wash	July 20
Aug. 13.	Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
Aug. 14.	Propelling machinery for dredge, Charleston, S. C Adv. Eng. Record, July 6 to 20, Aug. 10.	July 6
Aug. 14.	Pumping machinery for dredge, Charleston, S. C Adv., Eng. Record, July 6 to 20, Aug. 10.	July 6
Aug. 15.	Conduit, Washington, D. C	Aug. 3
Aug. 15.	Ft. Hancock, N. J Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 15.	Philadelphia, Pa	Aug. 10
Aug. 16.	Washington, D. C	Aug. 10
Aug. 17.	Derrick, Norfolk, Va	July 13
Aug. 20.	Conduit and wiring, Elgin, Ill Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 20.	National Soldier's Home, Va	Aug. 3
Aug. 21.	Ft. Yellowstone, Wyo	July 27
Aug. 21.	Elgin, Ill Adv., Eng. Record, July 27, Aug. 3.	July 27
Aug. 22.	Cleveland, O Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 24.	Portsmouth, N. H	July 13
Aug. 24.	Brick and steel bldgs., Portsmouth, N. H.	Aug. 3
Aug. 26.	Portland, Me Adv. Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 26.	Bldg., Sitka, Alaska	July 20
Aug. 26.	Philadelphia, Pa Adv., Eng. Record, July 27 to Aug. 10.	July 27
Aug. 27.	Hydraulic machinery, etc., Philadelphia, Pa	Aug. 3
Aug. 27.	Well, Ft. Monroe, Va	Aug. 10
Aug. 28.	Artesian well, Governor's Island, N. Y. Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 29.	Boise, Idaho Adv., Eng. Record, July 6, 13.	July 6
Aug. 29.	Brunswick, Ga Adv., Eng. Record, July 29, Aug. 3.	July 27
Aug. 30.	Arsenal storehouse, Philadelphia, Pa	Aug. 10
Aug. 31.	Philadelphia, Pa	Aug. 10
Aug. 31.	Coal towers, San Juan, Porto Rico	July 20
Aug. 31.	Bremerton, Wash	Aug. 3
Aug. 31.	Algiers, La	Aug. 3
Sept. 3.	Mechanical equip., San Francisco, Cal. Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Interior finish, San Francisco, Cal Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Canal work, Chicago, Ill Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Sept. 4.	St. Cloud, Minn Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Sept. 7.	New York, N. Y	Aug. 10
Sept. 9.	Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Oct. 1.	Galveston, Tex Adv., Eng Record, Aug 10.	Aug. 10
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
	BUILDINGS.	
Aug. 13.	Schools, Cambridge, Md	Aug. 10
Aug. 14.	School, Springfield, Mass	July 20
Aug. 14.	Htg. etc., school, Waltham, Mass	Aug. 10
Aug. 15.	Factory addition, Pontiac, Mich	Aug. 10
Aug. 15.	School, Wills Point, Tex	Aug. 10
Aug. 15.	Courthouse, Bainbridge, Ga	Aug. 10
Aug. 15.	School, Selma, Ala	Aug. 10
Aug. 16.	School, Delaware, O	July 27
Aug. 16.	Htg. school, Indianapolis, Ind	Aug. 3
Aug. 16.	School, Dubuque, Ia	Aug. 3
Aug. 17.	Court house plans, Ortonville, Minn	July 20
Aug. 17.	School, Washington, D. C	July 27
Aug. 19.	Court house plans, Philippi, W. Va	July 27
Aug. 19	School, Mandan, N. D	July 27
Aug. 19.	Park bldgs., Detroit, Mich	Aug. 10
Aug. 19.	Htg. school, Hallowell, Me	Aug. 10
Aug. 20.	Church, Findlay, O	Aug. 10
Aug. 20.	Hospital El Paso, Tex	Aug. 3
Aug. 20.	Pub. Bldg., National Home, Wis.	Aug. 10
Aug. 21.	Schools, htg. etc., New York, N. Y.	Aug. 10
Aug. 21.	State reformatory bldg., Mansfield, O.	July 27
Aug. 21.	Hospital bldgs., Rochester, N. Y.	Aug. 3
Aug. 21.	School, Institute, W. Va	Aug. 10
Aug. 23.	Htg. school, Indianapolis, Ind.	Aug. 10
Aug. 26.	Hospital, Patton, Cal	Aug. 10
Aug. 26.	Htg. schools, Cleveland, O	Aug. 3
Aug. 26.	Pub. Bldg., National Military Home, Ind	Aug. 10
Aug. 29.	Htg. School, Allegheny, Pa	July 27
Aug. 30.	School, New Haven, Conn	Aug. 10
Aug. 31.	Village Hall, Bellevue, O	Aug. 10
Sept. 2.	Asylum, Pine Bluff, Ark	July 20
Sept. 2.	College bldgs., Stillwater, Okla. Ter.	Aug. 3
Sept. 5.	Court house, Lake Charles, La	Aug. 10
Sept. 10.	School, Flint, Mich	Aug. 3
Sept. 17.	Court house, Cartersville, Ga	Aug. 3
Sept. 24.	Power house, etc., for Capitol, St. Paul, Minn Adv., Eng Record, Aug. 10.	Aug. 10
Sept. —.	Church, Bangor, Me	June 29
Sept. —.	Pub. bldg., Little Rock, Ark	July 13
	MISCELLANEOUS.	
Aug. 13.	Sea wall, Boston, Mass	Aug. 10
Aug. 14.	Cleveland, O	Aug. 10
Aug. 15.	El. Ry. work, Pittsburg, Pa	Aug. 10
Aug. 17.	R. R. work, Weatherford, Tex	Aug. 10
Aug. 19.	El. Ry. franchise, San Jose, Cal	July 20
Aug. 20.	R. R. work, Richmond, Va	Aug. 10
Aug. 22.	Drainage system, Raymond, Ill	Aug. 10
Aug. 26.	R. R. work, Arkinda, Ark	Aug. 10
Aug. 28.	Canal, Alexandria, La	Aug. 10
Sept. 3.	Grain elevator, Montreal, Que Adv., Eng. Record, July 20, 27, Aug. 10.	July 20
Sept. 4.	El. Ry. power house, Pittsburg, Pa Adv., Eng. Record, Aug. 10.	Aug. 10
Dec. 10.	Rosario, Argentine Repub	Apr. 13
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
——	R. R. work, Mineral, Kan	Aug. 3

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Safety of the Brooklyn Bridge.

The Engineering Record has given careful consideration to the recent failures of suspension rods on the New York and Brooklyn Bridge, but it has refrained from aggravating the unfortunate excitement of the public by giving the subject unwarranted prominence, or attaching to it a significance out of proportion to the true character of the failures. It is far from the intention of this journal to belittle any incident of a serious nature connected with a structure whose unsafe condition would endanger so many lives as that of this bridge. Any failure of detail or main parts of such an important construction cannot receive too serious consideration; it is a matter of the greatest gravity to the public and to those who are in any way responsible for the care of the structure. At the same time, however serious an incident of this character may be, it should above all receive reasonable treatment. To exaggerate the warning afforded by the failure and to alarm the public unnecessarily are to be deprecated as much as belittling or neglecting any material danger. It is on this account that the comments of The Engineering Record have been withheld until the unreasonable excitement of the public has subsided and there is no question as to the actual facts in the case.

It is public information that since the trolley cars have been traversing the roadways of this bridge, the structure has been worked to its full capacity. On this point there is no doubt, nor is there anything in it necessarily alarming. Such a condition may be perfectly consistent with safety and with a reasonable use of the structure. Indeed, it is highly probable that the rapid increase in railway moving loads during the past twelve or fifteen years has placed a considerable number of iron and steel railway bridges in the same category. Under such circumstances, some, but seldom all, of the members of the structure in question are stressed well towards the limits of the working resistance of the material in them. It is one of the elementary principles of good engineering in such a case to maintain a continuous and careful scrutiny of every main member and every detail, in order to keep them in the best possible condition to meet the exacting duties imposed upon them.

Manifestly the New York and Brooklyn Bridge should be constantly subjected to an intelligent and systematic inspection, both in consequence of its magnitude and because of the enormous number of people crossing it every day. This is a subject in which the public is fully justified in being deeply interested. If such a system of inspection be efficiently maintained it would be impossible for the bridge to become suddenly unsafe at any time. There might, and probably would be, from time to time, failures of details through the development of defects in material or possibly from originally bad design, but they would be immediately detected and prompt measures of renewal would eliminate all real danger. Too much emphasis cannot be given to this feature by the administration of the bridge. The structure was designed and constructed before the detailing of bridge members was so well understood or so carefully executed as at present. It is all the more necessary, therefore, indeed it is imperatively necessary, that all its parts should be constantly and efficiently inspected by men well qualified for such duties.

Inasmuch as all details of the bridge remain as they were first designed, it would undoubtedly be highly judicious to submit them all to a thorough recomputation under the loads, both dead and moving, which the structure now carries. It would be a matter of no surprise if such an examination, thoroughly made, should disclose the necessity of displacing some of them by others better designed, nor would it probably be a very expensive operation to execute such changes. This would constitute no real criticism of the original designer or of those who have had the care of the structure. It would simply be taking advantage of the material advances made in bridge design since this structure was completed.

As usual under such circumstances, much has been printed concerning the breaking of the short suspension rods near the center of the main span which engineering literature could spare without sensible loss. Its chief effect has been to stir up the apprehensions of the public unnecessarily. Doubtless those rods should not have broken; and it is certain that one or two of the fractures were old and that others were produced gradually. Neither is there any question that the expansion and contraction of the stiffening trusses under varying temperatures and the effects of such motions were both well understood by the designers of the bridge. It is equally beyond question that they provided such details as in their judgment would meet the requirements of the case, although it appears clear that their efforts were not altogether successful.

The expansion joints in the stiffening trusses are at the center of the span. This condition causes the greatest motions of expansion and contraction at precisely the place where the shortest suspension rods are found. If such motions took place where the longest suspenders are required, the flexibility of those members would practically eliminate all stresses produced by such motions. As the bridge now stands, the maximum motions are at the lower ends of the short suspension rods, and the imperfect action of the trunnion detail connecting the floor-beams and the rods subjects the metal in the latter to very high stresses. Every civil engineer who has had experience in bridge construction and maintenance must realize that such a trunnion will never work with sufficient freedom to serve the purpose for which it was designed. Even if it were lubricated, the grit and dirt which would blow or work into it would set up serious frictional resistances. High stresses would thus be produced in the metal of the rods, and the thermal motions would reverse those stresses with the greatest intensities in the trunnion blocks at the limits of movement. These bending stresses in alternate directions would inevitably produce just the kind of failure that has taken place and at precisely the sections of the bars where actual failure was observed.

There is nothing mysterious about the failures nor anything necessarily alarming. The detail in which the failure occurred should be displaced by a better one, and an effective system of inspection of the entire bridge should be introduced at once.

The State Sanitary Survey of the Illinois and Desplaines Rivers.

The effect of the discharge of the sewage of Chicago through the old Illinois & Michigan canal on the Illinois and Mississippi Rivers was investigated in 1886-89 by Dr. John H. Long, under authority of the State Board of Health of Illinois. In this investigation two facts were established, first, the marked improvement in the water of the Illinois as it flows toward the Mississippi, independent of sedimentation or dilution, and, second, the much slower rate of change in the water in winter than in summer. The report on these studies was never published and has been lost. When the drainage canal approached completion the Board decided to make two new series of investigations, bacterial as well as chemical, one before and the other after the opening of the canal. This work was again intrusted to Dr. Long, whose chemical and general studies were supplemented by the bacterial examinations of Prof. F. Robert Zeit and Prof. Gustav Fütterer. The bacterial studies were made in Chicago on samples sent from the various stations, a condition rendering the results less reliable as indications of actual river conditions than those of the chemical work, according to Dr. Long's report; nevertheless they confirm the deductions from the chemical studies in a noteworthy manner. The Board has recently published the reports of these three gentlemen, as well as one by Mr. Jacob A. Harman on a preliminary sanitary survey of the Illinois River drainage basin and one by Dr. James A. Egan, secretary of the Board, on the general subject of the pollution of the Illinois River as affected by the drainage of Chicago and other cities. All are interesting and contain valuable data; in the following notes the general outline of Dr. Long's report alone is given.

The first series of the last investigations was made with samples of water from twenty points, from Bridgeport in Chicago, where the sewage was pumped into the old canal, to the Mississippi River at Grafton. After the drainage canal was opened, samples were taken from practically the same stations and a few others. Both series of experiments were sufficiently extended to cover the effects due to variations in temperature. The analyses were started as soon as the samples reached the laboratory, and the following determinations were made: Solids in solution, total solids, chlorine, oxygen consumption in original and filtered water, free and albuminoid ammonia, nitrogen as nitrites and nitrates, and, in some cases, total organic nitrogen and loss on ignition. The report describes the methods of analysis, which need not be examined here. The main interest in the results lies in the relation of the quality and quantity of the dissolved and suspended substances at Bridgeport and the entrance of the drainage canal, as compared with the amounts of the same substances at Grafton, at the mouth of the Illinois River.

Survey of 1899.—A consideration of the Bridgeport water, as it was before the opening of the drainage canal, was first in order. For practical purposes this may be looked upon as made up from three sources, 1, house drainage and industrial sewage, 2, diluting lake water, 3, stock-yards sewage.

During this year, the Chicago River received the sewage of about 1,600,000 people, who received an average of about 22,400 cubic feet of water per minute from the water-works. This quantity is returned to the sewers, together with additional amounts from industrial establishments, exclusive of the stock yards, which are estimated to have raised the total to 26,000 cubic feet per minute. From various data stated in the report it is estimated that about 150 tons of organic matter were carried to Bridgeport every 24 hours from these sources.

The amount of diluting lake water was not large. From the practical absence of current in the river it follows that the pumps at Bridgeport lifted approximately what the sewers discharged. The pumpage was about 35,000 cubic feet per minute and as the sewage is estimated at 26,000 cubic feet, only about 9,000 cubic feet was received from the lake. The amount and character of the dissolved organic matters in this diluting water were considered unimportant in this investigation. The south branch of the river to the Bridgeport pumping station was little better than a septic tank in the summer of 1899, and Mr. Harmon describes it as "a seething, festering mass of decomposing sewage from house and factory, giving up great quantities of noisome gases, the surface of the river in many places having the appearance of a boiling caldron."

The drainage of the stock yards is an important factor in determining the quality of the Chicago sewage. Dr. Long found in his examinations of 1886 that the organic matter it contained was over 112 tons daily, and while stock-yard wastes are now utilized to a greater extent than formerly, the extent of the industry has increased materially, so that there are two counteracting influences which determine the amount of these wastes. It is estimated that about 90 tons per 24 hours was the amount of organic matter from this source in 1899.

It is difficult to estimate the proportion of this 240 tons of dry organic matter that was actually pumped into the old canal in the year in question, for the operation of the pumps is not definitely known. Some years before, however, an investigation showed that the ratio of discharge of organic matter from the main city and stock-yards sewers to that of the pumps was 31 to 24 in cold weather. A part of the loss was due to sedimentation and in hot weather there was an enormous loss from fermentation and putrefaction.

It is a very complicated problem to determine how far this canal water and the river receiving it are purified before the Mississippi is reached. The apparent purification found varied largely with the season of the year when the examinations were made, and its extent also depends on the arbitrarily assumed standards. At the outset it is necessary, of course, to separate the effect of dilution from that of apparent purification. Numerous streams mingled their waters with the discharge of the old canal before the Mississippi was reached, and their flow was extremely variable. It was considered unadvisable to rely on gaugings to determine the amount of this dilution, as greater accuracy could be obtained from chlorine determinations at various points in the main stream and the important tributaries. The decrease in the chlorine found by these frequent analyses becomes a measure of the amount of diluting water, if the chlorine content of the latter is known. The data determined in this manner are of course only approximations, but they are considered sufficiently accurate for the purpose, particularly as somewhat similar results have been found by actual surveys in corresponding seasons.

By the data furnished by the tabulated results of the chemical work, Dr. Long calculates what the organic contamination of the river should have been through 1899, supposing no purification to have taken place or no great sewage addition like that at Peoria to have been made. This follows by adding together the contaminations due to the fractions of canal and tributary waters which combine to make the discharge at any point. In the case of the small tributaries which were not analyzed, it was assumed that the diluting water contained the same kind and amount of organic matter as similar streams which were analyzed. The accompanying table gives the results of this method of comparison.

Actual and Calculated Analyses, in Parts per Million, to show Purification taking place in Rivers.

City.	Free Ammonia.		Albuminoid Ammonia.		Oxygen Consumed.	
	F'nd.	Calc.	F'nd.	Calc.	F'nd.	Calc.
Bridgeport	19.88	.....	3.22	....	26.65	.....
Lockport	19.86	19.88	3.33	3.22	27.90	26.65
Joliet	16.05	17.38	2.89	2.97	25.69	25.40
Morris	10.10	12.41	1.20	2.21	9.16	19.73
Ottawa	6.23	10.50	0.62	2.06	7.13	18.63
LaSalle	4.67	8.10	0.59	1.58	6.99	15.20
Henry	3.27	7.66	0.55	1.42	7.00	14.16
Peoria (a)	0.90	6.26	0.57	1.31	6.86	12.49
Peoria (b)	4.36	6.26	3.20	1.31	17.44	12.49
Pekin	1.40	6.26	0.83	1.31	7.81	12.49
Havana	1.70	5.45	0.70	1.20	7.18	12.00
Pearl	0.32	3.20	0.67	0.86	5.51	9.76
Grafton (c)	0.25	3.12	0.46	0.84	5.61	9.36
Grafton (d)	0.08	....	0.47	...	8.52	....

The two stations at Peoria were (a) near the Peoria water works, and (b) two miles below the city. At Pekin the samples were taken 600 feet below the last source of pollution from the distilleries. The Grafton stations were (c) on the Illinois and (d) Mississippi Rivers respectively.

The rapid rate of oxidation indicated by the table is considered all the more remarkable if the contamination at Peoria and Pekin is considered. At Peoria (a), a very advanced condition of oxidation is indicated, but below the city the increase in contamination is enormous, due mainly to the effects of cattle-feeding and the distillery slops. Dr. Long is satisfied that the amount of waste nitrogen here is practically equal to that discharged at Bridgeport, due allowance being made for the slop now dried and sold. During the summer months, the river between Peoria (a) and (b) is compared in the report to a large septic tank, the rate of decomposition of the organic matter in it is very rapid, and far-reaching changes occur in this 10-mile course. The report reads: "Much of the filth whch runs into the river from the sheds settles, to be decomposed later. We have a condition here resembling that in the stock-yards branch of the Chicago River. The evolution of the gases of decomposition attests the activity of the bacterial scavengers. If all this material could have floated down tne river without oxidation, the result would be greatly different from that actually found. As it is, it must still be recognized that the Peoria cattle-shed filth, and not the Chicago sewage, is the main factor in the animal pollution of the lower river."

The results of this year's work are stated to have proved that the amount of albuminoid ammonia and the oxygen consumption were less in the Illinois at its mouth than in the Mississippi. The Ilinois, at its mouth, was in better organic condition than most of its tributaries and a larger flow would doubtless have produced no very great change except in the oxidation of the free ammonia. "The physical appearance of the lower river and the extent of the fishing industry, aside from any data of chemistry or bacteriology, point clearly to the changes accomplished, and the clear stream which entered the Mississippi through the season of 1899 was not one which an unbiased observer could call seriously polluted."

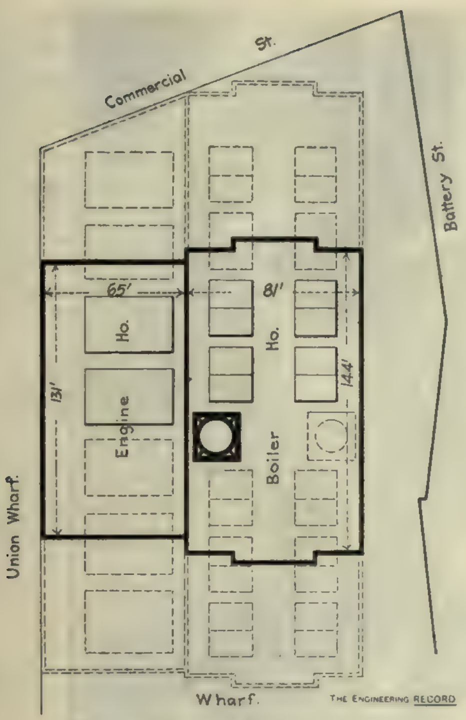
Survey of 1900.—In 1899 it was comparatively easy to follow the water from the Bridgeport pumps to the Illinois and down the latter stream, but the conditions were far more complicated in 1900, when not only the Illinois & Michigan canal, but the drainage canal also were in use. During much of the time water was sent through both toward Joliet, but with great irregularity. This made the collection of fair average samples a matter of great difficulty and uncertainty, and may account, Dr. Long states, for some of the irregularities in the tables of results accompanying his report. Moreover, with a high lake level and a wind from the east, the water of the south fork of the Chicago River may be completely banked up south of the Bridgeport pumps, so that comparatively clear water passes there. Occasionally during the year an enormous amount of stagnant filth collected in this way in the south fork, and the thick scum on top of it was firm enough for birds to walk over its surface. With a falling level in the lake and river, this great mass of sludge was flushed down both canals, making a sudden and pronounced change in the character of the flow. A study of the chlorine content shows that, as a rule, most of the stock-yards sewage passed down the old canal, while the remainder and the city sewage went through the drainage canal.

It is also important to note that the average discharge of the two canals was much below what the final flow is expected to be. During part of the period covered by the analyses, the works at Joliet were not in a condition to permit the passage of a larger volume.

In following the changes in the sewage in 1900 the comparisons must begin with the results at Joliet, for it is there that the mixed sewage from the two canals actually first appears. From a study of the chlorine contents for the two years, it would seem that the dilution in the spring of 1900 was about three times that in 1899; with the increased flow permitted later, the dilution became greater. The chlorine values at Joliet in 1900 are not positively known to be accurate, however, on account of the irregularity in the operation of the pumps at Bridgeport, and a complication is also introduced in the estimates of the dilution elsewhere by the much larger discharge of the Kankakee and Dupage rivers in 1900 than in 1899.

To illustrate the progressive purification of the Illinois River in 1900, calculations might be made like those carried out with the results of the work in 1899, but this was not done because Dr. Long considers the results themselves of the analyses, in comparison with those of the previous year, are suggestive enough. The 1900 result at Grafton was much more satisfactory than that of 1899. About 31 per cent. of the water in the Illinois passing Grafton in 1900 passed over the Joliet dam. This is about double the percentage calculated from the results of 1899, but, notwithstanding this fact, inasmuch as the gross discharge of filth through the Chicago canal was not greater, the evidence of organic pollution was less marked than in former years.

Dr. Long's General Conclusions.—"It has been shown that, in the stretch of canal and river between Chicago and Peoria, a remarkable destruction of organic matter is constantly taking place, not by sedimentation but by organic oxidation. The great mass of organic filth passing Lockport is practically destroyed or rendered harmless by conversion into stable compounds, while the myriads of bacterial cells depending on it for their existence have likewise disappeared. Save for the presence of inorganic remains, the chlorides and the nitrates of oxidation, there is nothing here to distinguish the Illinois from its unpolluted tributaries, which hold dissolved, mainly, the organic products of decay of vegetable matter. The condition below Peoria is vastly different from what it is above, and largely because of the pollution from the



PLAN OF LINCOLN POWER STATION.

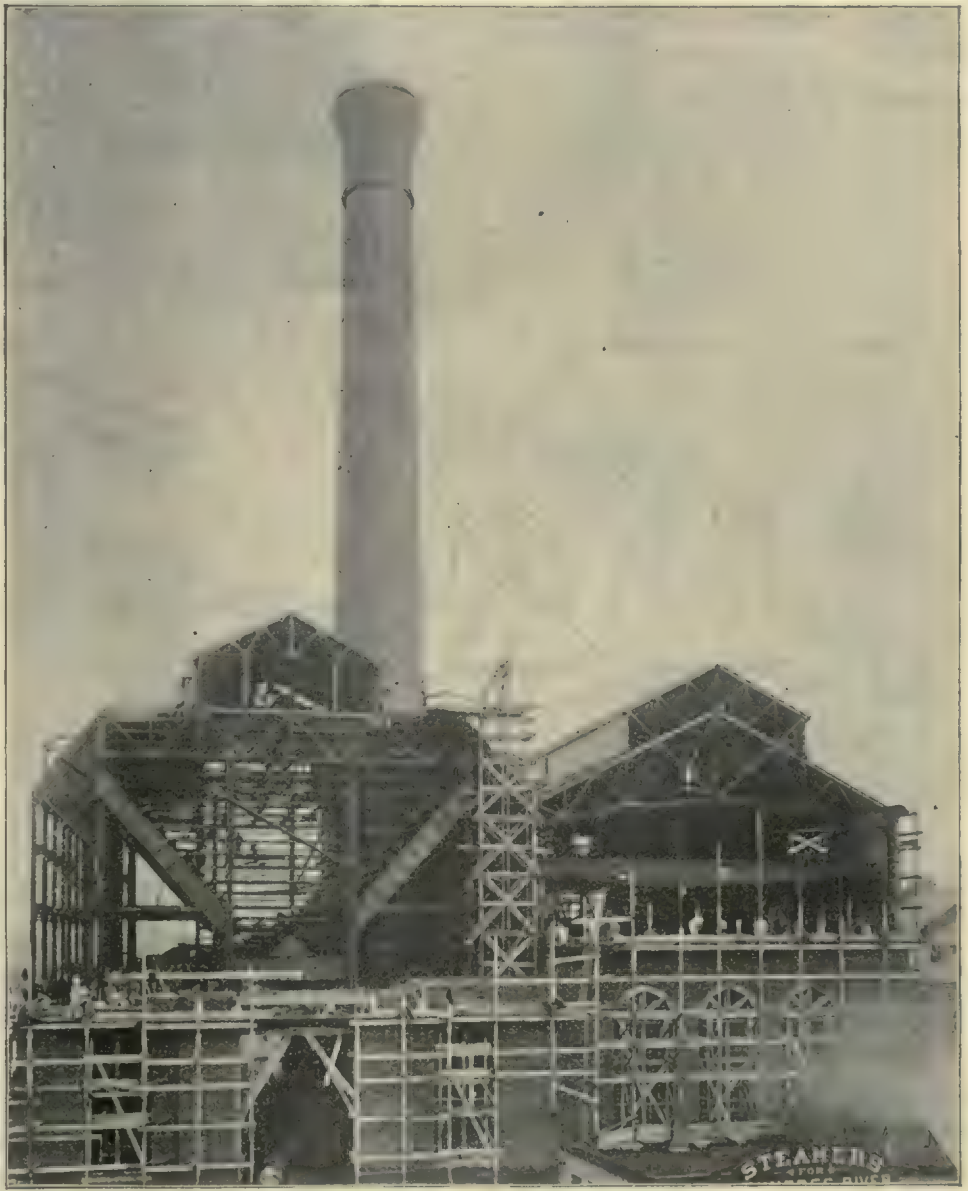
cattle sheds at the distilleries. But this, also disappears in time, and, at Pearl and Grafton, the normal river situation is again reached. I believe it may be safely said that if the whole of the sewage of Chicago were to be excluded from the Illinois River, the condition at Grafton would remain unchanged so far as organic content and bacterial organisms are concerned. With the flow from Chicago excluded, there would be a diminution in the harmless nitrates and chlorides only.

"With the present conditions at Peoria, it would be useless to talk of purifying the Chicago sewage before turning it into the canal; its great dilution renders it there inoffensive to the senses, and bacterial oxidation does the rest before Peoria is reached. If anything more is attempted for the Illinois River it must be done below Peoria. I believe that such an improvement is within the limits of the possible, although with exactly what means I am not prepared to state. Nothing of value can be done with the knowledge now at our command, but with a closer insight into the nature of bacterial oxidation, as it takes place under different conditions of temperature, dilution and pollution, it is not too much to hope that a more rapid destruction of organic matter may be accomplished by artificial means, and, broadly speaking, through the proper addition of fresh bacterial cultures at the right time and place. To determine the best conditions for this rational bacterial treatment of rivers is one of the interesting sanitary problems of the future. Meanwhile, much may be accomplished for the Illinois by comparatively simple means. We have seen that the chief source of pollution in the lower river to-day is the cattle-shed and distillery refuse from Peoria and Pekin. It would not be a difficult matter to destroy most of this organic waste by a septic tank process before discharging the water containing it into the river, and for the sake of the rapidly developing fishing industries, if for no other reason, this should be insisted upon."

A Good Roads Congress will be held at the Pan-American Exposition on September 16-21. It is proposed to have addresses on the financial and engineering features of road building, to exhibit all kinds of tools and machines for highway work, and to construct sections of earth, gravel, stone, tar-macadam, brick and other types of roads and streets.

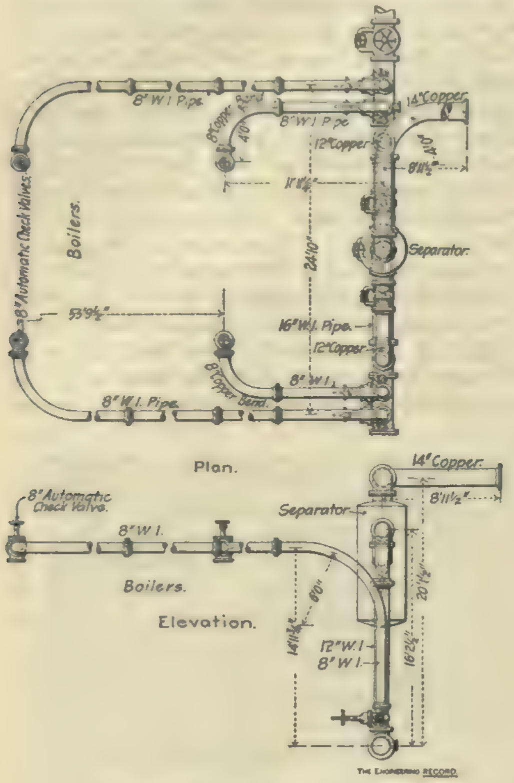
The Lincoln Power Station, Boston, Mass.

The electric power for operating the central portion of the Boston Elevated Railway system, including the surface and subway lines, has hitherto been supplied by three stations, one in East Cambridge, which was described in The Engineering Record for November 17, 1894, one in Charlestown, and the third and largest one on Albany Street, in Boston. The increase in power necessary to operate the elevated line now rapidly nearing completion will be supplied by the new Lincoln power station, which will supplement the other stations, supplying power to both new and old lines. The station is located on the water front at Lincoln wharf, on the line of the elevated railway, and is near the business center of Boston and the center of traffic of the company's lines as well. This location affords the additional advantages of economical coal supply and ample condensing water. The station is equipped with two direct-connected generating units of 5,400 kilowatts combined capacity, there being space in the building for a third such unit, together with the necessary steam plant. The building contains a boiler room and an adjoining engine room, the former about 144 x 81 feet and the latter 131 x 65 feet, and is of brick and steel construction. It is so designed that it can be extended to accommodate two and one-half times the present installation. The ultimate arrangement provides for two parallel rows of boilers, each of seven batteries, with a stack near the middle of each row, and a corresponding row of seven generating units parallel to them.

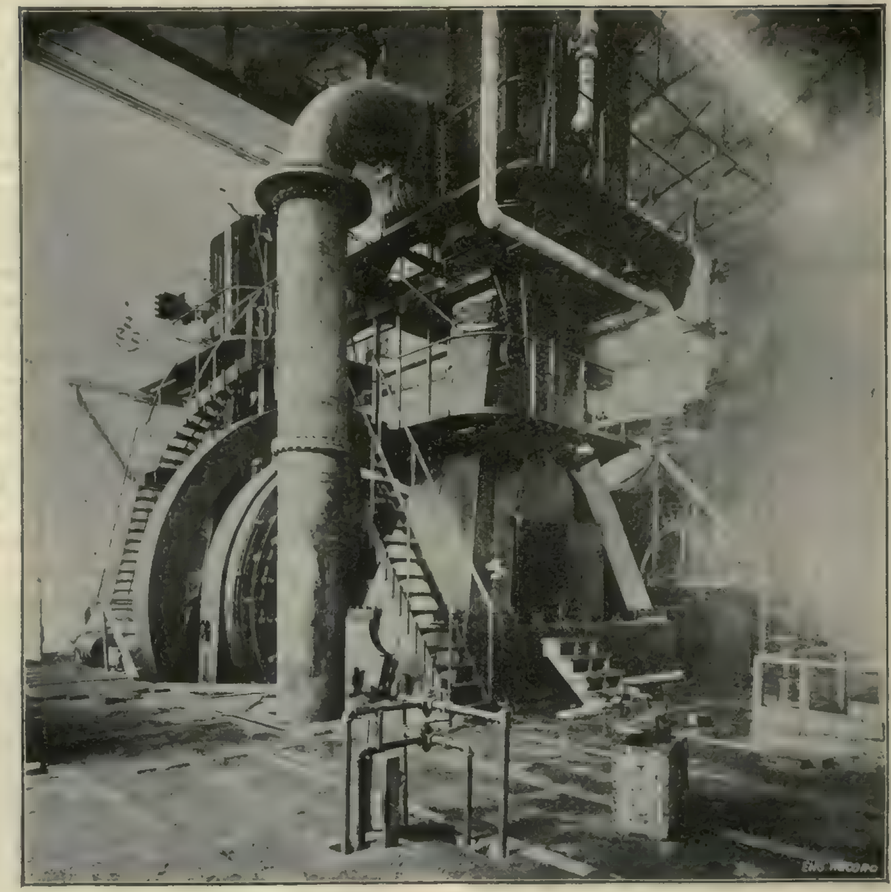


THE LINCOLN POWER STATION DURING CONSTRUCTION.

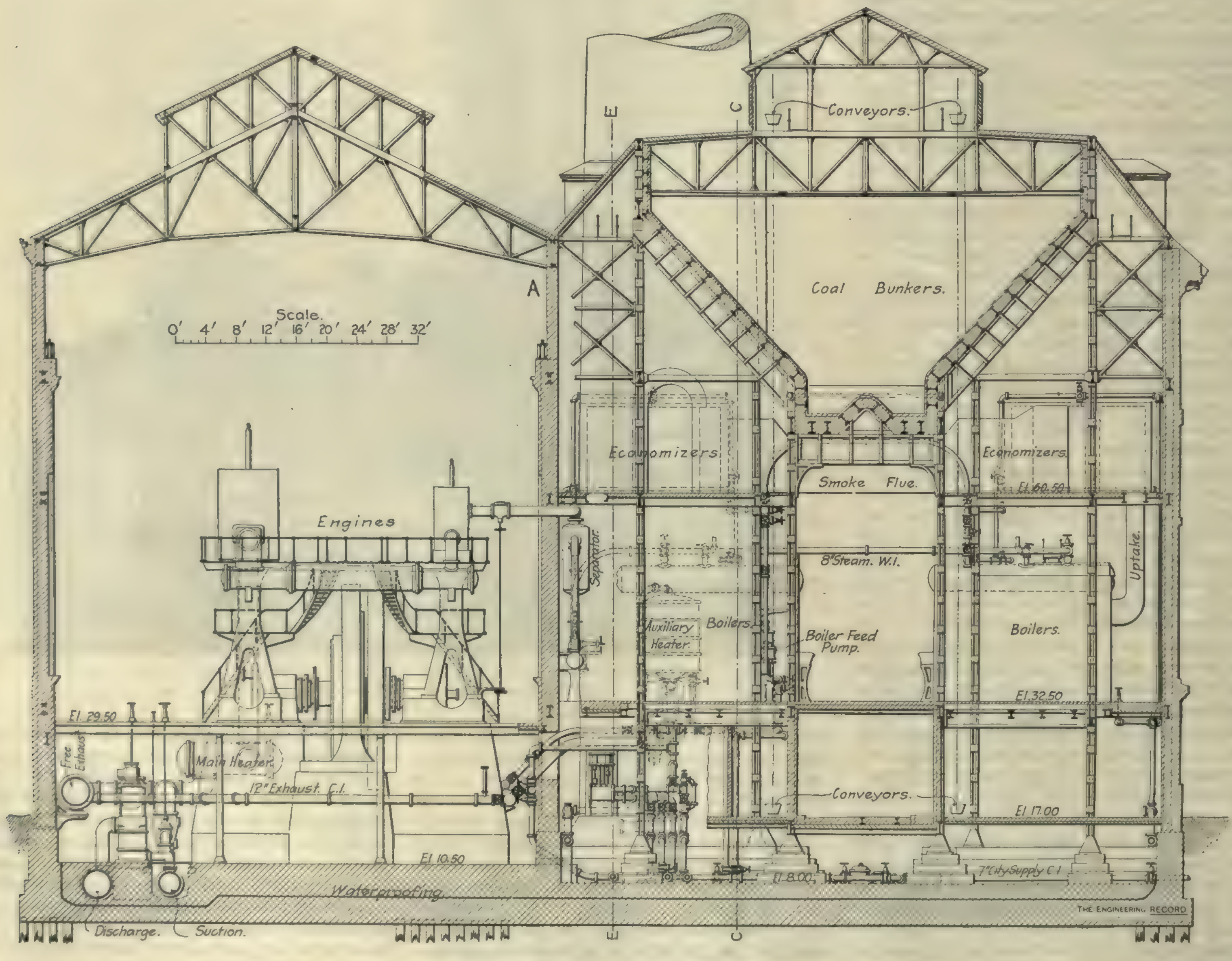
The foundation throughout is a solid monolithic bed of concrete supported on piles about 30 inches apart on centers. The wall footings are of stone masonry on rows of closer piles, and are lined on the inside with a concrete flashing carried up almost level with the ground outside. Under the engine foundations the concrete bed is 7½ feet thick, and in the boiler house it is 5 feet thick, with offset concrete footings for the interior columns built on its upper surface and having a continuous layer of water-proofing imbedded in it 4¾ feet above the bottom of the concrete. This water-proofing passes through the footing of the partition wall and is flashed up on the outside walls of both houses. The engine house has a basement about 17 feet high, and a single main story above it, which is about 100 feet high from the floor to the top of the lantern. It is lined with white enamel brick, and this, together with its height, gives it a light and pleasing appearance. The boiler room has two main floors above the basement, and a coal bin having a capacity of 3,500 tons occupies most of the building above the upper floor. The ground floor has a longitudinal railroad track through the center, and at the sides are the oil and stock rooms and the machine shop, there being also separate locker rooms and bath rooms for the engineers and the firemen, together with a bath room and sleeping room for the chief engineer. The second floor is planned for six 1,000 horse-power batteries of water-tube boilers, arranged on both sides of the center longitudinal line with a chimney near the middle of each row. The floors are all of segmental hollow tile arches, leveled up with concrete of a minimum thickness of 1 foot un-



Details, Main Steam Header.



Rice & Sargent Engine and Westinghouse Generator.

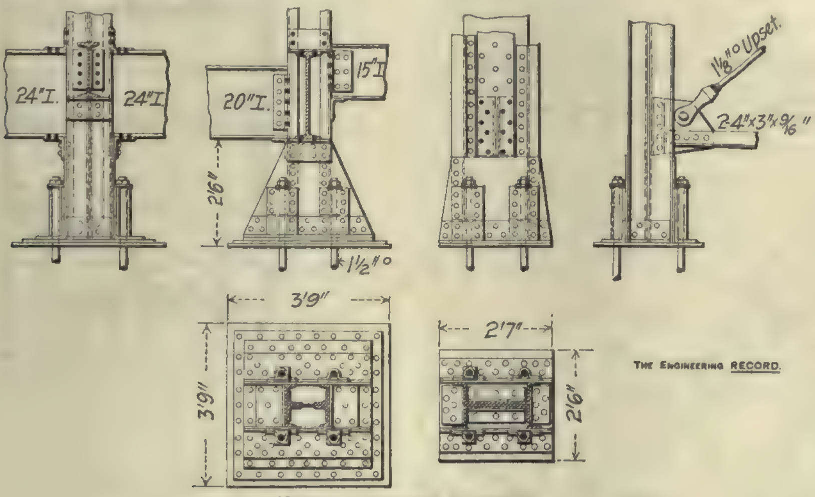


CROSS-SECTION OF LINCOLN POWER STATION.

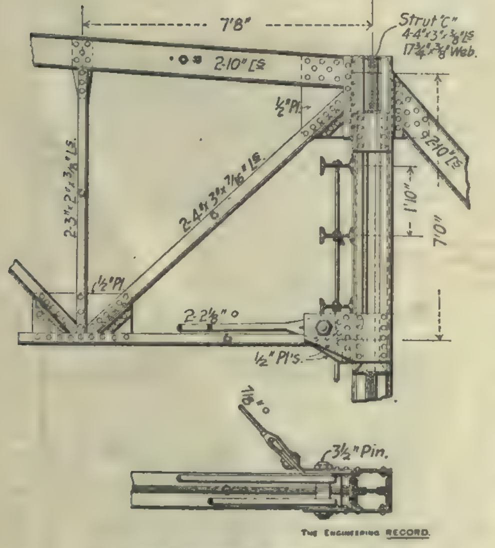
Geo. A. Kimball, Chief Engineer; J. C. Ostrup, Structural Engineer; Sheaff & Jaastad, Steam Engineers.

der the boilers and calculated for a maximum distributed load ranging from 250 to 450 pounds per square foot. The floor above the boilers is occupied by two corresponding rows of economizers, and the coal bin is above them. The latter measures about 60 feet in width, 122 feet in length and 36 feet in depth inside. In the lantern above the coal bin there are two conveyors by which coal is handled to the bin. The roof conforms to the outline of the main truss and lantern in the cross-sectional diagram, and has a flat surface about 16 feet wide on each side of the lantern, with a projecting balustrade. Both the flat and sloping roofs are made of flat arches of hollow brick and are slated; over the engine room the roof is made of Guastavino arches, slated.

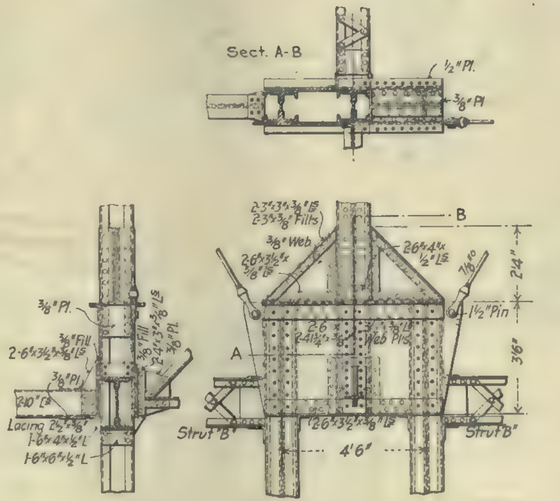
The coal is delivered in deep-water vessels at the adjoining wharf, and transferred to the bin above the boilers as before mentioned by unloading and conveying machinery installed by the C. W. Hunt Company. The capacity of this bin is practically the amount of two weeks' consumption for the present installation, this reserve being sufficient to tide over the delays incident to water transportation, there being other sources of supply available by rail. From the bin the coal is fed by gravity to Roney stokers, with which the boilers are provided, the ashes being removed by the returning empty coal conveyors. The boilers are of Babcock & Wilcox make, rated at 500 horse-power each, and are set two in a battery. They are of the forged-steel header type, built for a maximum working pressure of 200 pounds, and are fitted with the Babcock & Wilcox superheater. Of the six batteries planned for the part of the building now finished, four are in place and the remaining two will be installed later in the year. These are also to have superheaters. The waste heat passes upward through a flue at the rear end of each boiler and enters one side of a double smoke flue carried on the floor above, in the other half of which are placed fuel economizers built by the Green Fuel Economizer Company of Matteawan, New York. These are so arranged that the gases may be passed through them or direct to the stack. The arrangement of flues and dampers is the same on either side of the boiler room, the connection between the two sides being made by a cross flue, which may be done away with when the addition of more boilers makes the second stack necessary. There is at present one stack, built of ordinary brick, 13 feet inside diameter and 251½ feet high, though space and foundations for two are provided. It was described in detail in The Engineering Record for December 22, 1900. The circular space inside the stack below the entrance of the smoke flue is divided into three chambers at floors at convenient elevations, in one of which the secondary feed-water heater is placed.



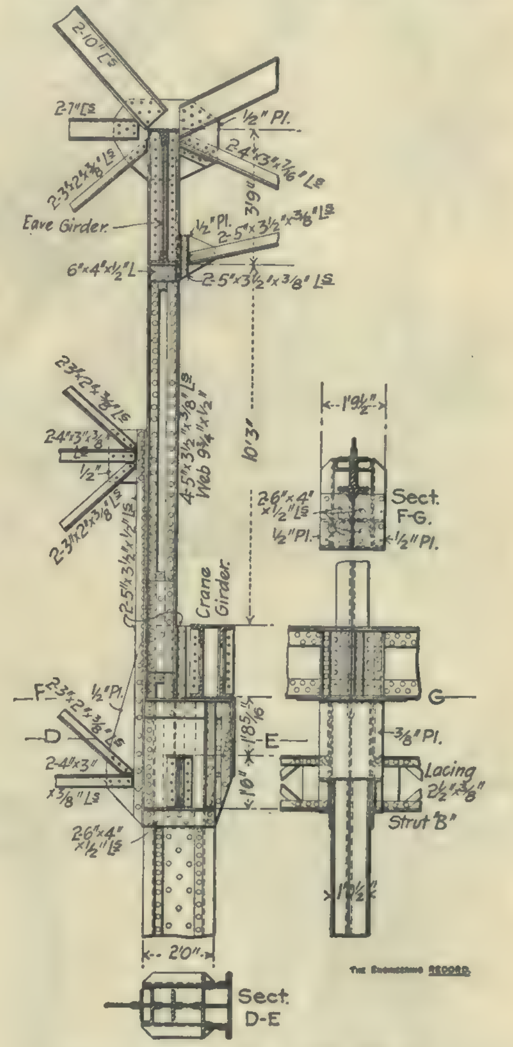
TYPICAL COLUMN FOOTINGS.



END OF BOILER HOUSE ROOF TRUSS.



TOP DETAILS OF TWIN COLUMNS.



DETAIL AT A, GENERAL CROSS-SECTION.

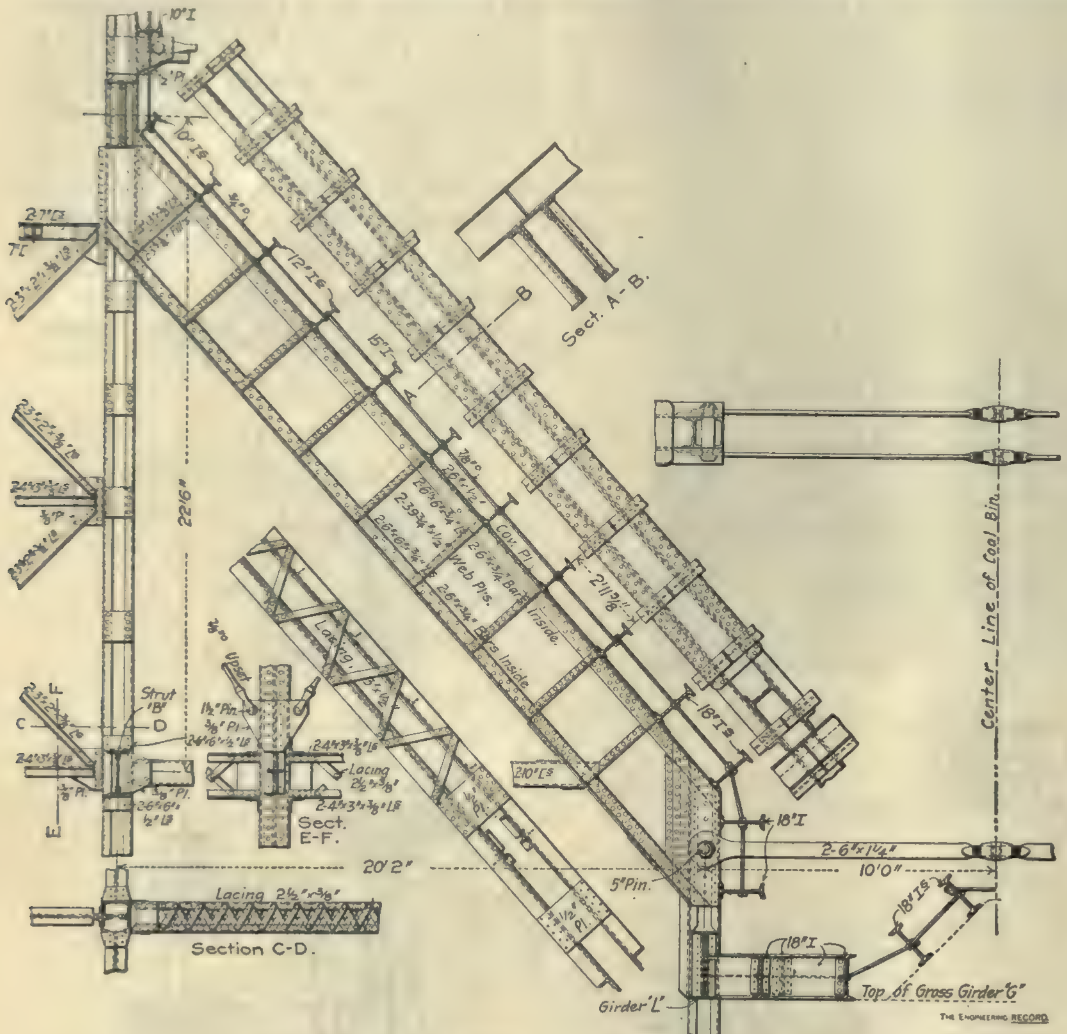
The steam main is 16 inches in diameter and is carried on brackets along the boiler house wall adjoining the engine room, about 5½ feet above the floor. The 8-inch feeders from the boilers are carried over and down to it, entering it on top, those to the nearest boilers having copper bends next the boiler nozzle. Each boiler has an 8-inch automatic check valve in place of the usual stop valve, in order to prevent the rush of steam in case of a leak in the boiler, there being also a gate valve in each branch next the main. The connection to each of the engines is made by two 12-inch pipes rising from this main, connected to a separator by a copper bend, a 14-inch pipe, also with a copper bend, leading to the throttle valve from the top of the separator. From three points on the main header 3-inch branches are taken to an auxiliary steam main supplying the pumps, stoker engines, etc. The fittings throughout are of cast steel, the pipe being extra heavy wrought steel, fitted with Van Stone joints made by the Walworth Manufacturing Company, who erected all the piping. The high-pressure lines are drained by the Holly return system. It will be seen that the foregoing arrangement of piping renders the steam main accessible without resorting to the usual gallery, and that it is capable of extension at either end, while affording an almost straight passage for the steam from each boiler to the adjoining engine, this advantage being increased by placing the engines with their throttle valves next the partition wall. Furthermore, each boiler is on a separate branch, in which there is sufficient offset to take up the expansion. Keasbey & Mattison "Magnesia" pipe covering, supplied by Nightingale & Childs, of Boston, was used.

The engines are of the vertical compound condensing type and are of the Rice & Sargent pattern, made by the Providence Engineering Works. Their cylinders are 44 and 88 inches in diameter and 60 inches stroke, their normal speed being 75 revolutions per minute with 160 pounds steam pressure, though a maximum pressure of 180 pounds may be used. Their most economical performance is when developing 4,000 horse-power. The main shaft is 37 inches in diameter at the flywheel and armature and 32 inches at the journals, with a 16-inch hole through it. It is oil tempered and was made by the Bethlehem Steel Company. The flywheel is placed close to the armature and is 26 feet in diameter, weighing 120 tons. The wrist pins are 12 inches in diameter and 12 inches long, the crank pins being 12 x 14 inches. The allowable speed variation from no load to full load is specified at 1 per cent., and no variation is to exceed 2 per cent.

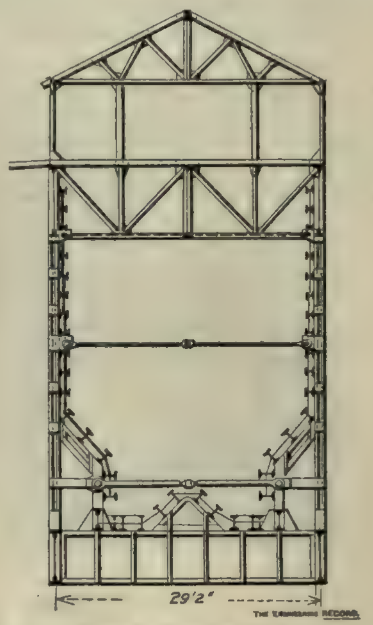
The third generating unit, which is being built by the Westinghouse Machine Company and the Westinghouse Electric & Manufacturing Company, will be of the vertical inverted cross-compound type, having cylinders 44 and 87 inches in diameter and 60 inches stroke. It will run at 75 revolutions per minute with superheated steam at 160 pounds pressure, under which conditions, with 26 inches vacuum, its economical load will be 4,000 horse-power, though it can be forced to 7,000 horse-power with safety. Balanced poppet valves will be used on the high-pressure cylinder, because of the difficulty in lubricating Corliss valves when superheated steam is used. The low-pressure cylinder valves wil be of the latter type. The shaft is made of open-hearth steel, hollow forged in a hydraulic forging machine. It is 37 inches in diameter at the flywheel and armature and 34 inches in diameter in the bearings. It is 27 feet 6 inches long from center to center of cranks and has a hole 16 inches in diameter throughout its length. The flywheel is 28 feet in diameter and weighs about 120 tons. The engine is furnished with an emergency stop valve, which acts automatically when a certain speed is exceeded. The generator will be the same as described below.

One of the two generators was made by the General Electric Company and the other by the Westinghouse Electric & Manufacturing Company, both being direct-current machines of the railway type, designed for 550 to 600 volts, their capacity at the latter figure being 2,700 kilowatts. These are the largest direct-current railway generators yet constructed, and it is interesting to note that in their design neither company saw reason to depart materially from the relative proportions of the standard machines of less capacity. The General Electric generator weighs 320,000 pounds, of which the armature is 120,000 pounds, the space required on the engine shaft being 87 inches, and there are 24 poles. The Westinghouse generator is of the same total weight, the armature weighing 130,000 pounds, requires 79 inches on the engine shaft and has 36 poles.

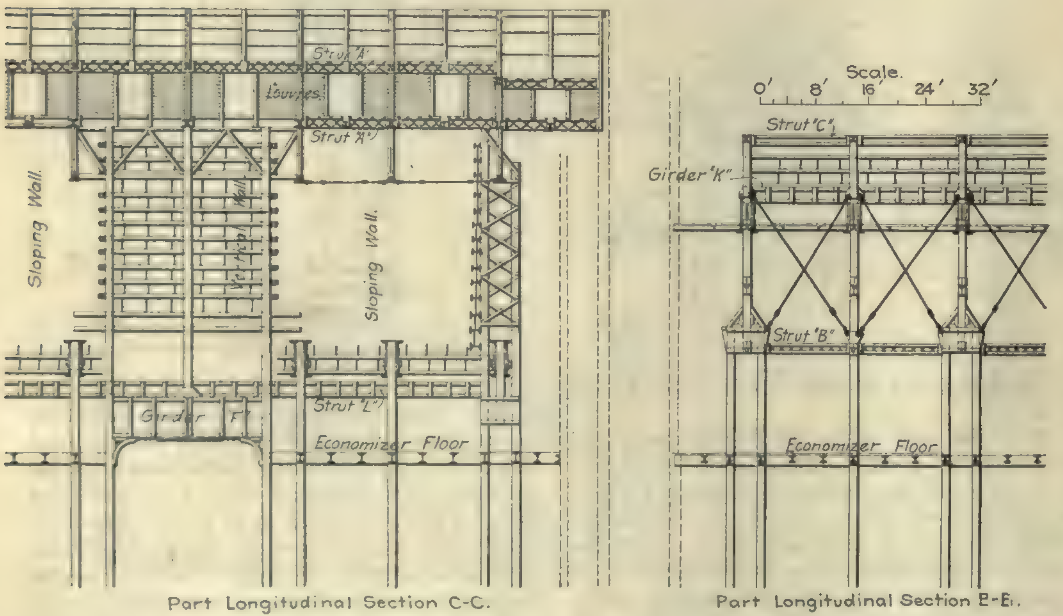
The exhaust from each engine is taken through a 30-inch pipe to a Wheeler feed-water heater placed next to the low-pressure cylinder, the exhaust passing thence to the jet condenser. These are of the Blake walking-beam pattern, one for each engine, and are placed on the engine-room basement floor on the side farthest



HALF CROSS-SECTION THROUGH COAL BUNKERS ON W-W.



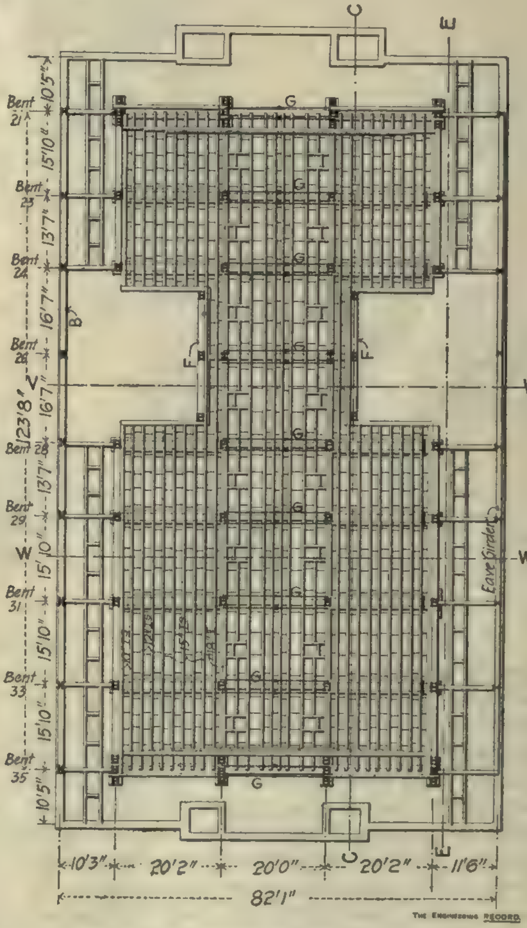
PART SECTION ON V-V.



Part Longitudinal Section C-C.

Part Longitudinal Section E-E.

TYPICAL SECTIONS THROUGH UPPER PART OF BOILER HOUSE.



PLAN OF FRAMING, COAL BUNKERS.

from the boiler house. In the foundation concrete beneath them are the condensing-water suction and discharge pipes, the former being 36-inch cast-iron flanged pipe as far as the first engine and 30-inch to the second. The latter is of the same material, also 36 inches in diameter, and is supported on brackets along the wall, the connection between the free exhaust and the condenser being made through an automatic relief valve of special type. This consists of a globe valve with an ordinary lifting disk secured to an upright stem passing through a stuffing-box to the piston of a water cylinder placed immediately above. Water under moderate pressure is connected to either end of this cylinder, the connection being made through a three-way cock. This can be set so that the upper and lower portions of the cylinders are in communication, in which case the cylinder merely acts as a dash pot, or the three-way cock may be set so that the water pressure is exerted on either side of the piston, the other side being open to the discharge, thus forcing the valve either open or shut. The rods controlling these valves, as well as the condenser steam and water valves, are carried up to standards on the engine-room floor.

The feed water is supplied by two Blake twin duplex vertical compound pumps, placed one on each side of the entrance to the stack foundation. The city water, under about 35 pounds pressure, passes through the closed primary heaters in the engine exhaust before mentioned, then passes to a secondary Webster open heater and purifier, placed beneath the stack. To this heater the exhaust from the auxiliaries is led, it being furnished with a by-pass and a 12-inch pipe connection to the free exhaust main. The feed pumps receive the water from the open heater and force it to the economizers and thence to the boiler through a ring-feed main. A by-pass connection is also furnished by which the economizers may be cut out if desired. The temperature of the water entering the boilers is from 300 to 325 degrees Fahr.

The framework of the engine house consists of steel bents from about 13½ to 16½ feet apart, with connecting purlins and wall girders. The two columns in each bent are built into the walls and leave the interior unobstructed. The columns in the partition wall are braced to those of the adjacent row in the boiler house, and, like those in the outer wall, carry box girders for the track of a 40-ton traveling girder crane of about 66 feet span and 51 feet clearance above the floor.

In the boiler house there are four interior longitudinal rows of columns, which support the floor beams and the coal bin. These are made with two kinds of cross sections, shown in the details of their bases, which have shop-riveted extensions for the distribution of the load on the pier masonry. One section has two 12-inch channels with the flanges turned inward and not latticed together, a 10 x ⅜-inch web and four 4 x 4-inch angles. The other columns are made with four Z-bars and a web plate. Most of them have four 6 x 3½-inch Z-bars and one 17½-inch web plate, the others have 4 x 3-inch Z-bars and a 7-inch web plate. All of them are riveted by four end flange angles to base plates from 27 to 45 inches wide, and all have bent-plate pockets riveted to their web plates to receive the anchor bolts, which have nut bearings on washers on the upper edges of the pocket plates. All beams and girders are connected to the columns by web and shelf angles. The base plates are of single, double, or treble thicknesses of ⅞-inch plates, according to their widths. Some of the columns which are built into the brick walls are made of an I-shape cross-section with four 5 x 3½ x ⅜-inch angles and a 9¾ x ½-inch web plate. The two outside rows of interior columns carry the roof trusses, as shown in the detail of the end connection of the latter, and also carry the upper ends of the valley rafter beams and of the inclined girders in the sloping side of the coal bin. They are trussed to the columns in the partition wall by two panels of X-brace angles, as shown in the details of the crane girder and column. These rows of columns are each interrupted near the middle and one column omitted to make room for the two chimneys, three other columns being inserted near each of the center rows to carry the floors and bin around the chimneys. The two center rows of nine columns each are continuous from end to end of the building and are only two stories high, carrying on top the middle girders and the lower ends of the side girders of the coal bins.

The roof is carried by nine Pratt trusses with all stiff members completely shop-riveted together with ½-inch connection plates, and having the ends of the top and bottom chords field-riveted to the columns. The top chord is composed of two 10-inch 20-pound channels riveted together, back to back, with ½-inch connection plates between, and is inclined 1:15 in two panels at each end and is horizontal in the middle. The web members are composed of pairs of angles riveted together, back to back, as are those of the lantern trusses, most of them being 3 x 2-inch. The two 5 x 3½-inch bottom-chord angles are reinforced by two adjustable 2⅛-inch rods which are pin-connected to the gussett plates which secure the chord angles to the columns. The trusses are connected together at the center points by vertical longitudinal trusses with pairs of 5 x 3½-inch angles for top and bottom chords, and ⅞-inch clevis rods for diagonals. The bottom chords are also braced by ⅞-inch clevis-connected lateral rods, which cross three trusses each at an angle of about 45 degrees. The top chords are also connected by longitudinal lattice girders at their ends and at the second panel points from the ends. The intermediate longitudinal girders have Z-shaped cross-sections made with two angles, the upper one carrying the sill of the louvre openings. The lantern roof trusses, nearly 30 feet long on centers, are in reality double connected cantilevers supported on posts 14 feet 10 inches apart, which are field riveted to the main roof trusses at the first panel point on each side of the center. The peaks of the lantern trusses are connected by a line of ridge struts made of pairs of 10-inch 20-pound channels, back to back, and the eaves are connected by Z-shape struts similar to those at the feet of the louvre posts. The louvre bars are riveted to the outsides of the vertical posts and are not movable or adjustable.

The lower ends of the valley rafters of the boiler house roof are riveted to the tops of the partition wall columns, to which the ends of the engine house roof trusses are also field riveted. The tops of these columns are connected by longitudinal plate girders 3¾ feet deep; they have I-shaped cross-sections made of four angles and a web plate. At the lower ends the angles project 2 feet beyond the web plate and are milled to bear on the cap plate of the main part of the column, at the level of the crane girder seat. The web of the lower section of the column projects above the cap to the web of the upper section and is shop-riveted between the angles and to the web cover splice plates. The lower section of the column is made of four Z-bars and a web plate, and below the girder seat is widened and stiffened by two additional web plates, one vertical diaphragm and four vertical angles, all milled to bearing, with the horizontal flange angles for the cap plate. There are several dormer windows between the inclined rafters at the ends of the roof trusses on each side of the boiler house. Their frames are made of single 8 x 3½ x ⅜-inch T-bars connected together and to the I-beam rafters with bent plates.

The coal bin walls are vertical at the ends and for about 10 feet below the top on the sides. The lower parts of the side walls slope inward at an angle of about 45 degrees, except in two panels on each side, where they are made vertical to clear the smoke stacks. The walls and bottom of the coal bin are made of flat arches of hollow tile, carried on horizontal I-beams which are uniformly spaced and have different depths to correspond with the maximum coal pressure to which they may be subjected. Where the walls are vertical these I-beams are riveted directly to the sides of the columns with their webs horizontal; where the walls or bottom are inclined the beams are riveted across the flanges of the transverse girders, and consequently have their webs inclined about 45 degrees to the vertical. The bottom of the bin is carried on horizontal transverse girders 20 feet long, which are web-connected to the tops of the middle rows of columns and have solid-web knee-braces with curved flange angles. Triangular flanged diaphragms are riveted to the tops of the girders to make summits, on both sides of which the coal is deflected to scuppers above the boiler chutes.

The tops of the columns are connected above the bottom of the bin by pairs of 6 x 1¼-inch eyebars with sleeve nut adjustments which tie the bottoms of the inclined girders together, and the tops of the same girders are similarly tied together by the pairs of rods in the lower chords of the roof trusses. The roof trusses pass through the upper part of the coal bin and their top chords serve as horizontal ties to connect the tops of the vertical walls. On each side of the bin that portion of the wall about 24 feet long which is made vertical to clear the smoke stack is supported on three special columns, set just outside the middle rows. Two of these columns are seated on foundation piers at the general level for all columns, but the center one is carried on the middle of a 69-inch plate girder, which is web-connected to the side columns as shown in the detail drawing.

To suit the arrangement of the batteries of boilers, three columns in each row are made double to a point above the economizer floor, above which they are connected by a double-web longitudinal plate girder 3½ feet deep, which carries in the middle the single upper section of the column. All three of the column sections pass between the girder webs and are flange-riveted to both of them, and the upper section of the columns in the outer rows are braced longitudinally by triangular vertical diaphragms in the planes of the girder webs, which are riveted to its flanges and to the top chords, and make an extremely rigid connection. Besides this, each longitudinal panel of the columns is X-braced with ⅞-inch clevis rods, with a line of 2-foot plate girders at the top and a line of lattice girder struts at the bottom.

The power station was designed and constructed under the direction of Mr. George A. Kimball, M. Am. Soc. C. E., chief engineer of the Boston Elevated Railway Company; Mr. J. C. Ostrup, M. Am. Soc. C. E., was the designing engineer for the steel construction, this being manufactured and erected by the Pencoyd branch of the American Bridge Company. The power installation was under the direction of Mr. Paul Winsor, of the Boston Elevated Railway Company, Messrs. Sheaff & Jaastad, of Boston, Mass., furnishing the designs.

Test of de Laval Turbine.

Tests of a 300-horse-power de Laval Steam Turbine were reported in the "Zeitschrift" of the Society of German Engineers of February 2 by Mr. W. Jacobson. According to "Science Abstracts," which gives the principal results, the turbine, which was made by the Actiebolaget de Lavals Angturbin of Stockholm, runs at 10,500 revolutions per minute and is connected to a dynamo made by Ganz & Company of Budapest, with a speed reduction by means of gearing to 750 revolutions per minute. The air pump is driven independently from an electric motor and the steam is delivered to the turbine superheated. When developing 300 horse-power, with steam at 132.3 pounds pressure, and a vacuum of 26.3 inches of mercury, the turbine consumed 18.3 pounds per horse-power-hour; with steam at 446 degrees Fahr., 17.2 pounds per horse-power-hour; with steam at 572 degrees Fahr., 17 pounds per horse-power-hour. In a test with a boiler pressure of 154.5 pounds (127.1 pounds at the turbine) with the steam superheated to 415.6 degrees and a vacuum of 27 inches, and 342.1 brake horse-power, 15.7 pounds of steam were consumed per brake horse-power per hour. The current to run the air pump was taken from an independent source.

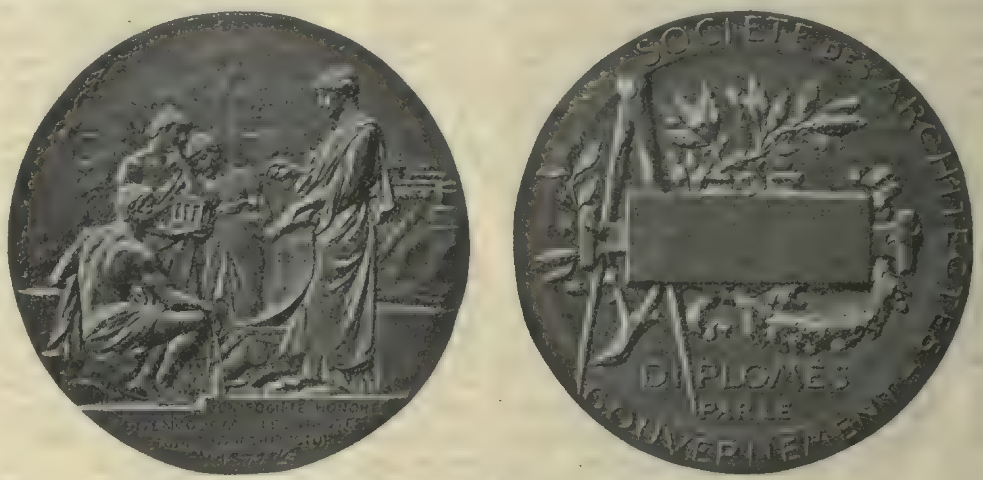
History of the French Projects to License Architects.

At the recent convention of the American Society of Civil Engineers a suggestion was made during the discussion of licenses for engineers, that a solution of the problem might lie in giving permits to properly qualified engineers to practice on State work. This would not debar any engineer from private practice, while it would create a body of known proficiency who alone would be in charge of public work and to whom people could apply without hesitation and with a fair assurance of receiving sound advice. Such a plan has been the outcome of the various attempts to license architects in France, of which the following interesting sketch was recently contributed by Mr. Arthur Cates to the "Journal" of the Royal Institute of British Architects.

In 1840 some of the most distinguished of French architects appointed a committee to consider what steps should be taken or demanded from the government to provide a remedy for the inconveniences which arose from the absolute freedom by which anyone could assume the title of architect, and exercise the functions of that profession. From this the Société Centrale des Architectes was established. In 1843 the creation of a diploma, obligatory on all architects, was proposed. The discussion of this resulted, in 1846, in the recommendation that "the creation of a diploma is necessary, and it shall be an obligatory qualification, authorizing the use of the title of architect. The diploma to be granted by examination—from which there should be no exemption. Temporary measures to be taken for the preservation of existing rights and positions. The diploma to be granted by the Minister of the Interior or of Public Works. The diploma not to be obtainable under thirty years of age." These labors would have borne fruit, and possibly the State would have established a diploma or certificate of capability which would alone give to its possessor the legal right to take the title and exercise the functions of an architect, whether for private clients or public departments; the Revolution of 1848, however, intervened, and ended the matter for the time.

The further discussion of the subject through successive years led to the conclusion that the diploma should be optional, and only imperative for architects employed by the State, important public bodies, and the tribunals. In 1855 the articles and pamphlet of M. Lance revived the discussion; but opinion was greatly divided on the question of making the diploma obligatory; and, after the reorganization of the École des Beaux-Arts in 1863, representations to the Emperor Napoleon III. and the Minister of Fine Arts led to the institution, in 1867, of the diploma, as the crowning honor and culmination of the course of study of architecture in the Ecole, but not as an obligatory condition for the practice of architecture.

The first examination was held in July, 1869, when four candidates were successful; but up to and including 1876 only ten diplomas had been granted. This remarkable result of the establishment of a distinction so long and so earnestly desired may have partly resulted from the events of 1870, and also from the fact that the diploma, the result of long years of earnest study, did not confer any privilege in the exercise of the profession, and did not even assure any advantage to those who possessed it. The diploma was also violently attacked as being the extreme glorification of an exclusive system of teaching rather than a guarantee of professional capability. The holders of the diploma, at first few in number, recognizing that *L'union fait la force*, combined, and by insistent endeavors in 1875 obtained from the Minister of Public Instruction recognition of the studies it necessitated.



MEDAL OF THE SOCIETY OF DIPLOMATED ARCHITECTS.

The persistent action of the Société des Architectes Diplômés par la Gouvernement obtained in time more substantial recognition of the professional position of its members. Thus, the Prefet de la Seine, on 30th January, 1885, directed that holders of the diploma under thirty-five years of age should be admitted without examination to the appointment of sous-inspecteurs de troisieme classe of the Direction des Travaux de Paris, provided that those so appointed did not exceed one-third of the whole number of that class.

In 1891, by a decree of the President of the Republic, the service of architecture of the Minister of Public Works for civil buildings and the national palaces was reorganized in the following ten grades: Les Inspecteurs Generaux; Les Architectes en Chef; Les Inspecteurs aux Grands Travaux; Les Inspecteurs a l'Entretien; Les Sous-Inspecteurs aux Grands Travaux; Les Controleurs; Les Verificateurs; Les Conducteurs de Travaux; Les Dessinateurs; Les Jardiniers. The Sous-Inspecteurs aux Grands Travaux are appointed by competition under the direction of the Conseil General des Batiments Civils, in which the works of the candidates and the diplomas and prizes, especially at the École des Beaux-Arts, are taken into consideration—particularly the diploma.

The Society further takes steps to keep before the official hierarchy, under whose influence and control so much of the architectural work of France is placed, the merits and qualifications of its members as manifected by the holding of the diploma, which is the result of long and serious studies in the École des Beaux-Arts, specially qualifying its holders to undertake important public works; chiefly by annually sending a circular to this effect (with a list of members) to the Presidents of the General Councils of each Department, and to the Prefects of the Departments, also to the Mayors of all the towns in which members are resident; and they are justified in taking this course by circulars issued by the Minister of the Interior in October, 1869, and October, 1871, to the Prefects of Departments, and in 1872 to the General Councils of Departments, desiring that favorable consideration should be given to architects holding the diploma.

The diploma is not to be gained by one spasmodic effort made at the close of a lightly considered course; it is the culmination of a long series of stages of education, in each of which a certain distinction must have been obtained. Admission to the examination for the diploma is only granted to students of the Ecole who have obtained not less than ten "valeurs" in the first class, either in the competitions in architecture or for the Rongevin or Godeboeuf prizes; also at the least a "mention" in the competition on the history of architecture, one "valeur" for figure drawing, and one "valeur" for ornament or figure modelling. Candidates must also produce a certificate that they have diligently attended, for at least one year, works of construction under the direction of an engineer of the State, of an architect of the Government, or some public or private administration. There is no limit of age for entrance to this examination, but the requisite "valeurs" must be obtained before the age of thirty years.

The examination is in three parts—written, graphic, and oral. That in writing is devoted to the working out of two questions, one relating to building law and the other to the practical execution of works and the use of materials in construction. To each question two hours is allotted. The graphic test is a design in architecture, conceived and carried out as for actual execution; it comprises the plans, sections, elevations, all details of construction, a descriptive memoir and specification, and quantities and estimate of part of the construction. The successful designs are now published in a collected form, of which two volumes have appeared, each containing about 250 phototypes.

The subject and programme of the design may be selected by the candidate, subject to the approval of the jury of adjudication, who may reject it, or modify its construction, and fix the scale at which it shall be carried out. The programme, once approved, cannot be varied by the candidate. The work may be carried out either in the Ecole or outside, and there is no limit of time for its execution.

The oral examination is in three sections:

1. The theory and practice relating to the design submitted by the candidates; questions and discussions on the materials employed in the construction.
2. Questions on the history of architecture, with particular relation to the style selected.
3. Questions on the laws affecting contracts, architect and client, owner and workman, easements, party walls, light, etc., private right, health, dilapidations, etc., drainage, dangerous structures, building regulations. The law affecting public works, finance, expropriation, accounts.
4. Questions on the elements of physics, chemistry, and geology, as applied to construction.

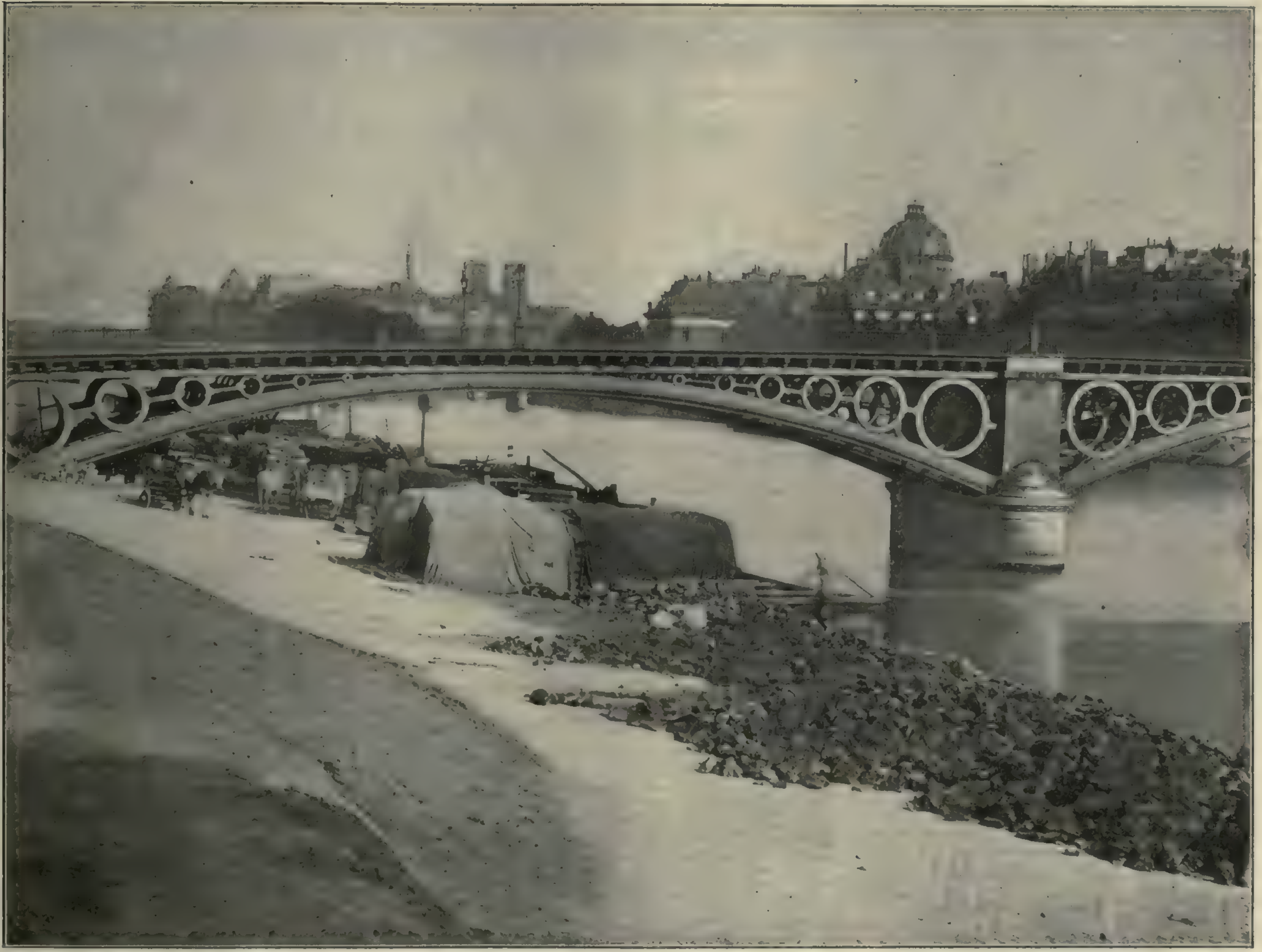
The adjudication is made by a jury specially appointed annually, composed of two professors of architecture (chefs d'atelier) of the École des Beaux-Arts, chosen by lot; two professors, heads of external ateliers, also chosen by lot from the members of the permanent jury of architecture; the professors of the theory of architecture, of construction, of physics and chemistry, and of building legislation.

The course of study necessary to warrant the student in entering on the competition for the diploma is thus summarized by M. Bonnier:

One year at least must be devoted to preliminary studies in order to obtain admission to the Ecole; two or three years must be passed in the second class; two years or more in the first class; and at least six months in the preparation of the first design and essay: time equivalent to one year must also have been spent on actual works.

Thus the acquisition of the diploma demands not less than six years of continuous serious study, and sufficiently ample means to render it unnecessary for the candidate to prolong the period of his studies by devoting any portion of his time to earning money by assisting older architects in their work; and one year at least beyond those mentioned must have been spent on actual work where knowledge of practice and construction can be obtained.

But the elasticity of the organization of the Ecole and the freedom of study which it allows permit the student to spread his work over a much longer period, during which he may spend half his time as an assistant in an office, may have travelled far and wide, may have been engaged in decorative work or other improving and profitable occupation, making it even ten years or more from entry into the Ecole before he obtains the Diploma.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXIX, PARIS, PONT DU CARROUSEL.

While pleasing in general form, the treatment of the iron arch is an example of a method of design to be avoided in such work. The piers are too slim to give proper accent to their structure. This bridge, also known as the Pont des Saints-Peres, was built in 1832-34 by Polonceau; there are three arch spans like that illustrated in this view.

The Societe des Architectes Diplomes par le Gouvernement, founded in 1877, has for its objects:

1. The encouragement and reward of the higher studies of architecture in their artistic and archaeological relations, and aiding their progress by competitions and exhibitions.
2. The making generally known in the public interest the importance and value of the higher studies carried on at the École des

Beaux-Arts, which lead up to the Diploma.

3. To aid and assist its members in need by pecuniary grants and pensions.

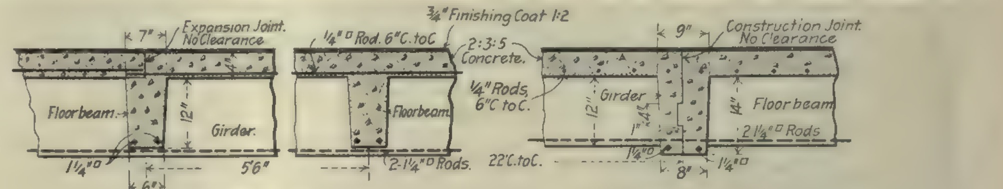
In 1893 the Society founded a medal, reproduced in the accompanying illustration, to be awarded each year to an "architecte diplome" still a pupil of the Ecole who shall have gained in the scholastic year the greatest number of "valeurs" since obtaining the diploma.

Notwithstanding the severity of the tests required for the diploma, the growth of the Society has been very rapid. In 1898 it numbered 399 members, and now approaches 500. In 1900 the diploma was gained by 98 candidates, and the normal number annually will now exceed 100. The members occupy distinguished positions as professors of architecture in Paris and the provinces, architects of the Government, inspectors of civil buildings, diocesan architects, architects and inspectors of the city of Paris, of the prefecture of police, Departmental architects, etc. And of the twenty-four architects engaged on the Exposition of 1900, seventeen held the diploma; and of the eight members of the "Institut" all are diplomes. The future of this distinction is thus well assured, and must have great influence on education. The "Grand Prix de Rome" confers the title of "Architecte Diplome" as a matter of right without examination.

M. Bonnier, president of the Society, has well summed up the position thus: "The diploma in France serves as a common bond of union, and a mark for those who by their studies may be regarded as really architects, among whom there are many more or less favorably endowed with talents. An 'Architecte Diplome' is not necessarily a man of exceptional ability. There are only a few men of genius in each generation, and among these does there ever exist the universal, omniscient, complete genius? There is not, nor ever will be, a perfect architect. Every day there is some new fact, some new process to master; new materials, new applications are continually discovered; new demands and necessities, and the application of architecture thereunto, advance with all social progress, and the diploma can only indicate a man whose studies have qualified him to successfully follow these movements, and to conform with intelligence to their requirements. The title of 'Architecte Diplome par le Gouvernement' has in France begun to take its place in current usage and to be duly recognized in the world, and may well be adopted in other lands; but it should not be made obligatory—that which is arbitrary is bad. It should only be granted as the result of the most serious and most complete studies in art and in construction. There should be no half-and-half measure—no 'shoddy' qualification. But, having once created the diploma, obtained the protection of the State, above all endeavor to establish its authority before the public and official departments by the value and importance of the essential acquirements which it implies, which alone can secure for it due appreciation."

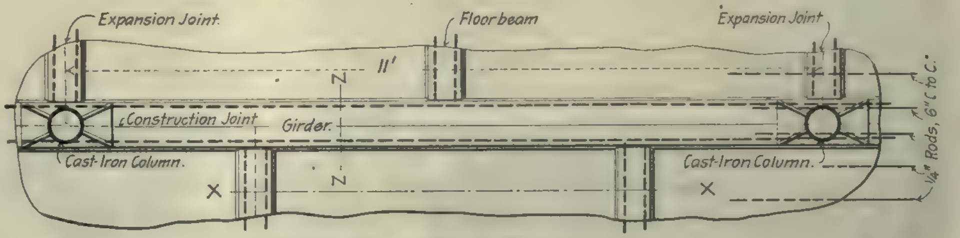
Concrete-Steel Foundry and Power Station Floors.

The Eastwood Company's machine shop and foundry in Paterson, N. J., was built and equipped for the manufacture of silk and general machinery. The foundry building is one story in height with brick walls and a steel framework, and has an 88 x 100-foot main part and a 22 x 100-foot wing. It is located near the center of the city where land is valuable, and the excavation of a basement story under almost the whole of the building was equivalent to providing a good-size yard. It furnishes abundant storage for sand, coal, iron, etc., and for piling flasks and other bulky articles where they will be conveniently accessible for use in the foundry. This construction involved the building of a very heavy solid floor at street level, and it was made of flat concrete slabs supported on concrete beams and girders, all of which were reinforced with twisted steel tension bars embedded in the lower part of the concrete according to the Ransome system.

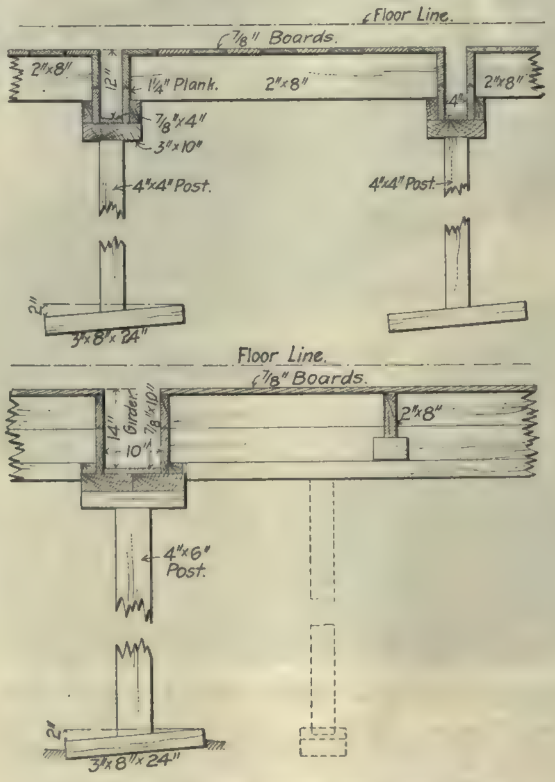


Section X-X.

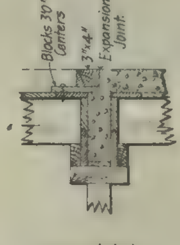
Section Z-Z.



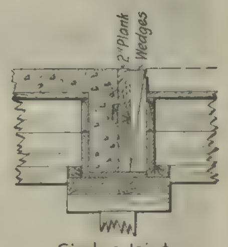
Plan of Under Side of Floor.



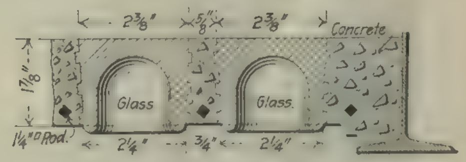
Moulds for Beams, Girders and Floor Slabs.



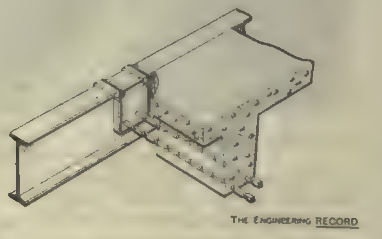
Beam Joint.



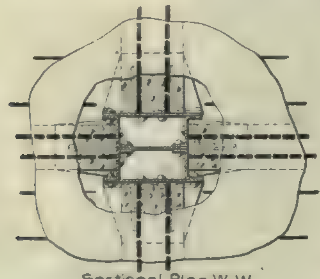
Girder Joint.



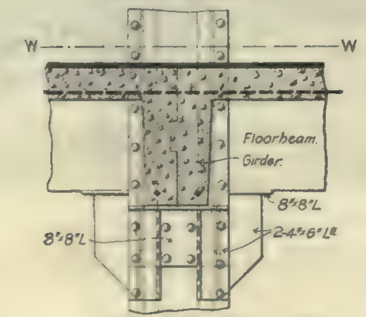
Sidewalk Construction.



Support of Concrete Beam on Wall Girder.



Sectional Plan W-W



Sectional Elevation.

DETAILS OF CONCRETE-STEEL FLOORS IN FOUNDRIES AND POWER PLANTS.

The floor is proportioned for a load of 250 pounds per square foot and is made in panels 5½ feet wide and 22 feet long on centers. The Portland cement concrete is mixed 2:3:5, the aggregate being ½-inch screened stone. It has ¼-inch reinforcement rods 6 inches apart, and is 4 inches thick, with ¾-inch top coat made 1 part cement and 2 parts of sand, with 50 per cent. beach gravel up to ½-inch in size, and is troweled smooth. The floor slabs are carried by floorbeams 5½ feet apart and 22 feet long, which are in turn carried by girders supported by columns 11 feet apart in rows 22 feet apart. Both floorbeams and girders were made monolithic with the floor slabs, and the latter were separated without open cracks, to make expansion joints over every girder and every alternate floorbeam, thus dividing the floor into 22 x 11-foot panels, each of which was made in one continuous operation.

The floorbeams were all made in single solid sections, those under expansion joints having one upper corner rebated to receive the edge of the adjacent slab, which was usually built on the finished surface without any separation, and was not divided from the beam except by the lack of adhesion between smooth concrete surfaces made at different times. Each girder was, however, made in two nearly equal parts separated by a vertical joint with an offset corresponding to a tongue and groove. The twisted rods in the floor slabs were laid to project across the rebate in the tops of the expansion beams and lap past those in the adjacent slabs so as to lock them together. Similarly the twisted rods in the floorbeams were made to project a few inches beyond the end so as to extend across to the opposite face of the double girder and lock its halves together. Both of these joints are indicated in the accompanying detail sections, where the twisted rods are shown at slightly different levels so that both can be seen, although in reality both are in the same horizontal plane.

Different spacing was required for the floorbeams in the wing and in the main building, and no difficulty was found in staggering them so that they were discontinuous across the main girder, as shown in a plan of the under side of the floor. The columns which support only the foundry floor are made of cast iron and receive the bottoms of the concrete girders on their horizontal cap plates; those which support the roof and framework are made of riveted steel sections and are continuous through the concrete floor, receiving its beams and girders on horizontal shelves with reinforced brackets about 8 inches wide similar to those for steel I-beams and girders.

At the street front the concrete floorbeams are supported on the steel I-beams which are framed into the columns, and as the available bearing on one side of the bottom flange was not considered sufficient, additional support was given to the concrete beam by building into it an ordinary U-shaped stirrup of flat iron, hung from the top flange of the I-beam as if for a wooden beam. Both floorbeams and girders are made 1 inch wider at the top than at the bottom so as to draw easily from the molds, and all concrete for them and for the floor slabs was rammed in molds of ⅞-inch matched boards tacked together and supported on blocks set on vertical posts and cross beams in such a manner that they could easily be knocked out and fall down when the concrete was sufficiently set.

No pains have been taken to limit or distribute the load coming on this floor from the ordinary heavy work carried on in the foundry. Core ovens are built on it, and heavy castings are molded and poured at any convenient point. Twenty-ton loads have been carried over it on the sharp flanges of a four-wheel truck with a wheel base about 2 x 6 feet, without causing any perceptible deflection or injury, and no cracks or chippings have been observed from impact. The jack shafts for an electric motor and a blower are suspended from the floor by bolts in holes drilled through the concrete, and the bearings are firm and solid and there is no sign of difficulty from vibrations.

The basement is continued under the sidewalk and the vault is roofed with Ransome concrete pavement slabs, 1⅞ inches thick, supported on the lower flanges of the steel I-beams as shown in the detail sketch. Sharpe's patent glass lights are set in the concrete 3 inches apart on centers, and give a satisfactory illumination below. The glasses are slightly conical with three ribs to engage the concrete and have a rounded rim projecting below the under surface of the concrete, which is claimed to be effective in reflecting the light and diffusing it more satisfactorily than is done by ordinary lenses.

A similar concrete floor has recently been built in the power house of the Edison Electric Light Company, Paterson. It is 93½ feet wide and 210 feet long, and is supported on 20 x 20-inch brick piers 12 feet apart, in rows 10 feet apart. The 4 x 10-foot floor slabs are 4 inches thick and are calculated for a load of 250 pounds per square foot, but showed no signs of injury, permanent set or failure under a test load of 500 pounds per square foot which was applied when the concrete was 40 days old, and produced a temporary deflection of less than 1/32 inch. The floor slabs are reinforced by ¼-inch twisted steel rods 12 inches apart; the 4 x 15-inch floorbeams 10 feet long, have single ⅞-inch rods, and the 9 x 18-inch girders, 12 feet long, have each three 1-inch rods.

The 180 x 50-foot floor of the shaft room in the reconstructed power house for the Georgia Electric Light Company, Atlanta, Ga., is required to carry at any point heavy high-speed machinery and line shafting which must have perfectly solid beds and preserve accurate alignment. The 5 x 14-foot panels are 4 inches thick and have ¼-inch rods 6 inches apart. The 4 x 12-inch floorbeams and the 10 x 14-inch girders have the same thickness at top and bottom, and the former each have one, and the latter each have two 1¼-inch rods.

During construction this floor is supported on 4 x 4-inch wooden falsework vertical posts under the floorbeams and by 6 x 4-inch posts under the girders. Planks laid flat on top of the posts form the bottoms of the molds for the beams and girders and receive the matched boards which make the sides. The edges of the bottom planks under the floorbeams project far enough to support the ends of planks set edgewise to receive a floor platform at the level of the tops of the beams and girders, and form a surface on which the concrete is rammed for the floor slabs. The expansion rebates in the floor slabs are formed against temporary strips nailed over the molds, as shown in the detail sketch, and the separate halves of the double girders are rammed in the same mold, the first one being limited by the partition board wedged in place as shown in the cross-section, and the second half being built against the face of the concrete in the first half after the board and wedges are removed.

All these floors were designed and built by Mr. Joseph Sharpe, Paterson, N. J.

The Internal Speed Variation of a Vertical Cross-Compound Engine.

A paper in the "Technograph" by Mr. W. L. Abbott, chief operating engineer, Chicago Edison Company.

The object of the investigation forming the subject of this paper, was to determine the amount of the angular variation which would occur during a revolution, in the relative positions of the armatures of alternating current dynamos, if connected to two similar engines of the type described below, when running in parallel at the same number of revolutions per minute; and to see if the variation in phase would be great enough to put the dynamos out of step, or if the amount of cross current would be objectionable.

The engine to which the calculations apply is a vertical cross-compound Corliss 30 x 80 x 60-inch condensing engine, built by the E. P. Allis Company, of Milwaukee, and is to be directly connected to one ACH 40-2,500-75 double-current General Electric generator for use at the Harrison street power-house of the Chicago Edison Company.

The condition of load under which the engine was assumed to be running was that of the economical rating, or 3,500 I. H. P., with a constant speed of 75 revolutions per minute.

The indicator cards from which the determinations were made, were derived from a set of cards obtained from the Allis Company taken on November 28, 1898, from the Allis Corliss cross-compound engine No. 4, of the South Side Elevated Railway Company of Chicago, while the engine was running under a steam pressure of 150 pounds per square inch. The cards were used merely to get the steam distribution of a Corliss engine working at a moderate load, and the ordinates of the cards were increased to 170 pounds per square inch, the latter being the pressure at which the new engine is designed to operate.

The various steps of the investigation in their proper order may be briefly enumerated as follows:

1. From the known weights and velocities of the reciprocating parts, calculate the force due to inertia, as modified by the length of the connecting rod, and construct a curve showing the same for all positions of the piston.
2. Obtain a pair of indicator diagrams (head and crank end) from each cylinder and deduct from the ordinates of each the simultaneous back pressure shown on the diagram taken from the opposite end of the cylinder.
3. Multiply the ordinates of these combined diagrams by the number of square inches of piston area, and plot a new curve showing the total pressures on the piston at each point of the stroke.
4. Combine the pressures shown by this last curve with those of the inertia curve to get a curve showing the total pressures on the crosshead.
5. Resolve the pressures represented by the ordinates of the combined steam-pressure and inertia curve, to determine the rotative effect at the crank-pin, and plot a curve showing the tangential effort on the pin for all positions of the piston.
6. Combine the curves of tangential effort for each cylinder to obtain a curve of crank effort for all cranks.
7. Draw a line through this last curve to represent the mean effective pressure of the varying forces acting during one revolution. Now, disregarding the original base-line, assume the forces above and below this mean line as positive and negative respectively, and from these positive and negative forces calculate the acceleration and retardation which would be produced upon the rotating mass connected to the engine shaft. With ordinates obtained in this way plot a curve showing the resultant velocities attained during each interval of the stroke.
8. From this curve of velocities, whose integrated sum must be zero, calculate the distance traveled by the crank-pin ahead of or behind some other point assumed to be revolving with an absolutely uniform motion at the same number of revolutions per minute, and plot a curve showing the amount of variation in the position of the pin, from normal, at the different points of the stroke. The maximum ordinate of this curve in degrees of arc or degrees of electrical phase, is the result we are seeking.

A more detailed description of the various methods employed in each of the above steps follows:

The weight in pounds of the reciprocating parts was as follows: Crosshead, 6,963; connecting-rod (total 6,500), one-half reciprocating, 3,250; reciprocating weight, common to all cylinders, 10,213; H.-P. piston = 2,120, rod = 1,466, 2,120 + 1,466 + 10,213 = 13,799; L.-P. piston = 8,040, rod = 2,042, 8,040 + 2,042 + 10,213 = 20,295.

For the derivation of the curve of inertia let the stroke be 5 feet; revolutions per minute, 75; $V = 5\pi \times 75 \div 60 = 19.63$; R, length of crank, 2.5 feet; W = weight of reciprocating parts on one crank; F_0 = inertia of reciprocating parts at dead center (connecting rod infinite) $= WV^2 \div gR, = 4.79\,W$; crank, 30 inches; connecting-rod, 165 inches.

Lay off M M′, Figure 1, to represent stroke of piston. Lay off MB' and $M'B''$ to represent pressure per pound of reciprocating parts at dead centers. Straight line joining B' and B'' = inertia curve with infinite rod. R_a = Connecting rod ÷ Crank = 5.5. $M'B^\circ = M'B'' - (M'B'' \div R_a)$. $MB = MB' + (MB' \div R_a)$.

Lay off NN' parallel to MM' a distance below MM' represented by 1 pound to scale: then ordinates from NN' are proportional to combined effects of weight and inertia, and the number of pounds which they represent multiplied by weights of reciprocating parts gives values in tables.

First Step.—To deduce the curve of inertia, Figure 1, the length of the connecting rod is first assumed to be infinite and the ordinates $B'M$ and $B''M'$, are determined. These ordinates represent the force due to inertia per pound of reciprocating parts at the two dead-centers, and are deduced from the well-known formula $F_0 = W V^2 \div g R$ where F_0 is the magnitude of the force above mentioned; W is the weight of reciprocating parts on one crank, and is assumed to be one pound in order to render the one curve applicable to both cylinders, or cranks; V is the velocity of the reciprocating parts, which are assumed to be concentrated at the center of the crank-pin, the velocity being based upon 75 revolutions per minute; R is the radius of the crank-pin circle, 2.5 feet. The magnitude of these forces at the respective dead-centers are equal, but opposite in direction. Ordinates from the straight line $B'B''$ to the base-line MM' correspond to forces due to inertia at various points of the stroke, and where the curve $B'B''$ intersects MM' at a point corresponding to the position of the piston at mid-stroke, the reciprocating parts are being neither accelerated nor retarded, and the force due to inertia is zero.

To determine the extent to which the curve $B'B''$ is modified by the influence of the finite rod whose length is 5½ times that of the crank, as in the case under investigation, the approximate position of the piston corresponding to zero acceleration of the reciprocating parts, point D, is determined as follows: The line C_R, which represents to scale the length and direction of the connecting rod, is drawn tangent to the circle of crank-pin travel, and the point D is located at the intersection with MM', the line of piston travel. This is very nearly the zero point of the inertia curve for the finite rod. The two maximum points on the new curve are next located by adding to MB', and deducting from $M'B''$, which represent the forces due to inertia at the top and bottom centers respectively, an amount equal to 1/5.5 of the force at those points. These points are represented by B and B°, Figure 1. Having found these three points of the new curve of inertia, the complete curve BDB° may be constructed. In practice, an arc of a circle may be substituted for the theoretical curve without introducing any appreciable error.

Finally, a correction for the effect of the direct weight of the reciprocating parts is made by laying off $M'N'$ to represent to scale a force of one pound, and the new base-line NN' is drawn. (This correction is required for vertical engines only). Ordinates drawn to this base line from the curve BDB°, will represent the forces due to inertia per pound of reciprocating parts, and when the forces which they represent are multiplied by the weights of the reciprocating parts the products will be the resultant forces due to inertia and direct weight of the reciprocating parts. The magnitudes of the resultant forces at various points of the stroke are shown in tabulated form under Figure 1.

Second and Third Steps.—Figures 2 and 3 represent the indicator diagrams taken from each end of the two cylinders of the engine. The ordinates of a diagram representing the resultant steam pressure on the piston may be obtained by deducting from the ordinates of diagrams Figures 2 and 3 the simultaneous back-pressures shown on the diagram from the opposite end of the cylinder. The ordinates of these resultant steam pressure diagrams are multiplied by the area of the piston to which they apply to get the total resultant steam pressure against the piston. The ordinates of diagrams AAAA, Figures 4 and 6, represent the total resultant steam pressure on the piston throughout the entire stroke.

Fourth Step.—The curve of inertia BB, deduced as already explained, when plotted to the same scale as the resultant steam curves and combined with them, gives the curve CCCC, whose ordinates represent the pressures on the crosshead due to the combined effect of the inertia of the reciprocating parts and the resultant steam pressure against the piston.

Fifth Step.—From the combined steam and inertia curve CCCC, for each cylinder, the net pressure on the crosshead in the direction of the axis of the cylinder may be read for all positions of the piston. As part of this pressure acts against the guides and part in the direction of the axis of the connecting rod, that part which acts in the direction of the rod must be again resolved radially and tangentially at the pin in order to obtain the tangential pressure on the pin corresponding to a given pressure on the piston. The method which was employed in the investigation, may be described as follows: As the instantaneous pressure on the crosshead multiplied by its corresponding velocity is equal to the simultaneous tangential pressure on the crank-pin multiplied by its velocity, it is clear that the tangential effort on the pin is equal to the product of the pressure on the piston into the ratio of the velocity of the piston to the velocity of the crank-pin. Now the velocities of the two ends of the connecting rod are in different directions, the crank-pin end always moving with constant velocity in a direction perpendicular to the instantaneous position of the crank, while the crosshead end always moves with variable velocity in a fixed direction parallel to the axis of the cylinder. In Figure 8, BbA represents the first quadrant of the crank-pin circle, and the radius OB is drawn to represent the constant velocity of the crank-pin. The velocity of the crosshead or piston may be deduced from that of the crank-pin as follows: produce ab, the direction of the connecting rod, Figure 8, until it intersects OA at f. Erect the perpendicular bc upon Ob at b equal to Ob. Then bc will represent the velocity of the crank-pin b, both in direction and magnitude. Draw cd perpendicular to the direction of the connecting rod. Draw be parallel to the direction of the velocity of the piston a to intersect cd produced. As the length of the connecting rod is fixed, the components of the velocities of the two ends resolved along the connecting rod must be equal. The component of the velocity of b in the direction of the rod is bd, and bd must therefore be the same component of the velocity of a; hence be represents in direction and magnitude the velocity of a. As the sides of the triangle bce are perpendicular to those of the triangle Obf, the angles of the two triangles must be equal, and, as the sides bc and Ob are equal, the two triangles must be equal. Therefore, be = Of, and Of represents the velocity of the piston when the crank-pin occupies the position b. Let P be the pressure on the piston when the pin is at b; then the tangential effort on the pin will be P × Of ÷ OA. If OA be made to equal unit length, then Of will be the factor by which the pressures on the piston must be multiplied to get the corresponding tangential effort on the pin. As indicated in Figure 9, this factor may be determined for any position of the piston and pin by merely prolonging the axis of the connecting rod till it intersects the perpendicular OA, when Oe, Oe′, Oe″, etc., will be the required factors for positions b, b′, b″, etc., of the pin. The ordinates of the diagrams of rotative effort, or tangential effort, on the crank-pin, Figures 5 and 7, were obtained by multiplying the corresponding ordinates of diagrams CCCC, Figures 4 and 6, by a factor deduced as described above. In Figures 5 and 7, DD is drawn to represent the diameter of the crank-pin circle.

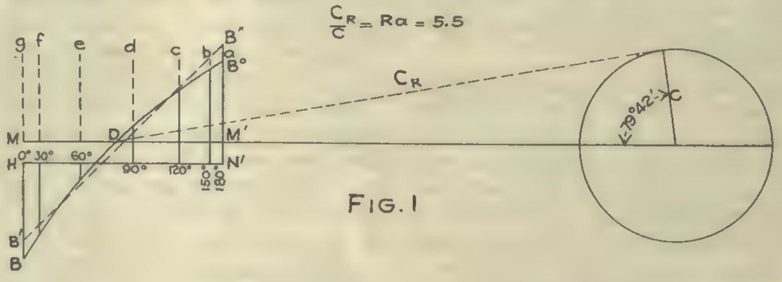


FIG. I

Ordinate a = Inertia at 180°
" b = " " 150°
" c = " " 120°
" d = " " 90°
" e = " " 60°
" f = " " 30°
" g = " " 0°

	H.P.	L.P.
Wt	13799	20295
a	69000	101475
b	63480	93357
c	49680	73062
d	24840	36531
[illegible]	– 12420	18265
f	– 48300	71032
g	– 64860	95386

THE CURVE OF INERTIA.

Sixth step.—Figure 10 shows the rotative effort on the pin for each cylinder, and is constructed from Figures 5 and 7, with due respect to the relative positions of the high and low-pressure crank-pins. The diagram of crank effort for both cranks, Figure 11, is derived by combining curves D_1 and D_2 of Figure 10. MM represents the mean crank effort for all cranks during one revolution, and OO is the rectified crank-pin circle.

For convenience in estimating, the circle of crank travel, OO, is divided into 12 equal spaces, and the applied force is assumed to be uniform within each space. The tangential effort during each space above or below the normal MM is represented by the mean height of each space above or below MM, and is exhibited in column F in the table.

Seventh step.—The velocity gained or lost during each twelfth of a revolution was deduced as follows: The equivalent weight of the revolving parts at the crank radius (2.5 feet) is 3,367,600 pounds divided as follows: armature, 1,081,600 pounds; engine, 2,286,000 pounds. The velocity of the crank-pin is 2.5 × 2 × 3.1416 ×

$75 \div 60 = 19.63$ feet per second. As the number of revolutions per second $= 75/60 = 1.25$, the number of spaces traversed per second $= 15$, and the time for each space is 0.0667 second. The mass of the revolving parts is $w \div g = 3{,}367{,}600 \div 32.2 = 104{,}584$. Let A denote the velocity gained (or lost) during one space; then the average acceleration is $A \div 0.0667$. From the law, force = mass × acceleration, $F = WA \div 0.0667g$; hence $A = 0.0000006374F$. The velocity A gained or lost during each interval is shown in column A in the table.

	F	A	V″	V′	V	S″	S′	S	Degrees of Arc.	Degrees of Phase.
Space No.	Tangential force in Lbs above or below Average Pressure. F=Mean Height of each space	Velocity gained during each 1/12 of a revolution. $A = \frac{I}{M} \times F$	Velocity attained up to the end of divisions. Assuming 0 at beginning of Stroke.	V″ corrected to bring 0 to its proper place $V' = V'' - .033$	Average Velocity during each interval	Space actually passed over during each interval	Space from normal assuming 0 at the beginning of Stroke.	S′ corrected to bring 0 to its proper place $S = S' + .0019$	S × 22.92 1 Ft. = 22.92°	There are 40 Poles on the Generator, consequently there are 20 changes of Phase.
1	-13500	-.0086	-.0086	-.0416	-.0375	-.0025	-.00250	-.00060	-.0137	-0.274
2	+57000	+.0363	+.0277	-.0053	-.0261	-.00174	-.00424	-.00234	-.0536	-1.072
3	+4500	+.0029	+.0306	-.0024	-.0012	-.00008	-.00432	-.00242	-.0555	-1.110
4	-10500	-.0067	+.0239	-.0091	-.0072	-.00048	-.00480	-.00290	-.0665	-1.330
5	+30000	+.0191	+.0430	+.0100	-.0015	-.00010	-.00490	-.00300	-.0688	-1.376
6	+ 1500	+.0009	+.0439	+.0109	+.0133	+.00089	-.00401	-.00211	-.0484	-0.968
7	+21000	+.0134	+.0573	+.0243	+.0155	+.00103	-.00298	-.00108	-.0247	-0.494
8	+30000	+.0191	+.0764	+.0434	+.0334	+.00223	-.00075	+.00115	+.0264	+0.528
9	-30000	-.0191	+.0573	+.0243	+.0390	+.00260	+.00185	+.00375	+.0859	+1.718
10	-48000	-.0306	+.0267	-.0063	+.0059	+.00039	+.00224	+.00414	+.0949	+1.898
11	-13500	-.0086	+.0181	-.0149	-.0097	-.00065	+.00159	+.00349	+.0800	+1.600
12	-28500	-.0181	-.0000	-.0330	-.0234	-.00156	+.00003	+.00193	+.0442	+0.884

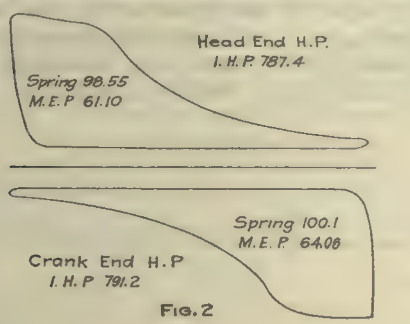


FIG. 2

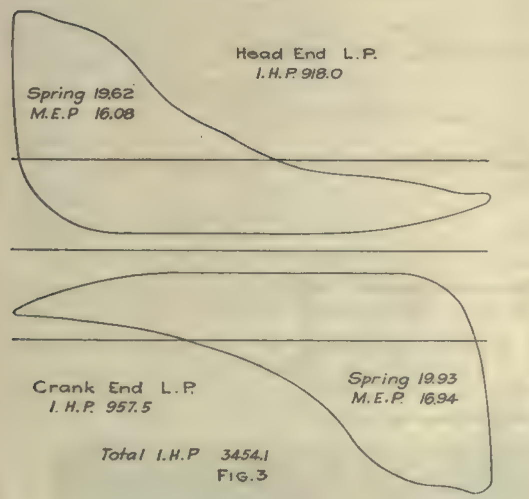
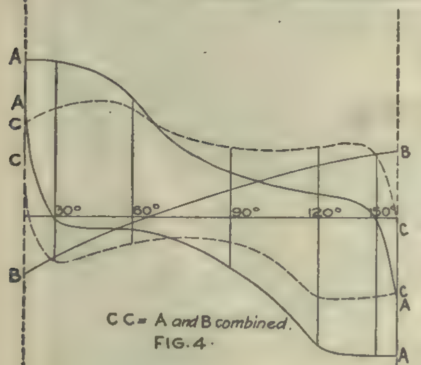


FIG. 3

A A- *Indicator Cards combined.* B B- *Inertia Curve.*



C C= A and B combined.

FIG. 4.

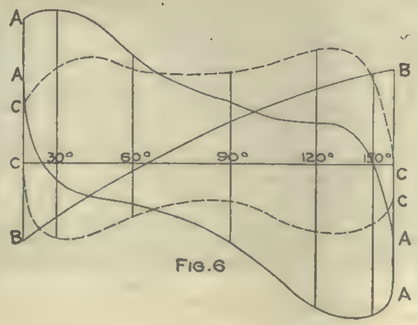
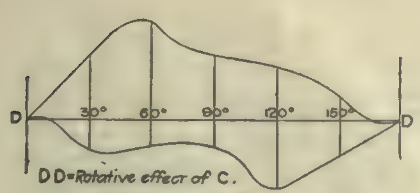
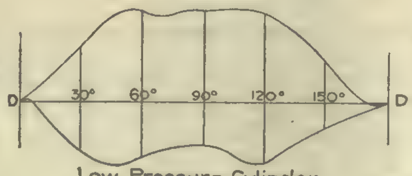


FIG. 6



High Pressure Cylinder.
FIG. 5



Low Pressure Cylinder.
FIG. 7

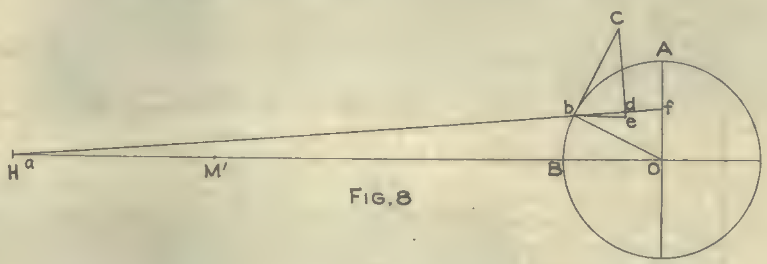


FIG. 8

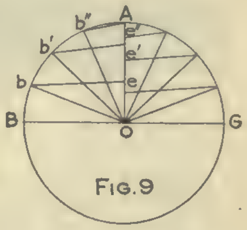
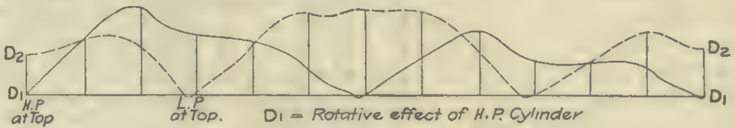
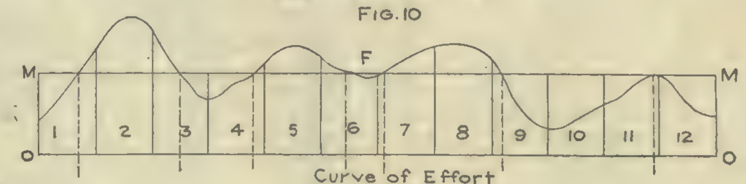


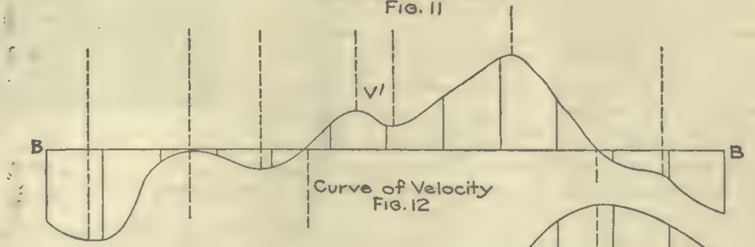
FIG. 9



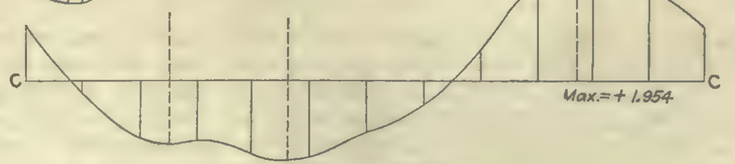
D1 = Rotative effect of H.P. Cylinder
D2 = " " " L.P. "
FIG. 10



Curve of Effort
FIG. 11



Curve of Velocity
FIG. 12



Curve of Degrees of Phase.
FIG. 13

THE ANALYSIS OF THE INTERNAL SPEED-VARIATION OF A VERTICAL CROSS-COMPOUND ENGINE.

Now, if the velocity of the pin be assumed normal at the beginning of the stroke, the velocity attained up to the end of the various spaces will be the algebraic sum of the velocities gained during each of the preceding spaces. These velocities attained up to the end of each space are shown in column V″. As the actual velocity of the crank-pin at the beginning of the stroke was not normal, but assumed, it becomes necessary to correct the values of V″ accordingly. The integrated sum of the velocities above and below normal attained during one revolution must be zero; therefore the correction to be applied is the algebraic sum of the velocities V″ divided by the number of spaces (12 in this case). Thus the correction is 0.033, and this amount must be deducted from the values of V″ in order to arrive at the true velocity attained up to the end of the successive intervals. With these true velocities given in column V′ in the table as ordinates, the curve of velocity V′, Figure 12, is plotted. The line BB represents the mean velocity of the pin.

Eighth step.—From the curve of velocity V′, Figure 12, ascertain the average velocity above or below the mean velocity, BB, during each space, shown in column V of the table. With these velocities given, the space actually passed over during each interval can be readily calculated by multiplying the values of V by 0.0667, the time for one space. The figures in column S″ were deduced in this way.

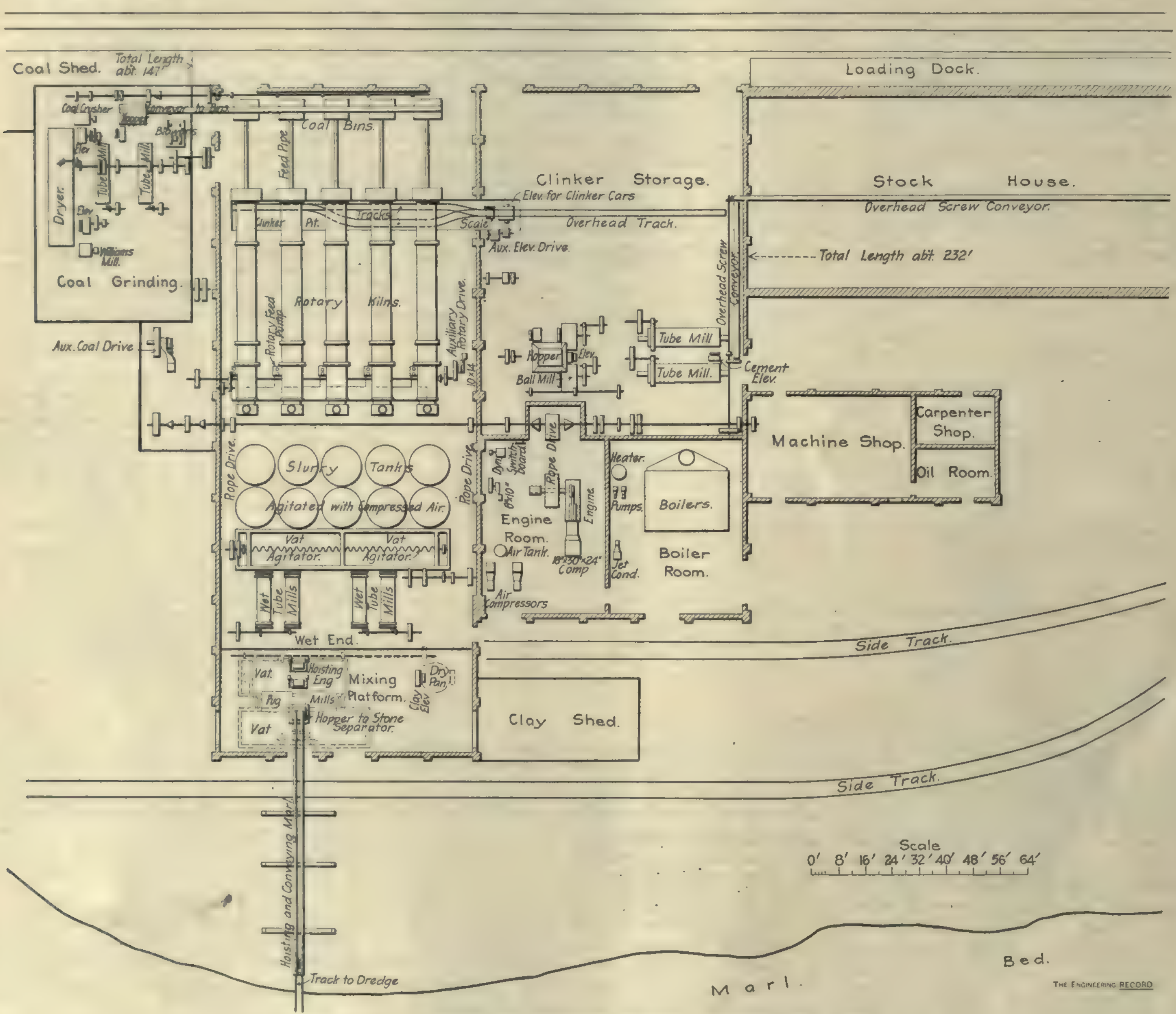
If the position of the pin be assumed normal at the beginning of the stroke, its distance from normal up to the end of the respective intervals will be the algebraic sum of the spaces actually passed over, ahead of, or behind the mean position, during each interval. Therefore the figures in column S′ are equal to the integrated sum of the preceding figures in column S″. As the position of the crank-pin at the beginning of the stroke was not zero, as assumed, a correction must be applied to the values of S′.

Since the integrated sum of the distances ahead of or behind the mean position must equal zero, the value of the correction is equal to the ratio of the algebraic sum of the values of S′ to the number of spaces. The value of the correction is .0019, and is to be added to the values of S′ to get the true distance from normal of the pin at the end of each interval, the figures for same being shown in column S. Since 1 foot corresponds to 22.92 degrees of arc, measured on the crank-pin circle, the number of degrees of arc from normal is the product of the true distances in feet from normal (column S) by 22.92 degrees of arc per foot. The number of degrees of arc from normal deduced in this way is shown in the penultimate column of the table. Finally, as there are 40 poles on the generator there will be 20 changes of phase per revolution; therefore, one degree of arc is equal to 20 degrees of phase, and the number or degrees of phase from normal (shown in the last column of the table) at the end of each interval may be calculated by multiplying the corresponding degrees of arc by 20. With the values of the degrees of phase from normal as ordinates, the curve of degrees of phase, Figure 13, was plotted, in which CC represents the mean position of the crank-pin.

To insure the satisfactory operation of two alternating-current generators when working in parallel, the maximum amount of angular variation should not be allowed to exceed 2½ degrees of phase departure from the mean position during any revolution, and as the maximum variation shown by this final curve is well within the 2½-degree limit, the design of the unit in that respect may be considered satisfactory.

The Omega Portland Cement Works, Jonesville, Mich.

The Omega Portland Cement Works are located at Omega near Jonesville, Mich., between that place and Mosherville, on the Jackson branch of the Lake Shore & Michigan Southern Railroad. They comprise a compact group of buildings arranged with regard to the process of manufacture, to give a forward run of materials throughout the different stages, and they are all under a continuous roof, including coal mill and stock house. The railroad extends along the plant on one side and a marl bed is located on the other, so that the buildings at once have good railroad facilities and close proximity to one of the raw materials. The process of manufacture is a wet one, with clay and marl as the raw materials. The clay is brought from a point east of Toledo, O., some 80 miles distant, and besides containing less than the probable safe amount of magnesia, costs less, it is asserted, than if it were hauled in wagons from an available clay bed near by. The raw materials are ground in tube mills, the slurry is burned in rotary kilns, which use pulverized coal for fuel, and the clinker is ground in ball and tube mills. Among the interesting features may be mentioned a machine for separating pebbles from the marl on its delivery to the mill and slurry pumps for feeding the kilns, one for each kiln with ready adjustment as to the amount of pumpage irrespective of the kiln speed. Considerable attention has been paid toward minimizing the possibility of shut-downs, by the installation, for example, of large slurry storage tanks, and in the provision of auxiliary steam engines; and a careful watch is kept both of the raw materials and of the finished products, in the physical and chemical laboratories.



THE OMEGA PORTLAND CEMENT WORKS, JONESVILLE, MICH.

The arrangement of the works is shown in an accompanying plan. The main building extends from the marl lake at the rear to the railroad at the front and is 200 x 80 feet in plan; it houses the wet mill and the kiln room, these two departments practically separated from each other by high tanks in the center in which the ground slurry is kept for calcination in the rotary kilns. At one side of the wet mill is a shed for clay, with a railroad track on each side of it, and in front of this in a building a counterpart of the main building, but 40 feet shorter, are located the engine and boiler rooms and the clinker storage and finishing mills. The power plant is separated from the clinker storage and finishing department by a tight wall to keep out the dust, being pierced only to allow for the shafting. The coal mill adjoins the kiln room and has a front along the railroad and the cement storehouse extends from the clinker-storage room in the opposite direction along the railroad. This building has required an extension, which is now under construction, and the total floor space is 14,000 square feet. A wing from the boiler room houses a machine shop and a carpenter shop and oil room. The offices and laboratories of the works are located a short distance beyond the cement storehouse in an attractive frame building. In general the buildings are of brick with steel roof trusses, corrugated iron roofs, and brick floors, except the clay shed and finishing rooms which have cement floors. The stockhouse, however, is of heavy boulder concrete walls, cement floor and frame roof.

Marl Analysis.

Silica	.91
Aluminum and ferric oxides	.29
Carbonate of lime	93.12
Carbonate of magnesium	2.98
Sulphuric anhydride	.31
Carbonaceous matter	2.13

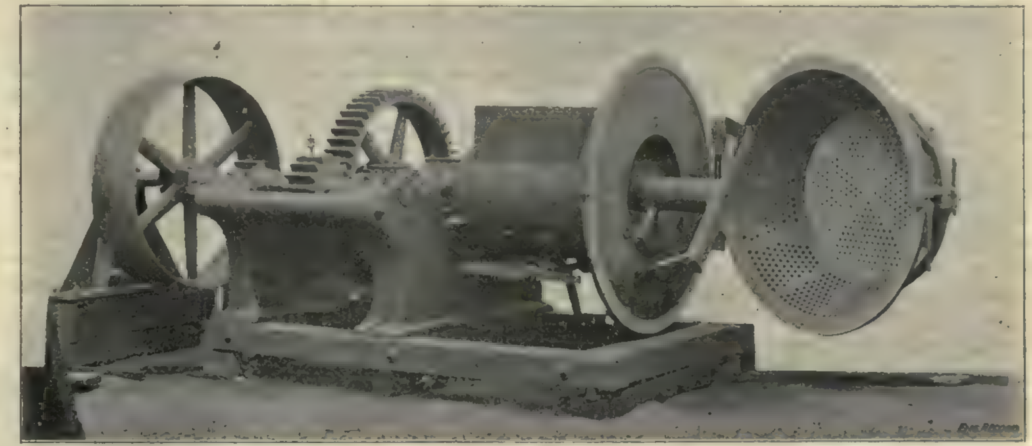
Clay Analysis.

Silica	64.78
Ferric oxide	5.22
Aluminum oxide	17.82
Calcium oxide	1.99
Magnesium oxide	1.51
Carbonic acid	3.24
Sulphuric anhydride	Trace
Organic matter	4.39
Alkalies (not determined)	1.05

Cement Analysis.

Silica	22.24
Alumina	7.26
Iron oxide	2.54
Lime	64.96
Magnesia	2.26
Sulphuric acid, anhydride	.41
Water and carbon dioxide	.33

The marl is obtained from a deep bed which lies a few feet below ground surface. Its general composition is given in the accompanying table, which was furnished by the manager of the plant. The marl is excavated by means of a dipper dredge floating in a lake which is being enlarged with the removal of the marl. The dipper dumps into a bucket holding about 1 cubic yard and the buckets are hauled by horse, two at a time, on cars, a distance of 200 or 300 feet toward the plant where each bucket is lifted to a timber trestle and, hanging from a traveling car, is pulled to a hopper in the wet mill. For this work a Lidgerwood hoisting engine is used. This is located on a mixing platform, so called, at that end of the wet mill. The marl passes from the hopper into a stone separator designed by Mr. George H. Sharp, the superintendent of the plant, and built by the Bonnot Company, of Canton, O. It consists of a screw conveyor which forces the marl against and through a screen of cast-iron containing ¾-inch holes. The screen envelopes the end of the screw and the marl that fails to pass through the end plate of the screen is forced through the conical side screen by a revolving turtle, and the stones thus work backward and fall to the ground below the separator, carrying comparatively little marl with them.


Stone Separator for Raw Marl.

Sample of Substances Removed by the Separator.

From the separator the marl falls into either one of two pug mills below the mixing platform and into these is dumped the required amount of clay, one pug mill being filled while the other is grinding. Three cubic yards of marl, that is, three bucketfuls, usually form one charge and the clay is added to it. The clay, the composition of which is given in the accompanying table, is thrown from the railroad cars upon the floor of the clay shed and is fed by the barrowful into a dry pan, where it is ground. To about every five barrowfuls of the clay from the clay shed are added two barrowfuls of clay that have previously been spread on the floor under the kilns and dried. The dry pan is about ten feet in diameter and is of the type in which the clay is ground by two heavy rollers, and the broken clay worked through the screen around the outside of the pan. An analysis of the marl for the proportion of contained lime is made about every third cubic yard, thus for every pug mill charge, and the ground clay, which is lifted by a Bonnot belt conveyor from the dry pan to a hopper above the mixing platform, is weighed in a car in which it is carried from the clay hopper to the pug-mill feed hopper. Water is then added from the mixing platform, by a man who judges the quantity of water by a clock, the amount of water flowing in a given time to obtain 45 per cent. water in the slurry, which is the proportion desired, having been determined. The pug-mills discharge into slurry vats underneath them, shown in dotted line underneath the mixing platform. For the purpose of the quick determination of the raw materials an office for the assistant chemist is partitioned off on the mixing platform; his work includes also a determination of the proportions of lime, silica and alumina in the ground slurry in the vats.

The raw mixture is then lifted from the vats by means of two Bonnot pumps of the duplex plunger power type, into a trough placed along the outside of the platform, and from this the slurry is discharged in spouts to the wet tube mills, below. The four wet tube mills, which are of the Bonnot make, 50 inches in diameter and 16 feet long, are driven at about 24 revolutions per minute. They discharge into a long slurry vat extending across the building below the floor, and from here it is lifted into the storage tanks, two duplex slurry pumps of the same size as the wet tube mill feed pumps being provided for this purpose, located on a timber flooring over the vat, one driven independently by a small steam engine, thus rendering them independent of the main engine or power.

The discharging main from these slurry pumps runs overhead between the two rows of tanks and opposite every pair there is a cross from the side outlets of which the discharge branch for each tank is taken. The tanks are filled one by one and emptied in the same manner, the piping and valves for emptying being located underneath the tanks, which are supported on concrete piers. One tank is thus being filled while another is being emptied, and the tendency for settling, it is believed, is thereby lessened. The various vats and the trough on the platform have Caldwell paddle and screw-conveyor agitators, driven from the shafting; but the agitation for the tanks consists in blowing air through them, a pressure of about 11 or 12 pounds being sufficient. The air piping is brought above the tanks and each tank is provided with five 1-inch pipes which pass vertically downward through the slurry and terminate a few inches above the bottom. From the storage tanks, the slurry is discharged into another vat, through a pipe which empties into a galvanized-iron-wire screen placed across the vat. This catches a surprisingly large amount of roots and vegetable matter chiefly, which, though combustible, might cause trouble in the kiln feed pumps where such trouble it is highly desirable to avoid owing to the annoyance and expense of stopping a kiln. So much of this debris is caught, in fact, that the slurry from the tanks is admitted only intermittently and the screen emptied between times. This slurry is made to pass a 98 per cent. test with a 100 sieve. The storage tanks are about 12 feet in diameter and 20 feet high; so that altogether they hold about 835 cubic yards. The wet mill is run about ten hours per day, while the kilns run continuously. The capacity of the tanks is considered a two days' kiln supply.

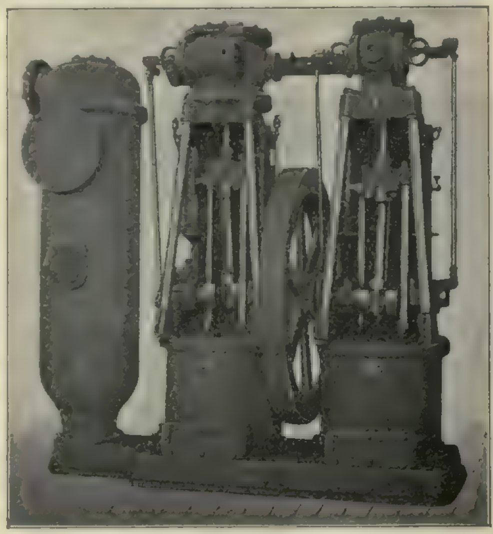
The kiln feed pumps draw directly from this last vat and discharge directly into the kiln. Each pump, which is of the single-acting single plunger type, is driven by means of gearing from the kiln drive, and always bears a constant speed relation to the kiln. It has, however, a means of varying the length of stroke, which was devised by Mr. Sharp, and it is by this arrangement that the supply to each kiln may be made independent of that to any other as well as of the speed of rotation of the kiln. The pumps have a capacity sufficient to supply two kilns and the piping has been arranged so that one pump may be used, in case of necessity, to feed two kilns. The kilns were made by the Bonnot Company and are 6 feet in diameter and 60 feet long; they are all driven from a common shaft by means of spur and bevel gearing with friction couplings for throwing any kiln in or out. This allows of driving opposite sections of the shafting from different power sources and thus, if desirable, at different speeds, as will be explained.

The clinker is discharged into a hopper under each kiln at one side of a clinker pit, which is a large trench passing underneath all and into the clinker storage. A car on a narrow-gauge track runs in this and all the clinker emptied into it from one kiln is weighed in the clinker room, and credited to that kiln. The car is then hoisted by a power-driven platform elevator to overhead tracking in the clinker storage and the hot clinker drops from this to the floor below to cool and wait its turn in the finishing mills. For the finishing mills it is carried on wheel barrows from the clinker pile, weighed again, sulphate of lime thrown upon it, and it is then dumped into the boot of an elevator which lifts it to a hopper. Two spouts drop from the hopper to two ball mills and the product from these is then elevated into a hopper and from there fed to the tube mills. One of these was found insufficient to cope with the output of the plant and the second one is now being installed. The tube mills discharge into a common elevator, and by means of two horizontal screw conveyors, from the elevator to the stockhouse and along through the stockhouse under the roof truss, the finished cement, which must pass a 98 per cent. test in a 100 sieve, is dumped into the various rooms and allowed to age. The finished cement is packed in bags by hand and loaded in cars standing at the loading platform.

The coal mill occupies a ground area of about 45 x 70 feet, and has a coal shed in front of it, extending all told 150 feet along the railroad. The floor of the coal shed is at the railroad level and the coal is dumped from the cars into the shed. It is then thrown into a coal crusher which reduces to the size of fine slack, is elevated into a bin from which it passes into a Cummer dryer, falls from there into a Williams mill, is again elevated into another hopper from which it is fed into two No. 12 Smidth finishing tube mills. Finally it is taken by a third elevator into an overhead hopper and from there passes through a screw conveyor across five bins in the kiln room, opposite the five kilns. In the coal room are located the blast fans used in connection with burning the fuel. These are Sturtevant steel-pressure blowers and are mounted on the one shaft. Under ordinary conditions one blower supplies air to the kilns, while the other discharges into the clinker pit to cool it. The outflow of pulverized coal from each dust bin is regulated to suit the conditions of that kiln by a speed controller made by the Reeves Pulley Co., ol Columbus, Ind., one of which is connected to the discharge pipe of each bin. The coal-dust pipe then meets the branch air-blast pipe and the dust is mixed with the air and blown through a 6-inch pipe into the kiln. The coal bins are of steel supported by angle-iron frames on concrete piers.

The main power plant consists of a battery of two Stirling boilers, of 500 horse-power total capacity, and a Russell tandem-compound engine of 18 and 30-inch cylinders and 24-inch stroke. Run-of-mine Youghiogheny coal is burned and a steam pressure of 125 pounds is carried. A Laidlaw-Dunn-Gordon jet condenser is used and the condensation and condensing water, which is drawn from the marl lake, is discharged back into it. A Pittsburg feed-water heater is provided to heat the feed water, which is also taken from the lake, utilizing the exhaust steam from the various pumps. The boiler-feed pump is located near the feed-water heater and besides this there is a large pump for the general water supply of the plant. The pumps were made by the American Steam Pump Company, of Battle Creek, Mich., and with the condenser are located in the boiler room.

The main engine runs at a speed of about 150 revolutions per minute and drives the main shaft by means of a rope drive, furnished by the Falls Rivet & Machinery Co., of Cuyahoga Falls, O., which is divided into two sections with two tighteners. The main shaft runs at about 200 revolutions per minute. It extends in opposite directions from the power room, one part driving the finishing mill and the other part the wet mill and the coal mill. In the wet mill there are two auxiliary rope drives, one at each end of the group of storage tanks. This section of the main shaft also drives the elevator for clinker cars, which, however, has a small steam engine close by as an auxiliary; this section of the main shaft may also be used to run the kilns. The kiln driving shaft, however, has a 10 x 14-inch Brownell engine directly connected to it through a cut-off coupling, and this is ordinarily used for the kilns, driving also the pressure blowers, the shaft extending for this purpose into an auxiliary engine room, containing a 16 x 24-inch Atlas engine intended primarily as an auxiliary coal drive. The shaft of this engine may for this purpose be directly connected with the rope drive of the coal mill, the driving sheave having a cut-off coupling on each side.


Barr Air Pump and Condenser.

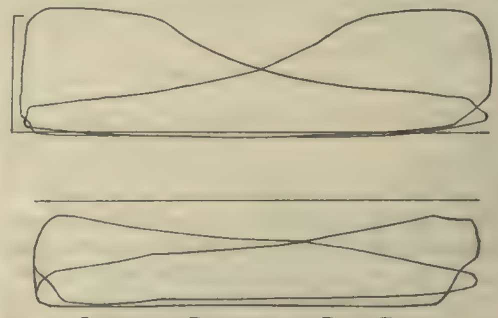
The engine room contains two direct-acting Marsh compressors installed in duplicate, of 14 and 18-inch cylinders for steam and air, respectively, and 20-inch stroke. These are governed automatically to main about 12 pounds pressure on the system, in which there is an air storage tank near the pumps, about 3 feet in diameter and 6 feet high. The plant is lighted by incandescent lights, the lighting unit consisting of an 8 x 10-inch Brownell engine and a 120-light 110-volt Card electric generator.

The general arrangement and design of the works is that of Mr. Charles B. Stowe, of Cleveland, while the construction of the works, the installation of machinery and the working out of details were taken care of by Mr. George H. Sharp, the superintendent of the plant. Mr. Frank M. Stewart is president of the company; Mr. Israel Wickes, vice-president, Mr. Charles F. Wade, secretary and treasurer, and Mr. C. Selden Richards, chemist.

The Barr Air Pump and Condenser.

The accompanying cut shows the general features of an air pump and jet condenser possessing some new features, which has recently been built for a power house for the United Gas Improvement Company, in Bridgeport, Conn., by the Barr Pumping Engine Company, Philadelphia, Pa. The air pump is of the vertical cross-compound flywheel pattern, the idea of the builders being that much less steam will be required to drive a pump of this type than the direct-acting steam pump.

The general arrangement of the machine consists of two pump buckets placed side by side on a common base. An extension of this base carries the condenser body. The two pump buckets are surmounted by a special housing for support of the cylinders, which are placed directly over the buckets, and is of entirely new design, as will be noticed. The housing is cut away on the front and made rigid by means of steel rods, so that what is lost in strength by the reduction in cast iron is more than made up by means of these steel tie rods, while the working parts of the pump are rendered easy of access; in fact the front of the machine is entirely open.


Indicator Diagrams of Barr Pump.

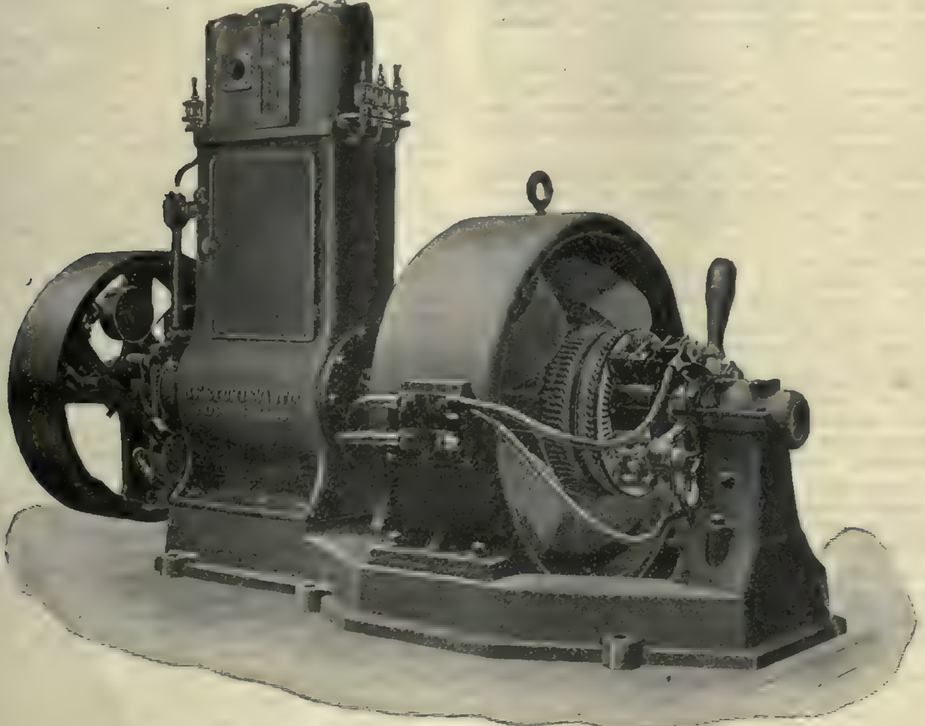
The air pump is of the usual bucket type, lined with brass, and provided with a number of soft rubber valves. The air pump rod is made of brass and is connected to the cross-head of the steam end by means of tie rods in such position that they will not interfere with the crank shaft. The crank shaft is of the double-throw type and made of steel. It carries a large, heavy flywheel between the pump cylinders, and is provided with extra large bearing surface to avoid the risk of heating.

The steam cylinders are carefully proportioned, so that a good distribution of steam as well as an approximate equalization of work is obtained. The high-pressure cylinder is provided with a rotary valve operated from a crank carried on the end of the main shaft. This high-pressure valve has within it a rotary cut-off, designed for this purpose, and operated by an eccentric valve on the main shaft between the flywheel and one of the air pumps. The connection between the high and low-pressure steam cylinders forms a receiver. The low-pressure cylinder is arranged to exhaust into the condenser.

A set of indicator cards from the high and low-pressure cylinders are herewith reproduced. They were taken under adverse circumstances in that the steam pressure was not as high as that for which the air pump was designed, but they serve to indicate, in a way, what might be expected under more favorable conditions. Evidence of the prompt closure of the cut-off valves is given, also of a satisfactory expansion of the steam.

Sturtevant Generating Set with Enclosed Compound Engine.

The accompanying cut illustrates one of the late designs of small and medium size generating sets of the B. F. Sturtevant Co., Boston. The running gear of the engine is entirely enclosed, all parts are oiled from sight-feed oiling devices on the exterior and access to the interior is provided through a tight-fitting door. The engine is of the compound vertical type and its general appearance is very similar to that of the double vertical engine of the same makers. The engines range from a 4 and 7 x 4-inch up to an 8½ and 15 x 7-inch. The cylinders are in a separate casting from the frame to which they are bolted, thus rendering them easily removed for repair. Two valves are employed, one controlling admission of steam to each cylinder, and motion is transmitted through a rocker, provided at its outer end with a ball-and-socket joint, and at its inner end connected by link to the valve stem yoke. Danger of damage from water in the cylinders is avoided by the use of special automatic relief valves.



Sturtevant Generating Set with Compound Engine.

The generator is of the standard four-pole Sturtevant type, with magnet frame of special magnet steel with field cores cast on. To these the pole shoes are secured by cap screws. The armature is of the barrel-wound toothed drum type. Ventilation is effected by the use of specially constructed air ducts between the laminae of the core. The winding for low-voltage machines is of copper bars with easy bends; high-voltage machines are wire-wound with machine-formed coils. The commutator segments are secured between cast-iron flanges of spider construction to allow free circulation of air. All machines are given a full load test for a sufficient time to bring every part to its maximum temperature, which is stated to never exceed 40 degrees Cent.

Personal Notes.

Mr. B. C. Bratt has been elected city engineer of Portsmouth, Ohio, succeeding Mr. R. A. Bryan, whose term of office has expired.

Mr. Cecil B. Smith, formerly assistant city engineer of Toronto, has been appointed on the engineering staff of the Canadian Niagara Power Co.

Mr. W. F. Miller, until recently in charge of the water filtration work at Pittsburg, has been appointed assistant road engineer of Allegheny County.

Mr. G. V. Flynn has severed his connection with the New York office of the Westinghouse Electric & Mfg. Co., to enter into partnership with Mr. H. J. Riley, Jr., as electrical contractors. The firm name is G. V. Flynn & Co., and the offices are at 72 Trinity Place, New York.

Mr. Arthur Thatcher, of St. Louis, has been appointed to serve with Messrs. Clemens Herschel and Lewis Johnson on the board to arbitrate the differences between the New Orleans Drainage Commission and the National Contracting Co. The announcement in this journal on July 27 of Mr. M. L. Holman's appointment to the board, although made on generally reliable authority, was incorrect.

The Albany Filter Plant naturally forms the subject of a large part of the last annual report of Mr. George I. Bailey, M. Am. Soc. C. E., superintendent of the Bureau of Water of that city. The plant and its management are both admirable, but an article on the subject, prepared by Mr. Bailey, appeared so recently in these pages that it is unnecessary to review the report at length. The tables are numerous and valuable, and the illustrations are particularly interesting, showing views of the men while cleaning the sedimentation basin and washing sand. One feature of the report which ought to be mentioned specifically is the threatened shortage of water before long, due to the excessive and growing waste. If the draft increases at the present rate, the capacity of the filters will be reached by the end of the present year. It is imperative to provide more filters and pumps, or check the waste, and as the draft averaged 191 gallons per capita daily during the period covered by the report, Mr. Bailey believes in the latter remedy. He states that an expenditure of $25,000 a year for meters will maintain an adequate water supply without distressing anyone, and the money can be furnished from the revenues of the Bureau without increasing the water debt. The recommendation is based on sound business principles and satisfactory experience elsewhere, so it is to be hoped it will be adopted.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Saginaw, Mich.—Bids are wanted Aug. 22 for furnishing cast-iron pipe, valves, hydrants and special castings for the remainder of the season of 1901. H. E. Terry, City Engr.

Cleveland, O.—Bids are wanted Sept. 6 for furnishing and delivering valves as may be required by the Water Works Division of the Dept. of Pub. Wks. Chas. P. Salen, Dir. Pub. Wks.

Geneva, O.—Bids are wanted Sept. 4 for installing a pumping station and constructing a gravity filtering plant on Grand River, Harpersfield Township, to be used for pumping and filtering water for the water-works. A. H. Reed, Clk. of Council.

Milton, Ore.—The East Side Irrigation Co. has been incorporated to construct and operate flumes and irrigation ditches and supply water for domestic and irrigation purposes. Capital, $5,000. J. K. Lawler, O. F. Wilson and Charles Burton are the incorporators.

Northampton, Mass.—The Finance Committee has sold water bonds amounting to $200,000.

Stanley, Idaho.—The Stanley Basin Water & Power Co. has been organized with $500,000 capital to secure mining water for working the placers of this region. The water will be taken 6 miles in a pipe line from lakes in the mountains.

Laurel, Neb.—City Clk. M. H. Dodge writes that it was voted Aug. 6 to issue bonds for water-works.

Glenwood, Minn.—Village Recorder Geo. S. Blood writes that it was voted Aug. 2 to issue $15,000 bonds for water-works. Bonds will be sold Aug. 31.

Vallejo, Cal.—City Engineer Noyes has submitted an estimate of the cost of proposed improvements, amounting in all to $120,511, $70,000 being for a 12-in. main and $15,000 for the installation of 1,500 meters.

Seattle, Wash.—See "Paving and Roadmaking."

Appleton, Wis.—It is stated that bids will be received about Aug. 28 for constructing water-works. Sturtevant & Todd, Engrs., Appleton.

Denver, Colo.—The North Poudre Irrigation Co. has been incorporated by Burton D. Sanborn, Geo. M. Huston and Henry C. Luther to operate in Larimer and Weld counties; capital, $150,000.

Washington, D. C.—Bids are wanted Sept. 21 for constructing a pumping station building, 256 ft. long, 150 ft. wide and 84 ft. high, at Trumbull St., northwest, for the Water Department of the District of Columbia. Lansing H. Beach, Commissioner, D. C.

Ishpeming, Mich.—P. H. Devine, Supt. Water-Wks., writes that the City Council has appropriated $12,000 for purchasing and installing water meters, and instructed the Board of Public Works to purchase meters and proceed with the work.

New Florence, Pa.—The contract for building a gravity water plant at New Florence is reported to have been awarded to P. F. McCann, of Greensburg; cost, about $15,000.

Fremont, Neb.—It is stated that the Council contemplates adding new boilers at the water pumping station.

Glidden, Ia.—The Town is reported to have voted for water-works.

Sharpsburg, Pa.—The Council is reported to have awarded the contract for drilling 6 artesian wells for the new water plant to W. J. McNeil, of Dehaven, Pa., for $3,950. The contract for the machinery, poles and wiring for the electric light plant is reported to have been let to Langton Electric Co. for $14,500.

Kern, Cal.—It is stated that Engineer W. C. Ambrose, who was appointed by the Trustees to prepare an estimate of cost of installing municipal water-works, has fixed the figure at $55,000. This includes erection of an electrical pumping station, laying of pipes and everything pertaining to a complete system.

Logan, Kan.—The question of constructing water-works is reported to be under consideration.

Guthrie, Okla, Ter.—T. A. White, City Engr., writes that the report of Water Committee and Engineer recommending ground-water supply has been adopted by Council and test wells will be begun as soon as the ground is secured. If it has to be condemned it will delay the construction indefinitely.

Davenport, Ia.—It is reported that the Water Works Co. is preparing to increase the capacity of the pumping plant. I. N. Hooper, Secy.

Yardley, Pa.—C. Taylor Leland, of Quakertown, and Benj. C. Warwick, of Philadelphia, are stated to have petitioned the Council for a franchise for water-works.

Caldwell, N. J.—Mayor Espy is reported to have recommended that a special committee be appointed to investigate the best source of water supply and to prepare plans for the work.

St. Anthony, Idaho.—J. T. Sidley and Levi Carter are reported to have received a franchise for 20 years to operate water-works and an electric light plant in St. Anthony.

Flora, Ill.—The Council on Aug. 10 is reported to have voted to accept the proposition of A. M. Searles, of Chicago, to construct a complete system of water-works.

Merrillan, Wis.—The citizens are stated to have voted Aug. 6 to issue $10,000 bonds for water-works and an electric light plant.

Greenwood, Miss.—The City Council is stated to have on Aug. 7 granted C. E. Wright a 25-year franchise for the construction of a complete water-works, sewerage and electric light system.

Huntington, Ore.—O. W. Porter and J. W. White, representing the Huntington Light & Artesian Water Co., are stated to have petitioned the Council for a franchise to construct water-works and an electric light plant.

Lewes, Del.—Harry M. Miller, of Wilmington, Del., is reported to have received the contract for constructing water-works and a sewerage system for $36,173.

Webster, S. D.—The citizens are reported to have voted Aug. 6 to bond the city for $20,000 for water-works.

New London, Wis.—The Council is reported to have authorized a committee to secure plans and specifications for water-works and an electric light plant.

Driggs, Idaho.—A press report states that the Grand Teton Canal Co. has been incorporated, with a capital of $50,000, to construct an irrigation and canal water system in Teton Valley, Fremont County. Incorporators: D. C. Driggs and R. C. Kimball, of Driggs, and others.

Buckhannon, W. Va.—W. G. L. Totten, Recorder, writes that a franchise for water-works has been granted to W. S. Tompkins.

Miamisburg, O.—Press reports state that at a citizens' meeting held here, N. J. Catrow, Pres. First Natl. Bank, was appointed Chmn. of a com. to secure engineer to prepare estimates, preliminary to organizing a local company, and submitting proposition for a franchise to Council.

Nassau, N. Y.—A. A. Gardiner, of Schodack Landing, N. Y., is reported to be preparing plans for water-works.

La Crosse, Wis.—R. F. Weston is stated to have received the contract for extending water mains for $18,780.

Bellwood, Pa.—H. Frank Stark, of Greensburg, is reported to have received the contract for constructing a storage reservoir for the Pennsylvania R. R. Co. at a point 2½ miles above Bellwood, in the Allegheny Mountains. It will have a capacity of 180,000,000 gals., and cost about $40,000.

Centralia, Ill.—The Council is stated to have rejected bids received Aug. 6 for constructing a 360-ft. dam at the reservoir. The Water Committee will receive new bids.

Batavia, N. Y.—It is stated that Hugh C. Smythe, of Pittston, Pa., attorney for the Attica Water & Gas Co., is about to petition the Council for permission to pipe the streets of Batavia and furnish water.

Sears, Ill.—A committee is reported to have been appointed, with C. H. Dibbern as chairman, to investigate the cost, etc., of constructing water-works.

Worcester, Mass.—The Council on Aug. 7 is stated to have voted to give the Water Department $35,000 for the Holden dam.

Water bonds amounting to $150,000, and $100,000 sewer bonds are reported to have been sold.

Hammond, Ind.—The Lake City Water Co., of Hammond, has been incorporated, with a capital of $35,000. Directors: Thos. Hammond, H. M. Bicknell and others.

Bozeman, Mont.—The Council has ordered the substitution and extension of water mains to cost $5,000 or $6,000.

Cannelton, Ind.—The City is stated to have purchased the water-works for $18,900.

Fayette, Miss.—The Aldermen are stated to have passed an order authorizing the issue of bonds: $10,000 for erecting and maintainig water-works and $4,000 to purchase the electric light plant.

Mt. Pleasant, Ia.—The Water Com. has been authorized to search for a good water supply.

Alexandria, La.—I. W. Sylvester, City Engr., writes that it is proposed to put down artesian wells to secure an additional water supply.

Havre de Grace, Md.—It is stated that the Havre de Grace water-works will be rebuilt and the reservoir enlarged to hold 3,000,000 gals.

Richmond, Va.—The Common Council has adopted a resolution, instructing the Committee on Water to investigate and report on the advisability of supplying water from artesian wells.

Brookings, S. D.—The following contracts are reported awarded for water-works: Fairbanks, Morse & Co., greater part of the work, $36,432; J. B. Nelson, Mankato, Minn., power house and chimney, $4,993; Chicago Bridge & Iron Works, steel tower and tank, $7,494.

Nadeau, Kan.—See "Government Work."

Sioux Falls, S. D.—The installation of municipal water-works will, it is said, be undertaken very soon.

St. Louis, Mo.—An appropriation of $25,000 for defraying the cost of analyzing water from the Mississippi, Illinois and Des Plaines Rivers and the Chicago Drainage Canal and the prosecution of the drainage canal suit has been made.

Salt Lake City, Utah.—City Engr. Kelsey has been directed to report concerning the practicability of throwing any impounding dam across any reservoir site in the Parley's canyon watershed.

Sault Ste. Marie, Mich.—The Pres. of Bd. of Pub. Wks., City Engr. J. A. Lawrie and two others have been appointed a committee to visit various cities to determine the most desirable power pumps to be placed in the proposed water-works pumping station.

Springfield, Ill.—It is reported that the Water Com. together with the Mayor and Supt. of Water-works, will go to Quincy to inspect the water filtration plant with a view to the probable erection of a filter plant.

Minneapolis, Minn.—City Engr. Sublette has been instructed to make soundings at the North Side station toward the installation of a proposed third pump.

North Chillicothe, Ill.—J. S. Daily has been granted a franchise to construct and operate a system of water-works in the village.

New York, N. Y.—Bids are wanted Aug. 29 for furnishing double-nozzle case hydrants, stop-cocks and stop-cock boxes in the Boroughs of Manhattan and Bronx and for driving 4 additional 10-in. wells and furnishing and placing necessary pumps and connections at the Tottenville pumping station, Borough of Richmond. Wm. Dalton, Commr. Water Supply.

Alexandria Bay, N. Y.—A survey is now being made toward building a $35,000 to $40,000 water-works plant, construction on which, it is stated, will be started this fall.

Parsons, W. Va.—The Parsons Water-Works Co. is reported organized, with a capital of $25,000, to establish water-works.

Riverside, Cal.—The Highland Water Co. is said to have voted to issue $50,000 bonds for development and past indebtedness.

Columbus, O.—The extension of the Jacobs conduit for 1,000 ft. and the construction of 62 wells is said to have been decided on for increasing the water supply at the west side station.

Wichita, Kan.—The City Engineer has been instructed by Council to report on a new system of water-works for the city.

Fonda, Ia.—M. G. Coleman, City Clk., writes that it is proposed to rebuild the water-works recently burned. L. S. Straight, Chmn. Water Com., has the matter in charge.

Cambridge, Minn.—Water-works for fire protection is reported under consideration.

Troy, N. Y.—J. L. FitzGerald, of Schenectady, is reported engaged in drawing up a report on water-works for Green Island.

Prairie du Sac, Wis.—It is stated that the question of water-works is being considered.

Terre Haute, Ind.—The City Engr. is said to be preparing plans and estimates for a municipal water-works.

Sandpoint, Idaho.—A system of water-works is being considered.

Youngstown, O.—Local reports state that the Water-Works Trustees are considering the proposition of installing a filtration plant.

Montezuma, Ga.—The validity of the bond issue for constructing water-works has been upheld by the Court.

Meridian, Miss.—The citizens have petitioned the Mayor and municipal boards to investigate the question of a water supply.

E. Orange, N. J.—The City Council has authorized the Water Com. to have plans and specifications prepared for the construction of a distributing plant.

Ocean Springs, Miss.—Jos. Katzun is reported to have received a 25-yr. franchise for the Peoples' Water-Works Co.

So. Milwaukee, Wis.—The Common Council has instructed the City Clk. to receive bids for 1,000 ft. of water mains, estimated to cost $5,000.

Marshall, Mo.—It is stated that the Light and Water Com. has been ordered to select a water supply and investigate the question of a municipal water-works plant.

Pleasantville, N. Y.—Bids are wanted Aug. 28 for a system of water-works. W. S. Moore, Clk. Bd. Water Commrs. Byrne & Darling, Engrs., White Plains.

Mt. Pleasant, S. C.—J. S. Hartzell, Town Treas., writes that R. H. Pickney is Chmn. of Com. appointed to investigate the construction of water-works. The town owns a spring and the idea of the committee is to construct pump and tank on hill, with piping through principal streets.

Eaton, Colo.—M. C. French, Supt. Construction, writes that the Town Board will receive bids on Aug. 20 for $20,000 water bonds. An 8-in. artesian well is being bored and when well is cased shall be in the market for a pumping engine.

Newark, N. J.—Morris R. Sherrerd, Engr. and Supt. Dept. of Water, writes that the following bids were opened Aug. 8 for constructing a storage reservoir at Cedar Grove, about 7 miles from Newark: A, National Contracting Co., 11 Broadway, N. Y. City; B, Bernard J. Sullivan, 19 W. Park St., Newark; C, Stewart & Abbott, Times Bldg., N. Y. City; D, T. A. Gillespie Co., 71 Broadway, N. Y. City.

Items and Quantities.	A	B	C	D
Clearing and grubbing, 61 acres	$75.00	$50.00	$76.20	$200.00
Earth excav. to 15 ft., 145,000 cu. yds	.35	.50	.42	.40
Earth excav., 15 to 30 ft., 11,700 cu. yds	.70	.90	.63½	1.00
Earth excav. below 30 ft., 3,100 cu. yds	1.00	1.00	1.00	1.90
Rock excav. under dams, 4,200 cu. yds	3.00	2.00	4.45	3.15
Rock excav. below 10 ft., 3,800 cu. yds	4.00	2.00	2.85	2.10
Rock exvac. elsewhere, 5,400 cu. yds	2.00	1.50	.90	1.40
Borrowed earth, 400,000 cu. yds	.45	.35	.24 1-10	.30
Clay puddle, 10,700 cu. yds	1.50	1.00	.95	.85
Sodding, 5,000 sq. yds	.60	.25	.28	.15
Seeding, 28 acres	20.00	25.00	12.70	42.00
Sheet piling, 20 M. ft	50.00	50.00	50.00	65.00
Rosendale concrete, 5:2:1, 38,100 cu. yds	4.90	4.75	4.00	4.75
Portland concrete, 5:2:1, 7,100 cu. yds	7.00	6.00	6.20	8.25
Expanded metal, 165,000 sq. ft	.05	.05	.05	.04½
Granite rubble masonry, 2,700 cu. yds	8.75	40.00	19.00	10.00
Rubble masonry, local stone, 350 cu. yds	5.00	4.00	4.45	4.20
Granite facing masonry, 145 cu. yds	22.00	44.00	34.30	37.00
Granite dimension masonry, 130 cu. yds	50.00	53.00	42.00	55.00
Hammered dressing stone, 750 sq. ft	.80	1.00	.65	.55
Granite paving, 60 sq. yds	3.00	2.50	2.54	2.65
Paving brick masonry, 100 cu. yds	30.00	14.00	11.43	12.00
Granolithic flooring, 94.4 sq. yds	1.80	1.20	1.60	1.50
Dry wall, 100 cu. yds	4.00	2.25	2.54	3.50
Slope paving, 5,600 sq. yds	3.00	1.50	1.58	1.10
Rip rap, 10,300 cu. yds	2.00	.75	1.58	.70
Laying 60-in. C. I. pipe, 3,400 lin. ft	2.75	4.00	2.20	2.80
Laying 48-in. C. I. pipe, 600 lin. ft	2.00	2.00	1.55	2.10
Laying 30 to 6-in. C. I. pipe, 530 lin ft	292.50	213.00	405.00	290.50
Furnishing and setting valves	5,689.00	5,545.00	5,829.00	5,190.00
Iron castings, 96,000 lbs	.08	.04	.04¾	.05
Structural steel, 12,000 lbs	.04	.04	.06¼	.05
Wrought iron, 1,000 lbs	.08	.10	.06¼	.05
Furnishing and laying tile pipe, 900 lin. ft	940.00	750.00	653.00	960.00
Telford pavement, 10,850 sq. yds	1.10	.85	.63	.90
Walks of screenings, 12,000 sq. yds	.25	.35	.19	.20
Cobble paving, 4,100 sq. yds	.75	.50	.63	.70
Fence, 12,000 lin. ft	.65	.75	.65	1.00
Blue-stone curbing, 12,000 lin. ft	.70	.50	.57	.60
Sluice gates	16,000.00	16,000.00	18,500.00	15,500.00
Bridge	600.00	642.00	660.00	625.00
Totals	$703,801.42	$713,030.78	$581,217.24	$625,504.60

Kansas City, Mo.—The Common Council has appointed Jno. Donelly and Stephen Mitchell on a committee to investigate the water-works question and has provided it with $5,000 to pay three expert engineers.

Hopkins, Minn.—Bids will be received by the Village Council of West Minneapolis until Sept. 2 for constructing water-works. Address E. A. Close, Village Recorder, Hopkins P. O., Minn.

Waterbury, Conn.—R. A. Cairns, City Engr., writes that the following bids were opened Aug. 13 for stripping portions of the basin of the Wigwam reservoir: A, Cenedella Bros., Milford, Mass.; B, Frank Pidgeon, Saugerties, N. Y.; C, Edw. McManus, Waterbury; D, David J. McNiece:

	A	B	C	D
Chopping and clearing, 200 sq. rods	$.90	$2.50	$4.75	$.40
Surface, 60,000 cu. yds.	.37	.36	.345	.33
Riprap, 800 cu. yds.	.87	.86	.845	.83
Stumps removed, 600	1.20	1.50	1.35	.60
Total	$23,796	$23,688	$23,136	$20,904

Reading, Pa.—Emil L. Nuebling, Supt. and Engr,. Dept. of Water, writes that the following bids were opened Aug. 6 for a 3,500,000-gal. filter plant under designs submitted by bidders; A, Pennsylvania Erecting Co., 1,421 Filbert St., Philadelphia; B, P. A. Maignen, 1310 Arch St., Philadelphia:

	A	B
Grading	$350	$1,463
Brick, stone and concrete masonry	21,000	12,610
Piping	5,700	4,424
Iron and steel work	1,750	1,554
Machinery complete	3,250	969
Sand, gravel or other filtering material	3,125	15,437
Woodwork, complete	1,200	2,202
Painting, glazing, roofing	900	1,737
6 mos. superintendence	500	1,200
Other work	200	3,142
Total	$37,975	$44,738

A bid was received from H. E. Ahrens & Bro., 821 Schuylkill Ave., Reading, under plans submitted by the Dept., as follows: 9,000 cu. yds. excavation at 38 cts., 1,600 cu. yds. broken stone and clay filling at $1.25, 2,400 cu. yds. concrete at $3.50, 540 cu. yds. brick masonry at $8, 1,290 cu. yds. broken stone for underdrains, at $1.75, 6,800 cu. yds. of filter sand at $1.75, 450 cu. yds. cinder filling at 75 cts., 1,700 sq. yds. vitrified brick paving at 85 cts., 610 sq. yds. roadway at 50 cts., 3,000 sq. yds. sodding at 20 cts., 1,351 lin. ft. of coping, $1,893, 307 lin. ft. curb at 75 cts., 3,642 lin. ft. vitrified pipe $1,355, stonework, woodwork, plastering, painting, hardware in buildings, etc., $1,250; total, $39,713.

SEWERAGE AND SEWAGE DISPOSAL.

La Junta, Colo.—Bids are wanted Aug. 26 for constructing sewers G and H. G. S. Thompson, City Clk.; F. T. Lewis, City Engr.

Columbus, O.—Bids are wanted Aug. 20 for furnishing and delivering 1,000 ft. of sewer pipe, various sizes, 35 iron catch-basin covers, 15 stone catch-basin covers, 20 manhole frames and covers, 10 manhole frames and covers, without lids, 20 lids for manholes, closed, 20 lids perforated, 15 wrought-iron gates 14 x 16-in., and 14 x 18-in., 150 bbls. of cement, etc. Clarence M. Addison, Clk. Bd. Pub. Wks.

Pittsburg, Pa.—Bids are wanted Aug. 21 for 12 to 24-in. pipe sewers in portions of numerous streets. Edw. M. Bigelow, Dir. Dept. Pub. Wks.

Moorestown, N. J.—Bids will be received by the Chester Township Committee at Moorestown until Aug. 27 for $45,000 bonds for the construction of a sewerage system in Chester Township. Arthur J. Collins, Chmn.

Conneaut, O.—City Engr. Geo. B. Pike writes that it was voted Aug. 9 to issue bonds as follows: $35,500 for sewers in Districts Nos. 3 and 4, $65,000 for paving, $20,000 for electric light improvements, and $10,000 for a city building.

Bloomington, Ill.—The City Council has ordered 2,000 ft. of 12 and 20-in. pipe sewers on Wood and Folsom Sts. Elmer Folsom, City Engr.

Kansas City, Mo.—Plans have been prepared for 13,000 ft. brick sewers ranging from 3 ft. 6 in. to 6 ft. in diameter, 24 manholes, 80 cu. yds. masonry and 10 yds. concrete, to cost about $80,000.

Batavia, N. Y.—Press reports state that the proposition to construct a sewerage syystem is under consideration. Estimated cost, $300,000.

Michigan City, Ind.—The plans of Harry M. Miles, City Engr., for a sewer in Washington St. have been adopted.

Springfield, Mass.—The Mayor is reported to have signed an order providing for the issue of bonds as follows: for the Forest Ave. sewer $8,000, and for the Belmont Ave. sewer $8,000.

Easthampton (L. I.), N. Y.—The question of constructing a sewerage system is reported to be under consideration.

Cerrogordo, Ill.—It is stated that bids are wanted Aug. 31 for 20,000 cu. yds. of excavation and 9,000 ft. of 16, 18 and 20-in. tile drains. P. C. Middletown, City Clk.; W. J. Day, Engr., Bement.

Paw Paw, Mich.—The Council is reported to be considering the construction of a sewerage system, and also the matter of securing a better water supply.

Worcester, Mass.—See "Water."

Springfield, Ill.—Wm. Spence, of Springfield, is stated to have received the contract for constructing the Town Branch sewer at $19 per lin. ft.; total cost will be about $10,000.

Sulphur Springs, Tex.—It is stated that a sewerage system will be constructed here at a cost of about $6,000. S. P. Mann, Mayor.

Greenwood, Miss.—See "Water."

Norristown, Pa.—There is reported to be a movement on foot here for a loan of $150,000, the money to be devoted to permanent paving and the extension of the sewerage system.

Bedford, O.—Ford P. Beers, 323 Columbus St., Cleveland, is stated to have received the contract for enlarging the sewerage system, for $16,224.

Seattle, Wash.—See "Paving and Roadmaking."

Waycross, Ga.—R. P. Bird, Clk. Water-Works Com., writes that it is proposed to extend the sewerage system in the near future; specifications, etc., can be furnished in 30 or 60 days; will use 18-in. pipe, best grade. H. Murphy, Chmn. Com.

Trenton, N. J.—Bids are wanted Aug. 20 for a sewer in a portion of Whitaker Ave. C. Edw. Murray, City Clk.

Great Falls, Mont.—At a meeting of the City Council, Aug. 5, it was decided to reject bids for sewer construction in 6th and 7th Aves., and to readvertise for the work.

Hancock, Mich.—S. D. Austin, of Milwaukee, is said to be preparing plans for brick paving, sewerage and other improvements.

San Luis Obispo, Cal.—Bids will be received, according to press reports, until Aug. 26, by the City Clk., for constructing additional sewers.

Danville, Pa.—J. Murray Africa, of Huntingdon, is reported surveying toward determining the most feasible plan for the proposed sewerage system.

Birmingham, Ala.—Bids are wanted Aug. 31 for constructing certain sanitary sewers. Julian Kendrick, City Engr.

Bowling Green, O.—It is stated that bids are wanted Aug. 20 for pipe sewers in certain streets. Alex. Williamson, City Clk.

Hammond, Ind.—It is stated that bids are wanted Aug. 27 for 15 and 18-in. tile sewers in 3 streets. Peter J. Lyons, City Engr.

Fond du Lac, Wis.—Local reports state that Jno. F. Blake has secured a $16,000 contract for beds and septic tanks, the latter 70 x 95 ft. and 9 ft. deep.

Portland, Ore.—The City Engr. has been directed to prepare plans and specifications for sewers in Hooker and Brazee Sts., and Minnesota Ave.

Medina, N. Y.—Engr. Holmes, of Batavia, is reported surveying for a $10,000 tile sewer in the southeast portion of the town.

Mt. Vernon, N. Y.—Snow & Barbour, Vermont Bldg., Boston, have been retained as engineers for the proposed sewage disposal works.

Woonsocket, R. I.—The City Council has appropriated $30,000 for sewers. Bids will soon be asked. Frank H. Mills, City Engr.

Cedar Rapids, Ia.—Bids are wanted Aug. 23 for 6 to 15-in. pipe sewers. R. A. Wallace, Chmn. Pub. Improv. Com.

Wausau, Wis.—Bids are wanted Sept. 2 for sewers in portions of Warren and 7th Sts. John R. Patzer, City Clk.

Mt. Pleasant, Mich.—Thos. Sampson is stated to have received the contract for constructing the North Branch drain, for $12,738.

Melrose, Mass.—Bids are wanted Aug. 21 for furnishing brick, cement, sewer pipe, manholes, and other castings and granite stone covers; also for constructing sewers in Melrose Highlands. W. Dabney Hunter, Engr. & Supt. Pub. Wks.

Columbia, Mo.—E. B. Cauthorn, City Sewer Engr., writes that one bid was received for sewer in District No. 6 and was rejected; no time has yet been set for reopening.

Swedesboro, N. J.—The question of a sewerage system is being agitated.

Wellsville, O.—The Sewer Commission is contemplating a sewer through 25th St.

Kansas City, Mo.—The Common Council has passed ordinances for a considerable number of sewers in the Westport section.

Laurel, Del.—Bids are wanted Aug. 26 for sewer extension. Chas. S. York, Engr., 1526 E. Biddle St., Baltimore, Md.

New Brighton, Pa.—F. C. O'Rourke, Secy. of Borough Council, writes that the following bids were received for 6,000 ft. of 8-in. pipe sewers: Robinson & Co., Meadville, Pa., 70 cts. per ft.; Ault & Co., McKeesport, Pa., 80 cts.; R. D. Hunter & Co., New Brighton, 97 cts., and C. M. Shuster, Rochester, Pa., $1.30 per ft.

Madeau, Kan.—See "Government Work."

Visalia, Cal.—L. E. McCabe, City Engr., writes that the following bids were opened Aug. 1 for 95,315 ft. of pipe sewers, 6 to 18 in. in diam., including 148 manholes, 44 flush tanks, 64 lamp holes, centrifugal pump and 5-H.-P. motor, one circular brick-in-cement reservoir with arch top and invert bottom, 21 ft. in diameter, a brick pump house and well and a screening chamber: R. H. Askins, Visalia, $65,112; W. D. Trewhitt & J. G. Martin, Visalia, awarded contract, $55,500; E. Cavanagh, Oakland, $71,000; John Geary, Oakland, $63,400; Williams & Belser, 302 Montgomers St., San Francisco, $66,300; Jas. Stanley, Mcdonough Bldg., Oakland, $58,352; Wm. Heafey, 466 24th St., Oakland, $67,000; D. Gamble, Hanford, Cal., $65,130; Martin & Ormand, Riverside, Cal., $76,616.

Sherman, Tex.—Jno. W. Maxcy, Houston, Tex., writes that the lowest two bidders for a sewerage system of which he is engineer in charge are Black & Laird, Kansas City, Mo., $71,278.60, awarded contract; and Humphreyville & Yeater, Houston, $77,196.40. The work includes 63,000 ft. of sewer pipe, 6 to 15 in. in diameter, 203 manholes and 58 flush tanks. The trench is expected to average 7 ft. in earth and about 2 ft. in rock.

BRIDGES.

Albany, N. Y.—The contract for a 2-span steel bridge, 247 ft. long, at Pratt's Landing, bids for which were received by John N. Partridge, Supt. Pub, Wks., June 26, has been awarded to the American Bridge Co., of New York, for $16,790.

Flint, Mich.—The American Bridge Co., New York City, is reported to have secured the contract for constructing an iron bridge at South Saginaw St., for $18,994. The bridge will be 125 ft. long and 99 ft. wide.

Westtown, Pa.—It is stated that the County Commissioners will let the contract for constructing a double stone arch bridge at Westtown, as soon as plans and specifications have been completed.

St. Petersburg, Russia.—Press reports state that bids are wanted for constructing a bridge across Neva River near the Winter Palace to replace present pontoon structure. It is 847 ft. long, 91 ft. wide and the cost is limited to $1,802,500. Specifications to be ready Sept. 1.

New York, N. Y.—Bids are wanted Aug. 28 for constructing a bridge across Bronx River at Westchester Ave., Boro. of Bronx. John L. Shea, Commr. of Bridges.

Frederick, Md.—It is stated that bids are wanted Aug. 20 for an iron and steel bridge across Catoctin River near Ringgold Ford. Wm. H. Horman, Pres. Co. Commrs.

Centralia, Ill.—It is stated that the question of building a viaduct across the railroad tracks in this city is being discussed by the Illinois Central officials and the citizens.

Helena, Mont.—The Commissioners of Lewis and Clarke Counties have been petitioned to construct a bridge at Stickney.

Davenport, Wash.—The Citizens are considering the construction of a $5,000 bridge across Spokane River, the cost to be borne by the county and city.

Tacoma, Wash.—The County Commissioners have awarded the contract for constructing the steel bridge over the Puyallup River near the reservation to the Northwest Bridge Co., of Tacoma. Contract price said to be $11,984.

Mayor Campbell has signed an ordinance providing for the construction of a bridge at Proctor Ave., to cost $5,797.

Georgetown, Md.—The Commissioners of Kent and Cecil Counties are stated to have awarded the contract for constructing an iron bridge across Sassafras River at Georgetown, to the York Bridge Co., for $7,704.

Lansing, Mich.—The State Commissioner of Railroads has approved plans submitted by the Grand Rapids, Grand Haven & Muskegon Electric Ry. Co. for bridges over the Detroit, Grand Haven & Milwaukee R. R. near Berlin, Mich., and over the Pere Marquette R. R. near Pickands Junction, Mich.

Kansas City, Kan.—The construction of a viaduct at either 10th or Mill Sts. is being considered.

Sherbrooke, Que.—The committee appointed by the City Council has requested J. W. Burke, Pres. of the Sherbrooke Street Ry. Co., to prepare designs and specifications for a bridge to be constructed at Wolfe St. It is stated that bids will be received immediately on both a riveted cantilever arch, having a 160-ft. span, and 2 short arms; and on a 3-span riveted truss bridge.

Napa, Cal.—The City Council has had plans and specifications prepared for a new arch stone bridge across Little Creek at Calistoga Ave., to replace the present wooden structure.

Passaic, N. J.—The Passaic and Bergen County Freeholders have decided to build a 4-arch bridge over the Passaic River at Monroe St., to cost $35,000. It will connect part of Garfield and Belmont with Passaic City.

Buffalo, N. Y.—Bids are wanted Aug. 21 for constructing a culvert over the water course in Ryan St. R. G. Parsons, Sec'y Bd. Pub. Wks.

St. Clairsville, O.—Bids are wanted Aug. 26 for furnishing material and constructing the stone substructure for a bridge across Wheeling Creek, at Maynard, Colerain Township. Bids for steel superstructure, with plans and specifications, will be received Aug. 27, not Aug. 26, as previously stated. M. Aldredge, Co. Aud.

Cincinnati, O.—Bids are wanted Sept. 10 for $250 000 viaduct bonds. Geo. F. Holmes, Clk. Bd. Pub. Service.

Camden, N. J.—J. J. Albertson, County Engr., writes that plans are being prepared for a steel draw bridge to be erected over Coopers Creek, at Baird Ave., to cost $25,000.

San Jose, Cal.—The County Surveyor has been authorized to prepare plans and specifications for a concrete bridge over Campbell Creek on the Stevens Creek road.

Swampscott, Mass.—The cost of widening the Boston & Maine bridge at Essex St. has been estimated at $5,000.

Annapolis, Md.—Bids are wanted Aug. 20 for the construction of a pivotal steel draw for South River bridge. Chas. Himelheber, Clk. Bd. Co. Commrs.

Indianapolis, Ind.—Separate bids are wanted Aug. 26 for constructing the substructure and superstructure of a bridge to cross Big Run on Acton and Julietta Road, in Franklin Township; also until Sept. 9 for constructing a bridge across Crooked Creek, near Broad Ripple, and a bridge over Little White Lick, near Bridgeport. Harry B. Smith, Co. Aud.

Souris, Man.—Bids are wanted Sept. 1 for constructing a 275-ft. span steel bridge across Souris River, at Monteith. Address G. A. Simpson, Gov. Engr., Parliament Bldgs., Winnipeg.

Miles City, Mont.—The proposition to construct a bridge, cost not to exceed $50,000, across Yellowstone River, near Miles City, carried at the recent election.

Cambridge, O.—Bids will be received by the County Commissioners until Sept. 3 for constructing an iron and steel bridge, having a guaranteed capacity of 125 lbs. per sq. ft. W. P. De Hart, Clk. of Bd.

Decatur, Ind.—Bids are wanted Sept. 2 for constructing 13 small steel bridges, including abutments, also one stone arch bridge. Samuel Doak, Co. Commr.

Minneapolis, Minn.—The City Council has adopted the Ways and Means Committee's recommendation that the city issue $215,000 bonds to build a bridge across the Mississippi River from 32d Ave. N. to 25th Ave. NE., and to repair the bridge at Washington Ave. S.

Cheltenham, Pa.—The Ransom Construction Co., according to press reports, submitted the lowest bid for constructing a concrete bridge in Cheltenham, at $12,100.

Hamilton, O.—Railroad Commissioner Morris has approved plans for an $8,000 overhead bridge and trestle at the intersection of the Cincinnati, Hamilton and Dayton and the Mill Creek Valley Electric Ry. Co. at Schenck's Station, Butler County.

Youngstown, O.—The construction of a bridge at Belmont Ave. and Wood St. is contemplated.

Binghamton, N. Y.—Bids are wanted Aug. 27 for the construction of the substructure and superstructure of a bridge at Exchange St. Appropriation, $50,000. I. C. Hull, City Clk.

Fond du Lac, Wis.—Plans have been accepted for a 3-track railroad bridge, which the Chicago & Northwestern Ry. Co. contemplates constructing across Fond du Lac River. E. C. Carter, Ch. Engr., Chicago, Ill.

Springfield, Mass.—Plans have been submitted to the New York, New Haven & Hartford R. R. Co. for a bridge 45 ft. long and 66 ft. wide, to be constructed at St. James Ave. by the city and railroad.

Milwaukee, Wis.—A committee has been appointed to confer with the officials of the Milwaukee road on a proposition relative to changing the railway draw bridge on the lower river to a bascule structure.

Reading, Pa.—Plans have been approved by the Board of Public Works and the Highway Committee for the bridge to be constructed, jointly, by the city and Philadelphia & Reading R. R., at Front St.

Grenada, Miss.—It is stated that $30,000 bridge bonds have been sold.

Des Moines, Ia.—Local press reports state that bids will soon be asked for constructing a Melan arch bridge at Sixth St., according to the design of the Concrete Steel Engineering Co., of New York City.

PAVING AND ROADMAKING.

Columbus, O.—Bids are wanted Aug. 20 for repairing about 10,000 sq. yds. of asphalt pavement on various streets. Clarence M. Addison, Clk. Bd. Pub. Wks.

Pittsburg, Pa.—Bids are wanted Aug. 21 for grading, paving and curbing portions of 4 streets. Edw. M. Bigelow, Dir. Dept. Pub. Wks.

Paterson, N. J.—Bids are wanted Aug. 23 for grading and macadamizing portions of several county roads. Edw. M. Kevitt, Dir. Bd. Chosen Freeholders.

Galion, O.—Bids are wanted Aug. 31 for brick or block pavement on a portion of S. Liberty St. J. O. Ross, City Clk.

Elizabeth, N. J.—Bids are wanted Sept. 3 for 5,625 sq. yds. of block pavement on Chestnut St. N. K. Thompson, Street Commr.

Findlay, O.—Bids are wanted Sept. 5 for block pavement on a portion of 2d St. Frank C. Ray, Clk. Bd. Improv.

Scott, Pa.—Bids are wanted Aug. 23 for grading and macadamizing about 4,900 ft. of Forsythe road, in Scott Township. McDonald & Andrews, Township Engrs., 810-813 Penn Bldg., Pittsburg.

Cincinnati, O.—Bids are wanted Sept. 7 for repairing a portion of Carthage Ave. in Columbia and Millcreek Townships. Eugene L. Lewis, Co. Aud.

Norristown, Pa.—See "Sewerage and Sewage Disposal."

Cedar Rapids, Ia.—Bids are wanted Aug. 23 for asphalt pavement on a portion of 10th St. R. A. Wallace, Chmn. Pub. Improv. Com.

Oshkosh, Wis.—Bids are wanted Aug. 26 for brick pavement on a portion of Church St. Frank Monahan, Chmn. Bd. Pub. Wks.

Knox, Ind.—Bids are wanted Aug. 30 for improving, by graveling, about 30 miles of roads in Wayne Township. John W. Kurtz. Co. Aud.

New Orleans, La.—The Louisiana Improvement Co., New Orleans, has been awarded the contract for paving Canal St. with sheet asphalt, detailed bids for which were printed in the issue of July 13. The total amount of asphalt is 116,000 sq. yds.; total amount of bid, $302,116.

Seattle, Wash.—The City Engr. has submitted estimates for street improvement work as follows: Brick, $6,300; grading, $24,600.

Des Moines, Ia.—G. A. Eberhard, Mem. Bd. of Pub. Wks., writes that the following bids were opened Aug. 9 for 4,859 sq. yds. of asphalt paving, with 1½-in. surface and 1-in. binder course on concrete base and 3,522 lin. ft. Portland cement curb: Bermudez Asphalt Pav'g Co., Chicago, $2.04 per sq. yd. for asphalt paving and 45 cts. per ft. for curbing: Grant Pav'g Co., Omaha, $2.09 and 48 cts.; Capital City Brick & Pipe Co., Des Moines, $1.98 and 44 cts.

Huntington, N. Y.—Bids are wanted Aug. 31 for regulating, grading and paving Main St. Address Commissioners of Highways.

Youngstown, O.—It is stated that bids are wanted Aug. 31 for asphalt pavement on 5 streets. C. E. Cross, City Clk.

Logansport, Ind.—The Common Council is in the market for a new steam road roller (15 tons) and will have competitive test about Aug. 28. Walter A. Osmer, City Engr.

Conneaut, O.—It is stated that the pavement of several streets is contempalted in the very near future.

Michigan City, Ind.—The contract for paving Washington St., bids for which were reported in last week's issue, has been awarded to the Western Construction Co., using the combination curb and gutter.

North Judson, Ind.—Press reports state that it has been decided at a special election to construct 30 miles of gravel road in this township, for which the contract will be let Aug. 30.

Barnesville, O.—The Council is reported to have passed a resolution to do more paving.

Springfield, Mass.—The Board of Supervisors has decided to pave Main St. with wooden blocks, which the United States Wood Preserving Co. is to furnish and lay at $2.85 per sq. yd.; altogether there will be about 2,400 sq. yds., laid on a concrete base.

It has been voted to pave several streets, some with brick and others with macadam.

Peoria, Ill.—The Bd. of Local Improvements is considering a petition for paving Peoria Ave. with asphalt.

Lincoln, Neb.—City Engr. Campen has been instructed to advertise for bids for repaving districts Nos. 8 and 13, including both brick and sheet asphaltum.

Lawrence, Mass.—The Union Paving Co., Boston, has been awarded the contract for about 7,000 sq. yds. of asphalt pavement on Hampshire St., for $2.93 per sq. yd., with Trinidad asphalt under a 10-yr. guarantee.

Cincinnati, O.—The Bd. of Public Service has directed the City Engr. to prepare specifications for paving Campbell St. with brick.

Spokane, Wash.—North Monroe St. property owners have petitioned for a brick pavement.

Cleveland, O.—The Bd. of Control has been requested by the Council to prepare plans and specifications for paving Anson St. with brick.

Sullivan, Ind.—It is reported that the County Commissioners have awarded a contract for building 7¼ miles of gravel roads in Fairbanks Township to Cassius Harrison for $14,000.

Toledo, O.—The preliminary resolution has passed for paving Superior St. with asphalt, except the portion between the street railroad tracks, which is to be paved with brick.

Menasha, Wis.—The Common Council, it is reported, has adopted plans for macadamizing two streets.

Los Angeles, Cal.—The Bd. of Pub. Wks. has recommended to the City Council the widening of Vernon Ave., for a distance of about 1½ miles.

Blountville, Tenn.—Press reports state that the County Court has deferred the question of issuing $100,000 in bonds for building macadam roads until Jan., 1902.

Ft. Dodge, Ia.—The City Council has voted for 20,000 sq. yds. of brick paving and 6,600 lin. ft. of cement curbing, subject to grievances to be heard Sept. 2.

Detroit, Mich.—The lowest bid reported opened Aug. 8 by Commr. Moreland for paving Vinewood Ave., with cedar on concrete, is that of Jas. Hanley, $16,926 with Medina curb, $16,101 with Berea curb and $15,243 with Elyria curb.

Pittsburg, Pa.—The County Commrs., it is stated, will soon advertise for bids for improving the Saltsburg road.

Seattle, Wash.—The Council has ordered $80,660 worth of local improvements, including $22,500 in sewers, $51,200 in paving and $4,460 in water mains.

Appleton, Wis.—The Council is reported to have reconsidered its recent action and to have ordered the paving of Oneida St. with asphalt.

Kinmundy, Ill.—A petition has been submitted to the Bd. of Local Improv. for a 30-ft. brick pavement on W. 2d Ave., and local reports indicate that the work will be done this season.

Rochester, N. Y.—Thos. W. Finucane is reported to have been awarded contracts for Grape St. brick paving, amount $5,212; Park Ave., brick block pavement, $12,709, and Orange St., traprock pavement, $5,832.

Danville, Ill.—A petition has been filed with the Board of Local Improvement to pave Oak St. with brick, about 27,000 yds. Work will be advertised some time this fall. W. H. Martin, City Engr.

Muskegon, Mich.—C. S. Gamble, City Engr., writes that the following brick paving work has been ordered by Council: Clay Ave., about 2,800 ft. long; Ransom St., ¾ mile long; Lake St., about 2 miles; Jefferson St., ¼ mile, and Pine St., ½ mile. He is also preparing plans for about 4 miles of streets.

Louisville, Ky.—Mayor Weaver on Aug. 9 approved ordinances for the improvement with asphalt of Von Borries, Castlewood and Winter Aves.

Cincinnati, O.—Bids are wanted Sept. 9 for brick pavement on a portion of Fenton Ave. Geo. F. Holmes, Clk. Bd. Pub. Service.

Des Moines, Ia.—Bids are wanted Aug. 26 for 3,625 sq. yds. of asphalt pavement, consisting of 1½-in. wearing surface and 1-in. binder course upon a concrete foundation. G. A. Eberhart, Chmn. Bd. Pub. Wks.

Portsmouth, O.—R. A. Bryan, City Engr., writes that the paving of 9th, N. Waller, Findlay and Market Sts. has been abandoned, and an effort is being made to pave 5th St. a distance of 1,716 ft.; probable number of sq. yds., 7,800; vitrified brick, tar filler.

Niagara Falls, N. Y.—City Engr. Very has reported final estimate of cost of paving Buffalo Ave. with asphalt as $35,329.

Middletown, N. Y.—The Eastern Paving Brick Co., Catskill, N. Y., has been awarded contract for furnishing about 240,000 bricks for $15.58 per M. for ordinary brick, beveled edges, for tracks, 59 to sq. yd.; $21.90 per M. for repressed beveled edge block, 42 per sq. yd.; and $15.58 for repressed beveled edge brick, 59 per sq. yd.

Hancock, Mich.—See "Sewerage and Sewage Disposal."

Barberton, O.—Bids are wanted for paving two streets.

Granville, N. Y.—The Bd. of Supervisors, at Whitehall, has passed the final resolutions for the improvement of about 2½ miles of State road, estimated to cost about $21,025.

Corydon, Ind.—Bids are wanted Sept. 5 for constructing a free gravel road in Heath Township. Jas. A. Watson, Co. Aud.

Peoria, Ill.—Bids are wanted Aug. 21 for 2,916 sq. yds. asphalt pavement, 1,142 cu. yds. excavation, 1,118 lin. ft. combined curb and gutter, etc. H. E. Beasley, City Engr.

Toledo, O.—Bids are wanted Sept. 10 for macadamizing and graveling stone road No. 34. Wm. M. Godfrey, Co. Aud.

Mt. Vernon, N. Y.—Bids are wanted Aug. 26 for paving Garden Ave.

Salt Lake City, Utah.—L. C. Kelsey, City Engr., writes that the Alcatraz Asphalt Paving Co., of San Francisco, has been awarded the contract for asphalt street paving, total bids for which were reported last week. The bid in detail is as follows: 45 cts. per cu. yd. for 13,000 cu. yds. grading; $1 per lin. ft. for 10,500 ft. curbing; 30 cts. per lin. ft. for 100 ft. resetting curb; $2.70 per sq. yd. for 11,500 sq. yds. stone block pavement with 6-in. pea gravel foundation; $2.40 per sq. yd. for 32,000 sq. yds. Alcatraz asphalt pavement with 2½-in. wearing surface and 6-in. concrete foundation; 45 cts. per sq. ft. for 2,000 sq. ft. crosswalks; $2.10 per lin. ft. for 1,000 ft. concrete gutter; $1.35 per sq. yd. for 3,000 sq. yds. asphalt pavement repairing; $1.40 per sq. yd. for 6,000 sq. yds. asphalt pavement resurfacing and $6 per cu. yd. for 100 cu. yds. concrete.

Council Bluffs, Ia.—The following bids are reported for 35,260 sq. yds. brick paving on 6th, 7th and 8th Sts. and 1st, Willow and 5th Aves: E. A. Wickham, Council Bluffs, with Council Bluffs brick base, Galesburg brick, $1.74; Des Moines, $1.61; St. Joseph, $1.53; Coffeyville, $1.54; Council Bluffs, $1.44. For concrete base add 10 cts. to the prices. John P. Weaver, Council Bluffs, Springfield, Ill., top, with concrete base, $1.89; Springfield top, with Council Bluffs base, $1.66. George F. Hughes, Council Bluffs, Des Moines top and Council Bluffs bottom, for all streets with the exception of Fifth Ave., $1.67; Fifth Ave., $1.73; St. Joseph top and Council Bluffs base, with exception of Fifth Ave., $1.58½; Fifth Ave., $1.75. For concrete base add 13 cts. to the above prices. Chas. E. Fanning, Omaha, Galesburg, $1.79½; Galesburg block, $1.79½; Des Moines, $1.68; St. Joseph, $1.63. All for Council Bluffs bottom. Add 12 cts. for concrete base. J. R. Rachliff, St. Joseph, Mo., St. Joseph brick, $1.83, and Coffeyville, $1.73.

POWER PLANTS, GAS AND ELECTRICITY.

Cleveland, O.—Bids are wanted Sept. 5 for furnishing, lighting, extinguishing and caring for 5,000 incandescent gas lamps for a period of one year, the same to be the property of the city at expiration of contract. Chas. P. Salen, Dir. of Pub. Wks.

National Military Home, O.—Bids are wanted Aug. 26 for furnishing material and extending the electric light plant at Central Branch, N. H. D. V. S. Address A. J. Clark, Treas., National Military Home.

Bowling Green, O.—The Citizens' Light, Heat, Power & Ice Co. of Bowling Green is stated to have been incorporated by G. S. Long, Jacob Heune and others, to construct a hot-water heating plant.

Kahoka, Mo.—See "Water."

Oshkosh, Wis.—The Oshkosh Electric Light & Power Co. is stated to have decided to rebuild its plant at a cost of about $60,000. Leander Choate, Pres.

Joplin, Mo.—John F. Wise and John M. Malang, of Joplin, have petitioned the Council for a franchise for a heat and power plant; cost of plant proposed reported to be about $40,000.

Sharpsburg, Pa.—See "Water."

Springfield, Ill.—The Council is stated to have granted the Springfield Hot Water Supply Co. a franchise to construct a heating plant.

Cooperstown, N. Y.—The Cooperstown Gas Co. has been incorporated; capital, $10,000. Directors: Gottfried Falkenstein, J. Warren Lamb, and W. I. K. Fuller, of Cooperstown.

Clayton, Mo.—J. M. Nelson and Wm. Hoeber are stated to have petitioned the County Commissioners at Clayton for a franchise to lay gas pipes and string electric wires for heat and light over a portion of Central Township.

Athens, Ga.—The Tallasee Shoals Power Co. is in the market for hydraulic and electrical machinery for its new plant.

Sparta, Minn.—E. M. Osborn is reported to have secured a franchise from the village for an electric light plant to cost about $7,000.

Braddock, Pa.—The Keystone Electric Co., of Braddock, has been incorporated, with a capital of $100,000, to construct an electric light plant. Incorporators: F. T. M. Redman, Harvey McKinney and others.

Chadwick, Ill.—It is stated that bids are wanted Aug. 21 for a power house, electric machinery, etc. Chas. Kingery, Village Pres.

St. Anthony, Idaho.—See "Water."

Kankakee, Ill.—A press report states that eastern capitalists have secured property rights along the Kankakee River, between this city and Wilmington, and will construct 7 dams for the purpose of developing power for electric roads and manufacturing concerns in eastern Illinois.

Greenwood, Miss.—See "Water."

Denver, Colo.—The Board of Supervisors is stated to have passed a bill granting a 20-year franchise to the Denver Steam Heating Co.

Beaumont, Tex.—The Beaumont Light, Heat & Electric Motor Power Co., of Beaumont, has been incorporated, with a capital of $100,000. Incorporators: W. H. Pope, T. W. Shepherd, of Beaumont, and others.

Merrillan, Wis.—See "Water."

Orange, N. J.—The Street Lighting Committee is stated to have decided to recommend to the Council the award of contract for lighting the streets for 5 years from Dec. 1 next to the National Electric Light, Heat & Power Co., at $70 a lamp a year. This is a new company, recently incorporated, with Wm. E. Gilmore, of West Orange, as president.

New London, Wis.—See "Water."

Ottawa, Ont.—Louis Simpson, Victoria Chambers, Ottawa, writes that it is proposed to erect a power plant at Chats Falls, near Ottawa. The total power which these falls will develop at low water is 100,000 H.-P. and the first development is proposed to be 20,000 H.-P. The company to undertake this work is now being formed. No engineer has yet been appointed. Probable cost of the work, including hydraulic and electrical machinery, is $750,000. All inquiries should be addressed to Louis Simpson.

Huntington, Ore.—See "Water."

Lena, Ill.—Thos. A. Glavin, of Chicago, is stated to have petitioned the Council for a franchise for an electric light, power and heating plant.

Puyallup, Wash.—See "Water."

Holland, Mich.—It is stated that the electric light plant will be improved, at a probable cost of $7,000.

Toronto, Ont.—Joseph Barrett, Elswood Smart and A. C. Morris, of Toronto, are reported to be the incorporators of the Humber Power & Light Co., Limited; capital, $50,000.

Superior, Wis.—The Black River Falls Power Co. has just received a franchise to string wires along the streets and alleys of Superior and will commence development work at once. The president of the company is W. C. Sargent, of Duluth. Thos. F. McGiloray, of 209 First Nat'l Bank Bldg., Duluth, Minn., is Consulting Engr.

Brookfield, Mo.—H. H. Stephens, Mgr. Gas, Electric Light & Htg. Co., writes that contracts for gas plant have been awarded as follows: For station equipment to the United Gas Improvement Co., of Philadelphia, Pa., and for gas holders, station meters, street main, governor, etc., to the Kerr, Murray Mfg. Co., Ft. Wayne, Ind.

ELECTRIC RAILWAYS.

Akron, O.—M. Spitzer is reported to be preparing plans for an electric light and power plant, 60 x 210 ft., for the Canton-Akron Electric Ry. Co., to be constructed at Akron, at a cost of about $50,000.

Galesburg, Ill.—The People's Traction Co. has been incorporated, with a capital of $10,000. Incorporators, F. W. Latimer, L. W. Sanborn and E. B. Hardy.

Delaware, O.—The Delaware County Commissioners are stated to have granted the Columbus, Delaware & Marion Electric Ry. Co. a 25-year franchise through the county to the city limits of Delaware.

Kansas City, Mo.—Local papers state that the Metropolitan St. Ry. Co. has under consideration the building of a second power house to cost, including equipment, $1,250,000. E. Butts, Ch. Engr., Kansas City.

Toana, Va.—Rights of way are reported as being secured by the Urbana, West Point & Yorktown Ry. Co., which proposes to construct an electric railway from Toana, on the Chesapeake & Ohio, to Urbana, Va. Thos. B. Henley is reported interested.

Toledo, O.—The Toledo, Columbus, Springfield & Cincinnati Ry. Co. has been incorporated with a capital of $100,000, to construct an electric line between the cities named. Incorporators: Ellis Bartholomew, Wm. P. Hester and others.

Wilkinsburg, Pa.—The Council is stated to have granted a right of way through the borough to the Wilkinsburg and Verona branch of the Monongahela St. Ry. Co.

Chattanooga, Tenn.—The Chattanooga Electric Ry. Co. will expend about $50,000 for power machinery and rolling stock. J. W. McFarland, Supt.

Parsons, Kan.—E. T. Selig, Pres. Ft. Scott St. Ry. Co., is reported interested in the construction of electric railway in Parsons.

Grand Rapids, Mich.—The Grand Rapids, Belding & Ionia Ry. Co. is stated to have been organized, with a capital of $100,000, to construct an electric railway from Grand Rapids to Ionia and Belding. Thos. F. Carroll, Pres.; Joseph Kerwin, Sec'y.

Manchester, N. H.—The Manchester Traction, Light & Power Co. has received a right of way on Jewett and Haywards Sts., about ⅓ mile; it will be constructed this summer. Another extension of about 2 miles is proposed. J. Brodie Smith, Gen. Mgr., Manchester.

Cleveland, O.—The County Commissioners are stated to have granted a 25-year franchise to Daniel Gindelsperger and others for the construction of an electric railroad to Akron.

The Lake Shore Electric Ry Co. has been incorporated to construct and operate an electric line between Cleveland and Toledo; capital, $10,000. Incorporators, B. Mahler, F. W. Coen, and others, all of Cleveland.

Mauch Chunk, Pa.—The Town Council is stated to have granted a franchise to the Tamaqua & Lansford St. Ry. Co.

Upton, Mass.—The Selectmen are stated to have granted a franchise to the Upton St. Ry. Co.

Huntington, Ind.—The County Commissioners are stated to have granted Mr. Heller, of Columbia City, a franchise through Huntington County.

Bessemer, Ala.—The Council is stated to have granted a franchise to R. F. Hanneman, representing the Steel Cities Ry. Co.

Piqua, O.—The Council is stated to have granted a franchise to the Dayton, Covington & Piqua Traction Co.

Milton, O.—The Council is stated to have granted a franchise through the town to the Toledo, Columbus, Springfield & Cincinnati Ry. Co.

Oshkosh, Wis.—The Falk Mfg. Co., of Milwaukee, is stated to have secured franchises for nearly the entire right of way for an interurban railway between Oshkosh and Fond du Lac, a distance of 20 miles.

RAILROADS

New Orleans, La.—The Council is stated to have adopted an ordinance granting the Illinois Central R. R. Co. permission to improve its terminal facilities in this city. O. M. Dunn, Div. Supt., New Orleans.

Burnside, Ky.—The Cumberland River & Nashville R. R. Co. has been incorporated, with a capital of $10,000, to operate a line from Burnside, Ky., to Nashville. L. F. Hubbell and J. C. Ogden are the incorporators.

Keyser, W. Va.—It is stated that the Potomac & Pocahontas R. R. Co. will construct a railroad from Keyser to Petersburg, a distance of about 40 miles. F. M. Reynolds is Vice-Pres. and E. B. Reynolds, Sec'y, both of Keyser.

Greenville, Ala.—The Monroe & Greenville R. R. Co. has been incorporated, with a capital of $100,000, to construct a line from the Alabama River, in Monroe County, northeasterly to a junction with the Louisville & Nashville, at Greenville, a distance of about 80 miles. Incorporators: J. W. Black, T. M. Stevens, and others, all of Mobile.

Wilmington, Del.—It is stated that the general plan of elevating the Pennsylvania Railroad tracks through the city has been made public. It provides for overhead crossings at all main streets and will include the erection of a new passenger station. It is said the work of improvement will start as soon as permission is obtained from the Street and Sewer Department.

Mineral Wells, Tex.—The Attorney-General is stated to have approved an amendment to the charter of the Mineral Wells & Northwestern R. R. Co. providing for the extension of its line, 61 miles in length, from Mineral Wells to Jacksboro and Graham.

Schenectady, N. Y.—Local press reports state that Mayor White has received plans from W. J. Wilgus, of New York, Ch. Engr. N. Y. Central & Hudson River R. R. Co., for eliminating the grade crossings in this city; estimated cost reported to be $725,000.

Shreveport, La.—The People's Belt R. R. Co. is stated to have been formed, with a capital of $100,000, to construct a railroad about 5 miles in length. Incorporators: Wm. I. Ingersoll, C. H. Minge and others.

Fayette City, Pa.—Press reports state that contracts amounting to about $500,000 for grading and other work on the extension of the Pittsburgh & Lake Erie R. R. from Fayette City to Brownsville have been awarded to H. S. Kerbaugh, of Philadelphia. The new line will be about 9 miles in length.

Joplin, Mo.—The Cherokee & Red River Ry. Co. is reported to have been formed with a capital of $200,000 to construct a line from Joplin to Galena, Kan. Dwight W. Tuttle, of New Haven, Conn., is one of the incorporators.

Harlow, Ark.—The Harlow & Northern R. R. Co. has been incorporated with a capital of $130,000 to construct a railroad about 18 miles in length in Calhoun and Dallas counties. Directors: Geo. D. Hope, S. M. Barnes and others.

East Granby, Conn.—The East Granby & Suffield R. R. Co. has been incorporated, with a capital of $100,000, to construct a line about 4 miles long. Incorporators: Chas. E. Perkins, Hartford; Chas. T. Bissell, Suffield; Chas. N. Bates, East Granby, and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Green Bay, Wis.—Bids are wanted Aug. 23 for the erection and completion of a city hall. Estimated cost, $25,000. S. J. Murphy, Jr., Chmn. Special Bldg. Com., Common Council.

Melrose, Mass.—Bids are wanted Aug. 21 for furnishing materials and repairing and altering the City Hall. W. Dabney Hunter, Engr. & Supt. of Pub. Wks.

Bloomington, Ill.—Bids are wanted Sept. 7 for labor, material and apparatus required in the steam heating, ventilating and heat regulation of the McLean County court house. John Reed, Secy. Special Bldg. Com.; Reeves & Baillie, Archts., 600 Y. M. C. A. Bldg., Peoria.

Peoria, Ill.—Bids are wanted Aug. 31 for erecting two 2-story brick buildings for the Fire Department. E. A. Furry, Commr. of Pub. Wks.

Bellaire, O.—Bids are wanted Aug. 30 for erecting a city hall. F. A. Jackson, City Clk.

Riverside, Cal.—Bids will be received Sept. 5 for erecting a county jail; also separate bids on same date for steelwork, consisting of window guards, cellwork, I-beams under first story cells, etc. W. W. Phelps, Co. Clk.

Jackson, Minn.—Bids are wanted Sept. 11 for erecting a county jail and sheriff's residence. P. D. McKellar, Co. Aud.

Wyoming, Pa.—Bids will be received by the Borough Council until Aug. 21 for erecting a town hall. A. C. Shoemaker, Pres.; F. L. Olds, Archt., Wilkesbarre.

Two Harbors, Minn.—The Pauley Jail Bldg. & Mfg. Co., of St. Louis, Mo., is stated to have received the contract for erecting the Lake County jail and sheriff's residence, for $18,000.

Racine, Wis.—Andrew Carnegie is stated to have offered this city $50,000 for a public library.

Vicksburg, Miss.—Davis, Larkin & Co., of Chicago, Ill., are stated to have received the contract for erecting a city hall here, for $52,140.

Boston, Mass.—Wheelwright & Haven, 100 Boylston St., have filed plans for a 3-story addition to the Massachusetts General Hospital, to include workrooms and a corridor 126 x 31 ft. Estimated cost, $37,000; material, gray brick, granite and limestone.

Nashville, Tenn.—B. J. Hodge, Cole Bldg., has prepared plans for an $18,000 building on N. Summer St., for Fire Department Headquarters.

Columbus, Miss.—The contract for remodeling and repairing the county court house at this place is stated to have been awarded to D. S. McClanahan for $18,000.

Springfield, Mass.—The Mayor is stated to have signed orders providing for the issue of bonds for the Armory St. engine house, $25,000, the Brightwood hose house $15,000, and a 4-room addition to Central St. school, $18,000.

San Francisco, Cal.—The German General Benevolent Society, office at 320 Geary St., are reported to have received plans and are considering same for new hospital buildings to be erected on Noe, Castro and Ridley Sts., at a cost of about $250,000. I. Gutte, Chmn. Bldg. Com.

East Orange, N. J.—Oscar S. Teale, 35 Bway, New York, N. Y., is stated to have prepared plans for an addition to the Calvary Methodist Church, to cost about $40,000. Rev. Dr. F. C. Baldwin, Pastor.

Grand Island, Neb.—County Clk. C. H. Menck writes that it was voted Aug. 7 to issue $100,000 bonds for the erection of a court house for Hall County.

Cripple Creek, Colo.—The County Commissioners are stated to have accepted the plans of C. E. Troutman for the new county hospital and poor house, to be erected on Broadway, in the northwestern part of the city. It will be 2 stories high, of brick, and measure 54 x 84 ft.

Guthrie, Okla. Ter.—T. A. White, City Engr., writes that plans for a city hall will be called for as soon as a site is selected by Public Improvement Committee.

Burlington, Vt.—Andrew Carnegie is stated to have offered this city $50,000 for a public library.

Lake Linden, Mich.—Charlton, Gilbert & Demar, of Marquette, are reported to be preparing plans for a church for St. Joseph's Catholic Congregation of Lake Linden. Architect C. A. Pierce, of Hancock, will supervise its erection.

Green Bay, Wis.—The plans of H. A. Foeller, 133 N. Washington St., are stated to have been accepted for the Carnegie Library.

Big Rapids, Mich.—Haug & Scheurman, Barnard Bldg., Saginaw, W. S., Mich., are preparing plans for a $10,000 edifice to be erected here for Rev. Mr. Delanty.

Aberdeen, S. D.—Andrew C. Fossum, of Aberdeen, is stated to have received the contract for erecting the Alex. Mitchell Library, for $13,408.

New York, N. Y.—The Dock Board is reported to have decided to erect 4 recreation piers, 2 on the East River and 2 on the North River.

Springfield, Mass.—Maloney & Peters, of Springfield, are stated to have secured the contract for heating St. Michael's Cathedral for $7,444.

Vincennes, Ind.—The County Commissioners are stated to have rejected all bids recently received for a jail to cost about $35,000. New bids will be received.

Montreal, Que.—Bids will be received by Rev. J. A. S. Perron, Archbishop's Palace, Montreal, until Aug. 23, for erecting a church and sacristy for the Parish of St. Leo, Westmount, County of Hochelaga. G. A. Monette, Archt., 97 St. James St.

Indianapolis, Ind.—Bids are wanted by the Board of Trustees of the Central Indiana Hospital for Insane until Aug. 20 for a steam pump and connections; also for 2 8-in. driven wells.

Carrollton, Mo.—The County Commissioners on Aug. 9 are stated to have accepted the plans of R. G. Kirsch, of Macon, Mo., for the proposed $50,000 court house.

Munising, Mich.—Edwin Niness, County Clk., Autrain, Mich., writes that the citizens have voted to issue $35,000 bonds for the erection of a court house at Munising.

Rock Island, Ill.—Collins Bros., 420 16th St., are stated to have received the contract to erect the public library; cost, about $70,000.

Tacoma, Wash.—Jardine, Kent & Jardine, 1262 B'way, New York, N. Y., are stated to have completed plans for the $75,000 Carnegie Library, and bids will soon be asked.

Hazlehurst, Miss.—The plans of J. Rieley Gordon, of Dallas, Tex., are stated to have been accepted for a $50,000 court house for Copiah County.

Tuscola, Ill.—J. M. Deal, of Lincoln, Ill., is reported to be preparing plans for a stone church for the Presbyterian congregation, to cost $15,000.

New York, N. Y.—Plans have been filed for a 1-story brick and stone edifice to be erected at 164 Waverly Pl. for the Abyssinian Baptist Church, to cost $30,000. Architects, Pollard & Steinam, 3 E. 14th St.

Cleveland, O.—Bids are wanted Aug. 21 for a hot-water heating plant in the monkey house, in Wade Park. Chas. P. Salen, Dir. Pub. Wks.

New Westminster, B. C.—Bids are wanted Aug. 31 for furnishing and installing a heating apparatus in the public building, New Westminster. Fred. Gelinas, Sec'y Dept. Pub. Wks., Ottawa.

Crawfordville, Ga.—John McKenzie, of Augusta, is stated to have received the contract for erecting the Taliaferro County court house, for $22,000.

New York, N. Y.—Bids are wanted Aug. 26 for a coal handling apparatus at the Manhattan State Hospital, West, Ward's Island. Henry E. Howland, Pres. Bd. Mgrs., 1 Madison Ave.

BUSINESS BUILDINGS.

Madison, Wis.—Bids are wanted Aug. 26 for erecting the Elks' club house. Henry F. Grove, Secy. Bd. Directors of the Elks' Clubhouse Association, 109 S. Webster St.; Claude & Starck, Archts., Madison.

New York, N. Y.—Whitney Warren, 3 E. 33d St., is stated to have prepared plans for an inn, which John Jacob Astor will erect on the west side of Pelham Parkway, at the junction Williamsbridge Road. It will be 3 stories high, of stone and wood, and cover about 35,000 sq. ft. of space. Probable cost, $200,000.

Wilmington, Del.—See "Railroads."

Cincinnati, O.—The Board of Public Service is stated to have decided to expend $27,000 for erecting the new Wade St. Market House.

Duluth, Minn.—The contract for constructing the round-house on Rice's Point for the Northern Pacific R. R. Co. is reported to have been awarded to Geo. Deeks & Co., of St. Paul; probable cost, $60,000.

Paris, Tex.—It is stated that the Texas & Pacific Ry. Co. will erect a depot here, to cost about $100,000. B. S. Wathen, Ch. Engr., Dallas.

Shawnee, Okla. Ter.—A. Daly, of Nevada, Mo., is reported to have received the contract for erecting the Choctaw, Oklahoma & Gulf R. R. shops here; cost about $75,000.

Birmingham, Ala.—Ryan & Son are reported to have prepared plans for a 5-story office building to be erected on 4th Ave. and 18th St., for A. W. Cochran, to cost $20,000.

Catskill, N. Y.—Fredk. N. Dubois, of New York, is stated to have given the Catskill Y. M. C. A. $25,000. Of this sum $20,000 will be used for the erection of a building.

Toledo, O.—Bacon & Huber, 808 "The Spitzer," are stated to be preparing plans for a 4-story brick building to be erected on Superior St. for Clayton W. Everett, to cost $20,000.

Jacksonville, Fla.—The Seminole Club will erect a $12,000 club house on Duval and Hogan Sts. J. H. Durker, Pres.

Creston, Ia.—The Masonic Building Committee is stated to have accepted the plans of I. P. Hicks, of Omaha, Neb., for an opera house and Masonic temple to be erected on Oak and Montgomery Sts., to cost about $24,000.

Pittsburg, Pa.—Geo. Orth & Bros., Stevenson Bldg., are stated to have prepared plans for an 8-story family hotel to be erected on Forbes St., East End, for Wm. Witherow, proprietor Hotel Duquesne, to cost about $350,000.

Leavenworth, Kan.—A 4-story office building will be erected for Chas. Espenscheit, to cost about $45,000.

An office building, depot, freight room and car barn will be erected here for the Kansas City & Leavenworth Electric Ry. Co., at a total cost of $26,000.

Chicago, Ill.—Peabody & Beauley, 1649 Monadnock Bldg., are stated to have prepared plans for a one and two-story store and office building to be erected at 120-130 E. 43d St., to cost about $20,000.

Grand Rapids, Mich.—W. G. Robinson & Son, of Grand Rapids, are reported to have prepared plans for enlarging and remodeling a brick business block on Monroe St. for the Foster Estate, at a cost of $14,000.

New Haven, Conn.—Plans are being prepared for a building for the City Missionary Association, to be erected on Orange and Elm Sts., to cost about $36,000.

West Baden, Ind.—The West Baden Springs Co. is stated to have been incorporated, with a capital of $1,100,000, to rebuild hotel recently burned. Incorporators: Lee W. Sinclair and Jas. F. Persise, of Salem, and others.

Montreal, Que.—Bids are wanted Aug. 20 for the demolition and reconstruction of the Fish Market. L. O. David, City Clk.

Thomas, Ala.—The Means & Fulton Iron Wks., of Birmingham, are stated to have secured the contract to build for the Republic Iron & Steel Co. at Thomas, a steel stock house, bins and stock yard to handle ore and pig iron. The contract calls for an expenditure of about $60,000.

Middletown, Conn.—W. C. Brocklesby, of Hartford, is stated to have completed plans for an addition to the factory of Wilcox, Crittenden & Co. It will be of brick and stone, 182 x 64 ft. and 2 stories high, and will have electric elevators and lights.

Rochester, N. Y.—Paul Aex is stated to have secured the contract for erecting a building for the Dairy Co., for about $150,000.

Atlanta, Ga.—J. H. Dinwiddie, Equitable Bldg., is stated to be preparing plans for a 3-story clubhouse, 50 x 190 ft., to be erected on Auburn Ave. for the Atlanta Athletic Club.

Dubuque, Ia.—The Dubuque Malting Co. is about to erect a $35,000 addition to its bottling works.

Royersford, Pa.—It is stated that the Philadelphia & Reading Ry. Co. is to erect a large depot here.

Spokane, Wash.—Albert Held, The Rookery, has prepared plans for a 4-story addition to the Tidhall block; cost, $20,000.

Knoxville, Tenn.—The contract for erecting a depot here for the Southern Ry. is stated to have been awarded to Nicholas Ittner, of Atlanta; the cost of the building will be about $80,000, with $20,000 additional for track and yard improvements.

Baltimore, Md.—Local press reports state that the officials of the National Bank of Commerce will receive bids until Aug. 23 for erecting building on South St.

Bayport (L. I.), N. Y.—It is stated that Regis H. Post will erect a $50,000 hotel here.

Kansas City, Mo.—C. A. Smith, N. Y. Life Bldg., has prepared plans for 6-story warehouse to be erected for the Geiser Mfg. Co. at 1410 to 1416 St. Louis Ave., to cost $40,000.

J. W. McKecknie, N. Y. Life Bldg., has prepared plans for a brick store building to be erected on 1210-1212 Grand Ave. for John Thacher, to cost $45,000.

New Orleans, La.—Local press reports state that Favrot & Livaudais, 219 Carondelet St., will supervise the construction of the 5-story brick and steel storage plant, to be constructed here by the New Orleans Cold Storage Co. H. T. Cottam, Chmn. Bldg. Com.

DWELLINGS.

New York, N. Y.—Ludlow & Valentine, 100 B'way, have been retained as architects for the construction of a 12-story apartment house on 45th St., to cost about $600,000. The plant will be equipped with an isolated plant for elevator service, electric lighting, steam heating, refrigerating plant, etc.

Chicago, Ill.—D. S. Pentecost, Metropolitan Blk., is stated to be preparing plans for a 3-story apartment house to be erected on Greenwood Ave. and 55th St., to cost about $65,000.

Rochester, N. Y.—Leon Stern, Chamber of Commerce Bldg., has prepared plans for an $18,000 dwelling to be erected at 218 East Ave. for Edw. Bausch.

Des Moines, Ia.—Liebbe, Nourse & Rasmussen, 724 Walnut St., are stated to have completed plans for an apartment house for Lowell Chamberlain, to be erected on Grand and W. 17th St., to cost about $35,000.

Salt Lake City, Utah.—The plans of S. C. Falkinberg, Hammond Bldg., Detroit, Mich., are stated to have been accepted for a $175,000 apartment house to be erected for Mrs. E. F. Holmes on State and Brigham Sts.

New York, N. Y.—Plans have been filed for a 4-story brick and stone dwelling to be erected at 17 E. 63d St. for W. W. & T. M. Hall, to cost $100,000. Architects, Welsh, Smith & Provot, 11 E. 42d St.

SCHOOLS.

Warrensville, O.—Bids are wanted Aug. 27 for erecting a school. G. W. Radcliffe, Pres. Bd. Educ.

Bozeman, Mont.—The citizens of Gallatin County have voted to erect a $30,000 high school. Bids for the bonds will be received Sept. 5. Frank B. Lewis, Chmn. Bd. Trus. County Free High School.

Weatherly, Pa.—Owen McGlynn, of Wilkesbarre, is stated to have prepared plans for a 3-story brick school of 10 rooms, to be erected here, as a gift of C. M. Schwab.

Langston, Okla. Ter.—The plans of Architect Bennett, of Guthrie, are stated to have been accepted by the Regents of the Langston Agricultural & Normal School for new buildings to be erected this fall, to cost about $25,000.

Worcester, Mass.—The Council is stated to have authorized the issue of $95,000 bonds for schools at Northville and on Home and Sever Sts.

Homestead, Pa.—Wm. Miller & Sons, of Pittsburg, have received the contract for erecting the Schwab Manual Training School for $80,000.

Woonsocket, R. I.—The Council is stated to have appropriated $50,000 for schools to be erected in the 4th and 5th wards.

Fall River, Mass.—The Council is stated to have authorized the issue of $25,000 bonds for the erection of the Textile School.

Westerly, R. I.—The Eli Jackman Co., of Gloucester, Mass., is stated to have received the contract for erecting a $50,000 high school. Ross & Seabury, of Boston, Mass., will install the heating apparatus.

Rolla, Mo.—The contract for erecting new buildings and improvements to the Rolla School of Mines at Rolla, Mo., is stated to have been awarded to Long & McCaw, of Rolla, for $23,444.

Bisbee, Ariz.—The citizens are stated to have voted to issue $20,000 bonds for erecting a school in the Central District.

New York, N. Y.—The Trustees of Teachers' College have filed plans with the Department of Buildings, through Architect Edgar A. Josselyn, 3 W 29th St., for a 5-story and basement brick building to be erected in Lawrence St., west of Amsterdam Ave., to be known as the Speyer School, to be erected at an estimated cost of $70,000.

Elmira, N. Y.—Bids are wanted Aug. 19 for $25,000 school bonds. C. F. Walker, Sec'y Bd. Educ.

Santa Barbara, Cal.—F. O. Engstrum is stated to have received the contract for erecting a high school for $54,000.

Lawrence, Kan.—The contract for constructing the museum building at the University of Kansas is stated to have been awarded to Henry Bennett, of Topeka, for $65,444.

Springfield, Mass.—See "Public Buildings."

Milwaukee, Wis.—The plans of Buemming & Dick, 1107 Pabst Bldg., are stated to have been accepted for a $55,000 school to be erected on 7th and Prairie Sts., to be used for primary grades and for the deaf.

San Antonio, Tex.—Geo. W. Breckenridge of San Antonio, Tex., is reported to have given $20,000 for the erection of a school for colored children.

Hyde Park, Ill.—A. F. Hughes, 437 W. 69th St., Chicago, is stated to have prepared plans for a 3-story building for St. Cyril's College, to cost about $50,000.

Greenfield, Mass.—Robt. E. Pray & Co. are stated to have received the contract for erecting a school here, for $17,777.

Sturgis, S. D.—The contract for erecting the new building for the Sisters' convent here is stated to have been awarded to Mullen & Munn, of Deadwood, for $21,500.

Canastota, S. D.—It is stated that bids are wanted Aug. 24 for a brick school. J. A. Healy, Clk.

Enid, Okla. Ter.—The citizens are stated to have voted to erect a $12,000 school.

Redding, Cal.—It is stated that bids are wanted Sept. 7 for a brick school at Redding, to cost $30,000. Ernest M. Hoen, Archt., Sacramento.

South Bend, Ind.—The Council has authorized the School Board to issue $75,000 for a new high school. Additional grounds, power house, etc., will add about $25,000, making a total expense of $100,000. Address Geo. A. Baker, Sec'y School Bd.

Swissvale, Pa.—Bids are wanted Aug. 20 for $56,000 school bonds. Address A. C. Coulter, 430 4th Ave., Pittsburg.

Cleveland, O.—Bids are wanted Sept. 9 for erecting Lawn and Willson schools. Thos. H. Bell, School Dir., Bd. Educ.

STREET CLEANING AND GARBAGE DISPOSAL.

Braddock, Pa.—The Council is stated to have decided to construct a garbage crematory to cost $25,000.

Salt Lake City, Utah.—Bids are wanted Aug. 30 for a garbage crematory having a daily capacity of 30 tons. John E. Dooly, Chmn. Bd. Pub. Wks.

Chicago, Ill.—The C. Turner garbage crematory at 2611 Archer Ave. was destroyed by fire Aug. 8.

Scranton, Pa.—The Dir. of Pub. Wks. has been instructed to ascertain whether it would be better to repair present crematory or build a new one.

Toledo, O.—The Mayor has recommended to Council that a garbage crematory be erected, one on each side of the river, if possible, for which $20,000 all told would be required.

Findlay, O.—The Council has purchased a site for a garbage crematory.

Oakland, Cal.—Bids are wanted Sept. 4 for sweeping and cleaning certain streets by machinery or by machinery and hand during the fiscal year ending June 30, 1902. R. F. Jackson, Secy. Bd. Pub. Wks.

Hamilton, O.—Local press reports state that bids will be received by the Board of Control until about Sept. 7 for constructing a garbage crematory, having a capacity of 20 tons daily, and to cost about $12,000.

Allentown, Pa.—Bids were opened Aug. 6 for a garbage crematory, reported as follows: The Dixon Garbage Crematory Co., Toledo, O., steel-shell crematory, with a furnace 38 ft. long, 8¼ ft. wide and 9¾ ft. high, of 25 tons daily capacity, $13,950 with steel stack, $14,550 with part steel and part brick stack, and $15,585 for full brick stack, building included; Bridgeport (Conn.) Boiler Works Co., Smith two-crib crematory, with steel stack, 100 ft. high, 20 to 25 tons daily capacity, $6,550, with brick stack $7,400, without building. It offers to erect a wooden structure for $2,000 or a brick structure for $4,150.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted Aug. 19 for repairs to the heating and steam plants in the U. S. Treasury and Winder buildings at Washington. James Knox Taylor, Superv. Archt., Treas. Dept.

Detroit, Mich.—Bids are wanted Aug. 31 for dredging Hay Lake Channel, St. Mary's River, Mich. Col. G. J. Lydecker, Corps Engrs., U. S. A.

Charleston, S. C.—A site at Chicora Park is stated to have been secured for the $1,000,000 dry dock.

Grand Junction, Colo.—Bids are wanted Sept. 3 for furnishing material and erecting a brick warehouse at the Indian School, Grand Junction. Address Theo. G. Lemmon, Grand Junction; W. A. Jones, Commr. of Indian Affairs, Dept. of Interior, Washington, D. C.

Lawrence, Kan.—Bids are wanted Sept. 5 for furnishing and delivering material and erecting a stone domestic building, with plumbing, steam heating and electric lighting, and a frame employees' quarters, with plumbing and steam heating, at Haskell Institute, Lawrence. Address H. B. Peairs, Supt. Haskell Institute; W. A. Jones, Commr. of Indian Affairs, Dept. of Interior, Washington, D. C.

Southport, N. C.—Bids are wanted Sept. 5 for erecting quarters for detained crews at the U. S. Quarantine Station, Cape Fear, N. C. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Preble, Me.—Bids are wanted Sept. 4 for erecting, plumbing, heating and electric wiring one barrack and one double set officers' quarters at Ft. Preble. Address C. J. Bailey.

Mobile, Ala.—Bids are wanted Sept. 9 for constructing one lighted beacon in Key West Harbor, and the removal of 2 lighted beacons in Choctawhatchee Bay, Fla., and their re-erection at Bahia Honda Harbor and Long Key Shoal, Fla. Lieut.-Col. A. N. Damrell, Corps. Engrs., U. S. A.

Nadeau, Kan.—Bids are wanted Sept. 6 for water and sewer systems in Pottawatomie Boarding School, Nadeau. W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D.. C.

Abilene, Tex.—The following bids were opened Aug. 7 by Jas. Knox Taylor, Supervising Archt., Treasury Dept., for constructing postoffice and court house: Jno. Barden, Ft. Worth, $81,613; J. M. Brown & Co., Houston, $83,375; Stephenson & Getaz, Knoxville, Tenn., $84,500; Martin Moodie, Comanche, $88,859.

Los Angeles, Cal.—The following bids were opened Aug. 6 by Jas. Knox Taylor, Supervising Archt., Treasury Dept., for constructing an addition to the court house and postoffice: Thornton & Lang, Los Angeles, $165,792; Child, Hatton & Field, Los Angeles, $191,165; Paul Haupt, Los Angeles, $173,169; J. W. Morrison, Los Angeles, $190,000; Congress Const'n Co., Masonic Temple, Chicago, $159,817.

New York, N. Y.—The Navy Department on Aug. 7 is stated to have decided to award the contract for dredging 20,000 cu. yds. in front of Cob Dock to R. G. Packard Co., 130 Pearl St., at 21.4 cts. per cu. yd.

A contract was also awarded for the dredging of 100,000 cu. yds. in Wallabout channel to the Henry Dubois' Sons Co., 119 South St., at 16 cts. per cu. yd.

Ft. Hunt, Va.—The following bids were opened Aug. 9 by Chas. J. Allen, Lieut.-Col., Corps of Engrs., U. S. A., Washington, D. C., for furnishing and installing an electric-light and power plant: W. M. Sheehan, New York, N. Y., $8,860; McCay Engineering Co., Baltimore, Md., $8,990; Smith Courtney Co., Richmond, Va., $9,497; National Electrical Supply Co., Washington, D. C., $11,932; Edw. Heaton, New York, N. Y., $12,352; the Geo. A. Williams Co., Jersey City, N. J., $14,739; Jas. C. McGuire, New York, N. Y., $15,480.

MISCELLANEOUS.

Stockton, Cal.—Bids are wanted Aug. 26 for constructing a concrete bulkhead in Stockton Channel. Estimated cost, $11,000. G. A. Atherton, City Engr.

New York, N. Y.—Bids are wanted Aug. 27 for furnishing a steam pump, steam fittings, tin roofs, etc. Francis J. Lantry, Commr. of Correction.

Collingwood, Ont.—Bids are wanted by the Cramp Steel Co., at Collingwood, for constructing a dock and approaches.

New Orleans, La.—Bids are wanted Aug. 27 for constructing a wharf along the river front, a distance of 900 ft., to be known as Henderson St. wharf. Hugh McCloskey, Pres. Bd. Port Commrs.

Lewiston, Me.—Bids are wanted by W. H. Bower, Agent for the Columbia Mills, Lewiston, until Aug. 21 for furnishing material and building granite wall and cofferdam at the Columbia Mills. About 1,500 cu. yds. of masonry will be required.

Iona, N. S.—Bids are wanted Aug. 30 for constructing a wharf at Iona. Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

Boston, Mass.—The State Executive Council is reported to have awarded the contract for erecting a 5,000-ton coal pocket under the State House Park to Merritt & Whitten for $25,933.

Glens Falls, N. Y.—Jas. Anderson and D. V. Brown, 2d, both of Glens Falls, bid $6,843 and $5,827.40, respectively, for raising the Keenan storage dam 4 ft.

NEW INDUSTRIAL PLANTS.

N. B. Turner, St. Albans, Me., is rebuilding his shovel handle factory. The building will be 40 x 60 ft., and about 50-H.-P., water power, will be used.

The Knoxville, Tenn., Ice Co. will add a 50-ton ice machine.

The Bonham, Tex., Ice Co. will double the capacity of its plant.

The Olympia, Wash., Door Co., is erecting a new plant. A new 100-H.-P. boiler has just been installed, and an 80-H.-P. engine will be put in.

The Wyman & Gordon Drop Forging Works, Worcester, Mass., expect to put up a 2-story, 150 x 50-ft. machine shop, an 80 x 35-ft. addition to the forge shop and a new power house for two 100-H.-P. boilers and a 40-H.-P. engine in addition to its present power plant.

The Planters' Oil Co., Hearne, Tex., will build a 15-ton ice plant to be run in connection with its cotton-oil mill.

The Sun Portland Cement Co., Ltd., Owen Sound, Ont., is about to begin the construction of a 600-bbl. plant which will be of brick and steel throughout. Contracts for some of the machinery have been let.

The L. S. Starratt Co., Athol, Mass., will erect three factory buildings of mill construction, including a 50 x 165-ft. 4-story machine shop, a 50 x 160-ft. 3-story graduating shop and a 2-story power house. Brick and stone will be used and two fireproof floors, elevators, heating plant, etc., will be needed. Fred S. Hinds, mill architect, Essex Bldg., Boston, is preparing the plans.

The Brompton Pulp & Paper Co., Brompton Falls, P. Q., Can., will receive bids until Aug. 20 for the construction of a 2-story, 142 x 84-ft. pulp mill and a 2-story, 67 x 65-ft. wood-preparing building, both of brick and steel construction. Geo. B. Bearce, Pres.

Henry Doyle & Co., 511-513 Clay St., San Francisco, Cal., are interested in the erection of the Pacific Coast Cotton Mills, which will be located on Puget Sound. The initial plant will be a 2-story, 72 x 234-ft. brick building to be run by an electric power plant of about 200 H.-P. capacity.

The International Cement Co., James B. Graham, pres., has bought a tract at Aliquippa, near Pittsburg, Pa., on which to build a slag cement plant.

BUSINESS NOTES.

The Consolidated Mines, Duluth, have recently started a 110-H.-P. engine for electric lighting, furnished by the Ball Engine Co., Erie, Pa. This company reports the recent export sales of engines to Cuba and Japan, a 300-H.-P. engine for the Roanoke, Va., Ry. & Electric Co. and a 70-H.-P. engine for the Merchants' Cold Storage & Ice Co., Richmond, Va.

The Girard Boiler & Mfg. Co. will add a 40 x 100-ft. main building, two 30 x 60-ft. wings and other minor additions to its plant, and considerable new machinery, which has been contracted for, will be installed.

The American Tube Works, Somerville, Mass., are having a boiler house built from plans designed by Arthur F. Gray, of Boston. A Green economizer is included in the equipment.

The Wisconsin Traction, Light, Heat & Power Co., Appleton, Wis., recently placed an order for water power equipment, to include two units of water wheels, each unit containing three pairs of 42-in. Victor turbines mounted on horizontal shafts, and developing 3,200 H.-P. for driving the main plant, and two single 24-in. horizontal Victor turbines for driving the exciters, made by the Stilwell-Bierce & Smith-Vaile Co., 279 Lehman St., Dayton, O. The company has also received an order from the village of Holgate, O., for two 300,000-gal. Smith-Vaile deep-well pumps and a 500,000-gal. Smth-Vaile general service pump.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Aug. 19.	Morton, Minn Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 21.	New Berlin, N. Y	Aug. 10
Aug. 22.	Pipe, valves, etc., Saginaw, Mich	Aug. 17
Aug. 23.	Lonaconing, Md	Aug. 3
Aug. 27.	Boston, Mass Adv., Eng. Record, Aug. 3 to 17.	Aug. 3
Aug. 27.	Well, Ft. Monroe, Va	Aug. 10
Aug. 28.	Governor's Island, N. Y Adv., Eng. Record, Aug, 10, 17.	Aug. 10
Aug. 28.	Kahoka, Mo Adv. Eng. Record, Aug. 17.	Aug. 17
Aug. 28.	Appleton, Wis	Aug. 17
Aug. 28.	Pleasantville, N. Y	Aug. 17
Aug. 29.	Stanley, Wis Adv., Eng. Record, Aug. 17	Aug. 17
Aug. 29.	Hydrants, etc., New York, N. Y	Aug. 17
Aug. 30.	Supplies, Minneapolis, Minn	Aug. 10
Sept. 2.	Artesian well, San Jose, Cal	Aug. 10
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 2.	Hopkins, Minn	Aug. 17
Sept. 4.	Geneva, O	Aug. 17
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Valves, Cleveland, O	Aug. 17
Sept. 10.	Plans, Muskogee, Ind. Ter Adv., Eng. Record, Aug. 3.	Aug. 3
Sept. 18.	Soerabaya, Java	July 20
Sept. 21.	Washington, D. C	Aug. 17
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29.	June 29
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
	SEWERAGE AND SEWAGE DISPOSAL.	
Aug. 20.	Camden, N. J	Aug. 10
Aug. 20.	Supplies, Columbus, O	Aug. 17
Aug. 20.	Oxford, Miss Adv., Eng. Record, Aug. 17.	Aug. 17
Aug. 20.	Bowling Green, O	Aug. 17
Aug. 20.	Trenton, N. J	Aug. 17
Aug. 21.	Birmingham, Ala	Aug. 17
Aug. 21.	Melrose, Mass	Aug. 17
Aug. 21.	Pittsburg, Pa	Aug. 17
Aug. 23.	Cedar Rapids, Ia	Aug. 17
Aug. 24.	Oshkosh, Wis	Aug. 3
Aug. 24.	Youngstown, O	Aug. 10
Aug. 24.	Tile drains, Garrett, Ill	Aug. 10
Aug. 26.	La Junta, Colo	Aug. 17
Aug. 26.	San Luis Obispo, Cal	Aug. 17
Aug. 26.	Laurel, Del	Aug. 17
Aug. 27.	Hammond, Ind	Aug. 17
Aug. 27.	Moorestown, N. J	Aug. 17
Aug. 28.	Elkhart, Ind	Aug. 3
Aug. 28.	Bowling Green, O	Aug. 10
Aug. 29.	Stanley, Wis Adv. Eng. Record, Aug. 17.	Aug. 17
Aug. 31.	Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 31.	Cerrogordo, Ill	Aug. 17
Sept. 2.	Glenville, O	Aug. 10
Sept. 2.	Wausau, Wis	Aug. 17
Sept. 2.	Disposal plant, Kings Park, N. Y Adv., Eng. Record, Aug. 17.	Aug. 17
Sept. 3.	Dayton, O	Aug. 10
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 25.	Havana Cuba Adv., Eng. Record, June 29 to July 20.	June 29
	BRIDGES.	
Aug. 19.	Rutland, Vt Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 20.	Annapolis, Md	Aug. 17
Aug. 20.	Frederick, Md	Aug. 17
Aug. 21.	Buffalo, N. Y	Aug. 17
Aug. 22.	Summerville, Ga	Aug. 3
Aug. 23.	Woodsdale, O	Aug. 3
Aug. 23.	Athens, O	Aug. 10
Aug. 24.	Terre Haute, Ind	Aug. 3
Aug. 26.	Alexandria, La	Aug. 3
Aug. 26.	Indianapolis, Ind	Aug. 17
Aug. 26.	Substructure, St. Clairsville, O	Aug. 17
Aug. 27.	Superstructure, St. Clairsville, O	Aug. 10
Aug. 27.	Binghamton, N. Y	Aug. 17
Aug. 28.	New York, N. Y	Aug. 17
Aug. 29.	Doylestown Pa	Aug. 10
Aug. 31.	Melan arch bridge, Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 31.	Steel arch girders, Washington, D. C Adv., Eng. Record, Aug. 10.	Aug. 10
Sept. 1.	Souris, Man	Aug. 17
Sept. 2.	Vicksburg, Miss	Aug. 3
Sept. 2.	Decatur, Ind	Aug. 17
Sept. 3.	Cambridge, O	Aug. 17
Sept. 3.	Toledo, O	Aug. 10
Sept. 3.	Medo, Minn	Aug. 3
Sept. 3.	White Sulphur Springs, Mont	July 27
Sept. 3.	LaMoure, N. D	Aug. 10
Sept. 4.	Olivet, S. D	Aug. 3
Sept. 9.	Indianapolis, Ind	Aug. 17
Sept. 30.	Fredericton, N. B Adv., Eng. Record, Aug. 17.	Aug. 17
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
——	St. Petersburg, Russia	Aug. 17
	PAVING AND ROADMAKING.	
Aug. 20.	New York, N. Y	Aug. 10
Aug. 20.	Brooklyn, N. Y	Aug. 10
Aug. 20.	Marinette, Wis	Aug. 3
Aug. 20.	Scottsburg, Ind	Aug. 3
Aug. 20	Reno, Nev	Aug. 10
Aug. 20.	Columbus, O	Aug. 17
Aug. 21.	Pittsburg, Pa	Aug. 17
Aug. 21.	Peoria, Ill	Aug. 17
Aug. 22.	Houston, Tex Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Aug. 23.	Cincinnati, O	July 27
Aug. 23	Elwood, Ind	Aug. 10
Aug. 23.	Cedar Rapids, Ia	Aug. 17
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Concrete-Steel Structures.

The new type of structure composed of a suitable combination of concrete and steel has already attained an extent of adoption that demonstrates an unusual possession of merit. It is difficult, if not impossible, to state the earliest application of this type of construction to American engineering work, but it was scarcely more than ten or twelve years ago. Probably one of the earliest instances is that of the piers at the extremities of the draw-span of the Harlem Ship Canal bridge in New York City. Although this instance can scarcely be classed in all respects with the true concrete-steel construction, steel lattice girders were actually embedded in the concrete hearting of the masonry, in order to reinforce the latter and prevent it from cracking.

The concrete-steel designs of the present time reach considerably beyond such a simple combination, in that the two materials are so placed and proportioned that each receives a determinate amount of stress dependent upon their relative coefficients of elasticity, so that they are enabled to discharge functions corresponding to their relative capacities of resistance. The theory of the composite design is well defined and well understood, but it involves the value of one quantity which has not yet been subjected to a satisfactory empirical determination, and that is the coefficient of elasticity of Portland cement concrete or of Portland cement mortar, the estimates of these values ranging at present from 750,000 pounds to perhaps 3,000,000 pounds or more per square inch. Some fairly good determinations have been made, but much highly desirable experimental work still remains to be done in this special direction. It would appear that with mortar and concrete made of such excellent quality as may be now secured under reasonable conditions, the higher values are the more nearly correct. Obviously the coefficient of elasticity, as well as other physical properties of mortar and concrete, will depend upon age, and it is further evident that the values to be used in the class of work under consideration should be those which will be reached after a relatively long period of time, greater in some cases than that which will have elapsed when the structure is first subjected to use. The determination of this single empirical quantity is worthy of the serious attention of those civil engineers who have at their command facilities for the requisite laboratory operations. It is within their power to render in this manner a valuable service to a line of important professional work.

The wide range of application of this particular type of construction is illustrated by the concrete-steel arches lately constructed in Porto Rico by Mr. Thacher, a description of which was printed in The Engineering Record of August 3, and by the adoption of a considerable range of standard concrete-steel structures by the Illinois Central Railroad Company, without mentioning other cases which might be cited. These applications of the system show that it is receiving not only extended but favorable consideration in quarters where it would not be used did it not possess distinct practical value. They also make both the theory and the fabrication of such composite structures subjects worthy of the most careful and thorough engineering treatment.

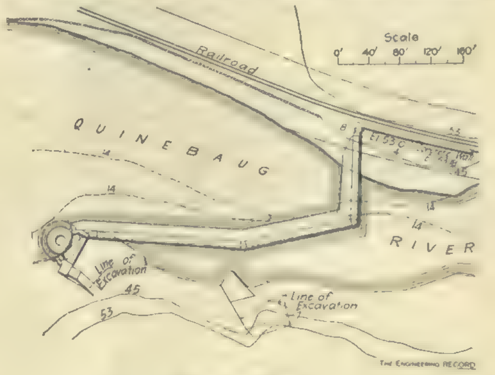
The system adapts itself readily to a great variety of applications, prominent among which are beams and arches, as well as a multiplicity of other monolithic masses. The theories of composite beams and arches of the various types used are well developed and capable of fully as satisfactory application as any engineering theory involved in structural work. Some practical features of construction, however, have probably not yet reached equally satisfactory development. It is clear that the concrete mass used in any particular case should be not nominally but actually monolithic. This is essential in order that some of the chief advantages of the system may be secured. While it is perfectly practicable to reach such an end within the limits of reasonable operation, it is absolutely necessary that scrupulous care be exercised in the mixing and putting in place of the concrete. This feature of the work revives to some extent the old dispute as to the merits of relatively dry and wet mixtures. Less air voids, less tendency to stratification and the best monolithic results in general will be reached with a higher percentage of water in the mixture than with a lower, at the same time avoiding excessive hydration. Again, it is equally imperative to secure a perfect bond between the steel and concrete so that the entire composite mass may act as a true unit; without this feature the tenacity due to the high ultimate resistance of the steel cannot be given to the mass as a whole, and failure in detail under a small external load will result. This bond cannot be created in general if the steel portion is of the solid or plate girder or rib type; the articulated or open type should be used. In arch structures, even when little or no tension exists in the mass, it is best to employ a complete lattice or braced rib, even though it be of the lightest section. Simple bands or strips of steel without bracing between, embedded in the concrete or mortar, do not become sufficiently locked or bonded with it to insure against separation under stress. This is a practical feature of the steel design which has not always received sufficient attention. It may be stated broadly that in every case whatever, the steel part of the arch section should be found as a completely braced rib, although its flanges and braces may have a small amount of metal in them. With such design the steel and concrete are so interlocked and perfectly united that there can be no possible separation of material or lack of action as a whole in respect to internal stresses.

In the early stages of development of a type of construction which possesses the practical advantages of the concrete steel system, there is danger of giving full credit to its merits without giving sufficient attention to the scrupulous care required, both in the theory and the actual fabrication of the materials required to secure them. It is probably correct to state that material advantages in this system of construction have been conclusively demonstrated, but it must not be forgotten that they may be neutralized by indifferent methods of construction alone, as well as by the use of indifferent materials, or, even when materials of the best quality are employed, by injudicious or faulty procedures.

The Norwich Hydraulic Compressed Air Plant.

On the Quinebaug River at Taftville, Conn., an interesting hydraulic compressed air plant is now nearing completion which has attracted considerable attention from New England engineers. It is the property of the Continental Compressed Air Power Company, of which Mr. John A. Inslee is manager, and its purpose is to furnish compressed air through 3 miles of 16-inch plain cast-iron pipe to power users in Norwich. This pipe, it may be said in passing, will have double stuffing-box joints with soft rubber bands.

The conditions at the site of the plant gave the hydraulic works, designed by Mr. J. Herbert Shedd of Providence, an unusual arrangement. The dam has a Z-shaped plan made necessary by the narrowness of the gorge and the proximity of a railway. It is built of concrete, in three sections. The first is approximately 120 feet long and inclined slightly upstream, meeting the second at an angle of about 110 degrees. This second section is about 140 feet long and inclined downstream at a sharp angle with the opposite bank of the river. The third section is 200 feet long and is still more sharply inclined to the bank. This extreme length was deemed necessary in order to obtain a sufficient rollway, for the river is only 240 feet wide at this place. The dam is 7 feet wide on top and about 18 feet high on an average. The upstream face is nearly vertical, while the downstream face has a batter of 1:6. The top is fitted with hinged flashboards of a new type.



PLAN OF DAM.

The dam terminates in a forebay about 40 feet wide, with abutments rising 12 feet above the top of the dam. This forebay ends in a nearly cylindrical head tank of sheet iron, approximately 24 feet in diameter and 18 feet in height. Below this head tank is a cylindrical shaft sunk into the rock below the bed of the river for a depth of 208 feet, 24 feet in diameter for the first 138 feet of its depth, then gradually enlarging into a chamber 52 feet in diameter with vertical sides 20 feet in height. In this shaft is a downflow pipe of an average diameter of 12 feet 8¾ inches, of ⅜-inch steel plates, terminating in a cylindrical tank 47 feet in diameter with vertical sides 16 feet in height, covered by a conical roof joining the downflow pipe. Leading out from this large cylindrical chamber at the bottom is a horizontal shaft 8 feet high and wide and 100 feet in length, as a storage chamber. This is screened off from the main shaft by a curtain wall through which projects a 24-inch wrought iron pipe leading from the top of this horizontal shaft to the upper end of the conical roof of the cylindrical chamber before described, which forms the air chamber. Also leading from the upper part of this conical roof is a 16-inch air supply pipe leading to the surface.

The compressor, with all of its operative parts, was designed by and erected under the charge of Messrs. Webber & Smith of Boston.

The average head of water on this compressor is 18½ feet and the plant is expected to give 1365 horse-power of compressed air at a pressure of 85 pounds per square inch, and was designed and calculated on an average flow of 680 cubic feet of water per second. This compressor is expected to give an efficiency of 85 per cent., based on the results of Mr. J. P. Frizell's experiments at the Falls of St. Anthony on the Mississippi River, who obtained from 40 to 51 per cent. on a small compressor with a shaft 29 feet in depth, and a downflow pipe of 450 square inches, and estimated that a shaft 10 feet in diameter and a depth of 120 feet, with a fall of water of 15 feet, would give 76 per cent. of efficiency, and that with a head of 30 feet and a fall of 230 feet, with a shaft 10 feet in diameter, an efficiency of 81 per cent. would be realized. These expectations have been carried out, in that the plant at Magog, with a head of water of 22 feet, and a downflow pipe 44 inches in diameter to a depth of 128 feet, has given an efficiency of 71 per cent.

An article describing these tests at Magog was printed in The Engineering Record on June 1, 1901. It was based on a paper presented to the American Society of Mechanical Engineers by Mr. William O. Webber, and from another paper by the same author, read before the Boston Society of Civil Engineers last November and printed in the "Journal" of the Association of Engineering Societies, the following notes on compressors of this type have been condensed.

Air compressed by the ordinary mechanical methods contains at least the same amount of moisture as the surrounding atmosphere from which it was compressed; and, in parting with the heat necessarily contributed to the air by the mechanical compression, it is inclined to absorb more moisture. Air compressed directly by falling water is kept at the same temperature as this water. It is compressed isothermally, and the consequent expansion, when used in motors, produces an almost truly adiabatic expansion line. Tests, however, have shown that air compressed in this manner contains only one-sixth of the moisture originally in the surrounding atmosphere from which it is compressed. Incidentally there is no loss of power in parting with any heat, and there is a practical result which is of more importance—the hydraulically compressed air can be expanded down to a temperature much below the freezing point, while atmospheric air, with the usual amount of moisture, mechanically compressed, cannot be used at all, owing to the freezing up of the exhaust passages of the motor in which the attempt to use it is being made.

Probably one of the oldest applications of the use of water power to the wants of man was a form of hydraulic air compressor which operated as an entrainment apparatus. This was the well-known water bellows or trompe of the Catalan forges. This apparatus, briefly described, consisted of a bamboo pole, disposed at a slight inclination from the perpendicular, into the upper end of which a stream of water was led, entraining air with it in its downward passage. The lower end of this bamboo pole was introduced into a bag made of the skin of some animal, the air being allowed to escape from the water into the upper part of the bag, whence it was led by pipes or tuyeres to the forge, the water being allowed to escape from the lower edge of the bag.

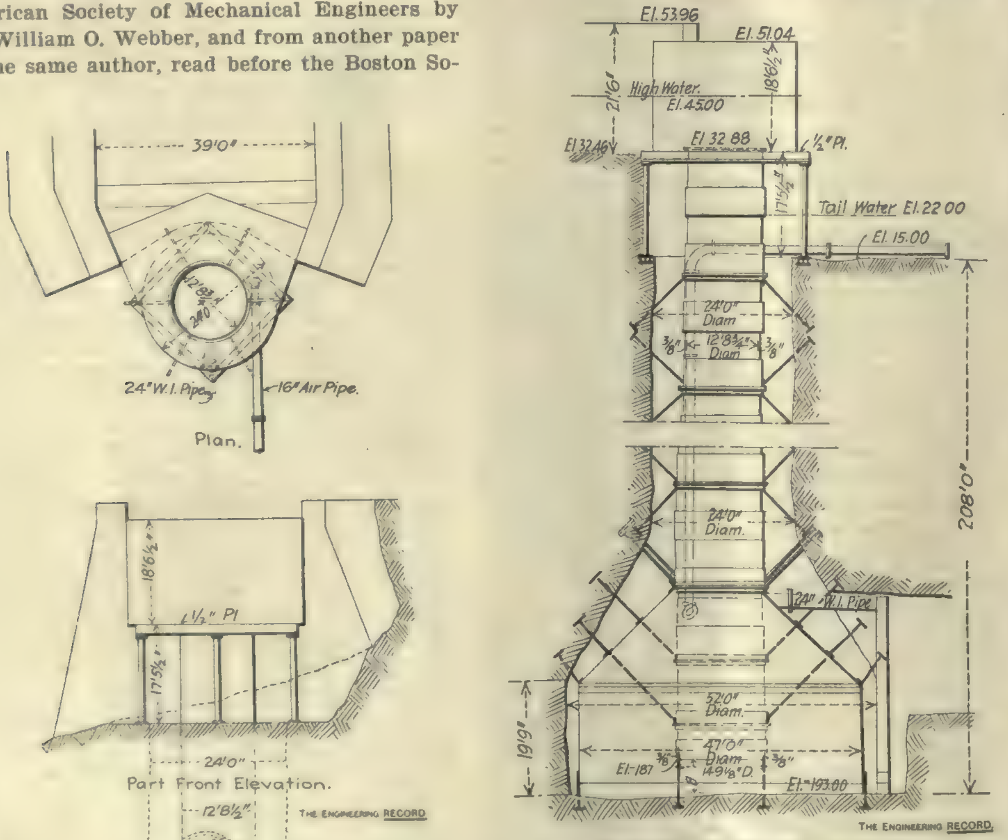
Siemens invented an apparatus on the principle of the steam injector, but the use of this was confined principally to the production of a vacuum. It is used to operate the pneumatic dispatch tubes in London. It has also been used for blast purposes in Siemens' furnaces and in sugar works.

Another quite ingenious device, shown in a patent granted to W. L. Horne, consists of two flat horizontal plates inclosing between them an air space from which a pipe leads to the atmosphere. The upper plate is perforated with conical holes, the smaller end of each hole being adjacent to the air space between the two plates. Directly opposite the apertures of the upper plate are corresponding conical apertures in the lower plate, with the smaller end of the aperture next the air-space, the lower and larger part of the conical openings being prolonged by tubes. The upper plate is kept under a head of water, and the water jet, passing across the thin air space referred to, draws in the air through the large air pipe leading from the atmosphere and compresses it through the smaller orifices.

One of the first inventions carrying out the idea of the old trompe was made by Mr. J. P. Frizell, of Boston. His invention made use of an inverted siphon having a considerable horizontal run between the two legs. A stream of water was led into the upper end of the longer leg and at the top of the horizontal run between

View of Face of Quinebaug River Dam.

View of Upper Side of Quinebaug River Dam.



Plan.

Part Front Elevation.

Sectional Elevation of Compressor.

Details of Shaft, Continental Compressed Air Power Company.

the two legs of the siphon was provided an enlarged chamber in which the air separated from the water. The water was then led off from the lower part of this air chamber and passed off through the short leg of the siphon, the pressure of the air accumulated in the air chamber being therefore due to the height of water maintained in the shorter leg of the siphon. This application of carrying upward the water, after the air was separated from it, so as to produce a considerable pressure upon the air, seems to have been original with Mr. Frizell, and in this feature his device differs from the old trompe.

Mr. Frizell made two working models of this type of apparatus. In the first the legs of the siphon were 3 inches in diameter, the head of water being 25 inches, and an efficiency of 26½ per cent. was obtained. The second model has already been mentioned.

Another air compressor, differing somewhat from that of Mr. Frizell, was invented by A. Baloche and A. Krahnass in 1885, and consisted of a siphon carrying water from an upper to a lower reservoir, the lower end of the siphon being projected through an inverted vessel placed nearly at the bottom of the second reservoir. Just beyond the bend of the siphon, and in line with the vertical axis of its longer leg, an air pipe projected into the descending leg of the siphon, thus entraining the air with the descending column, which carried it down into the inverted chamber, from which the air escaped at the top, while the water passed out from the bottom into the lower reservoir. This apparatus produced pressure on the air in the top of the inverted chamber, due to the height of the water column upon it. Another device patented by Thomas Arthur in 1888 dispensed with the siphon and had the air pipe rising through the vertical pipe down which the water passed to the chamber at the bottom of the shaft.

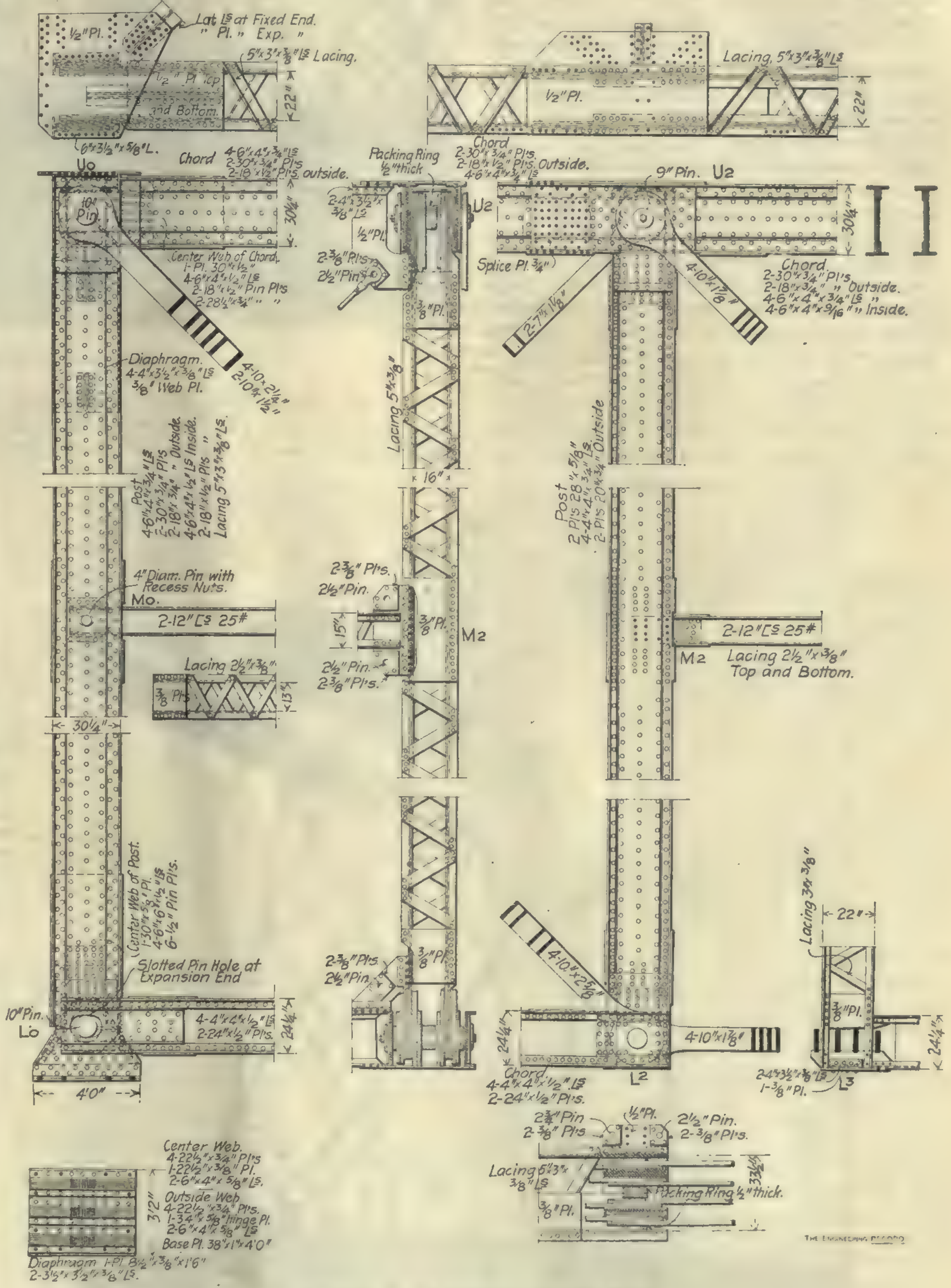
A number of patents on apparatus of this type were issued to Charles H. Taylor in 1895. His inventions consisted principally of a down-flow passage having an enlarged chamber at the bottom and an enlarged tank at the top. A series of small air pipes projected into the mouth of the water inlet from the large chamber at the upper end of the vertically descending passage, so as to cause a number of small jets of air to be entrained by the water, Taylor seemingly having been the first to introduce the plan of dividing the air inlets into a multiplicity of smaller apertures evenly distributed over the area of the water inlet. Taylor at first seems to have attempted to utilize centrifugal action in causing the separation of the air from the water in the larger chamber at the bottom of the compressed column; but he afterward abandoned this scheme and used, instead, deflector plates in combination with a gradually enlarging section of the lower end of the down-flow column, in order to decrease the velocity of the air and water and cause partial separation to take place. The deflector plates changed the direction of flow of the water. This was evidently intended to facilitate the escape of the air.

The latter improvements on this device have been in the method of introducing the air into the mouth of the downwardly flowing water column, so as to insure the largest proportion of air being taken down with the water, and in methods of decreasing the velocity of the combined air and water at the bottom of the descending column, causing the water to part more readily with the air, the water then passing out at the bottom of the enlarged chamber into an ascending shaft, maintaining upon the air a pressure due to the height of water in the uptake, the air being led off from the top of the enlarged chamber by means of a pipe.

The Boone Viaduct.

A description of the general features of the Boone viaduct and its substructure was printed in The Engineering Record of July 13, and in this article it is proposed to describe some of the details of the steelwork and its erection. Each end of the 300-foot channel span is supported on a steel tower about 80 feet high, which has a pair of columns in the plane of each main truss. These columns are battered longitudinally so that they are 27¼ feet apart at the base and are united with a single cap at the top. Each column has a rectangular cross-section, nearly 2 feet square, made with three cover plates and four corner angles, inside, with one face of the column latticed. At intervals of 9 feet or more, each column is stiffened by an interior horizontal diaphragm, which is an octagonal plate connected to the four faces of the column with pairs of angle clips. In the lower parts of the columns these plates are solid, but in the upper parts of the columns they have a 15-inch hole in the center, leaving merely a ring connected to the column sides at four equi-distant points. Projecting gusset plates are riveted in pairs to both sides of the columns to receive the field-riveted connections of the X-braces in all four faces of the tower. These braces are all pairs of 12-inch channels, latticed together and having at intersection pairs of rectangular plates which are shop-riveted to the continuous brace, and field-riveted to the ends of the other brace, which is cut to clear it.

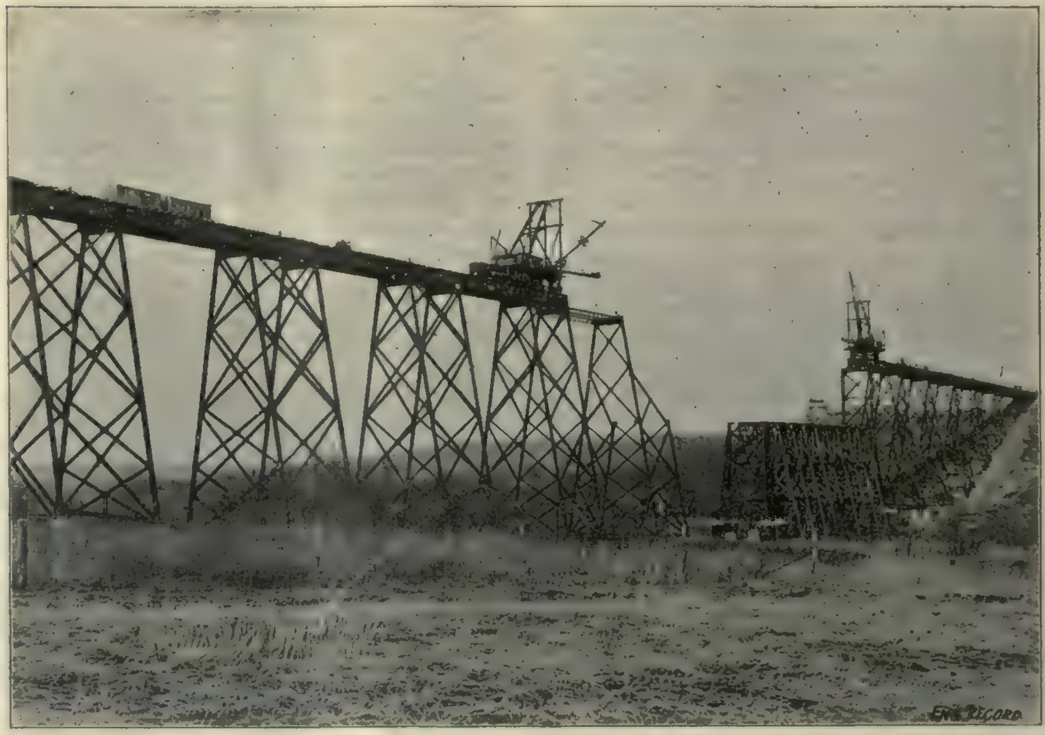
The two columns in each longitudinal bent are connected at the top by two cover plates 16 feet deep, between which there is a center vertical transverse diaphragm made with a vertical plate and four 6 x 6-inch angles. The cap is a ¾-inch plate about 4 feet square which receives the tower girders and the top chord of a double transverse lattice girder 8 feet deep and 5 feet wide at the bottom, the two webs of the girder lying in the planes of the batter posts. At the base of the tower there are longitudinal and transverse horizontal struts and the pedestals are shop-riveted to the columns and are provided with vertical angles and bent plates forming pockets, on the upper edges of which the anchor bolts have nut and washer bearings.



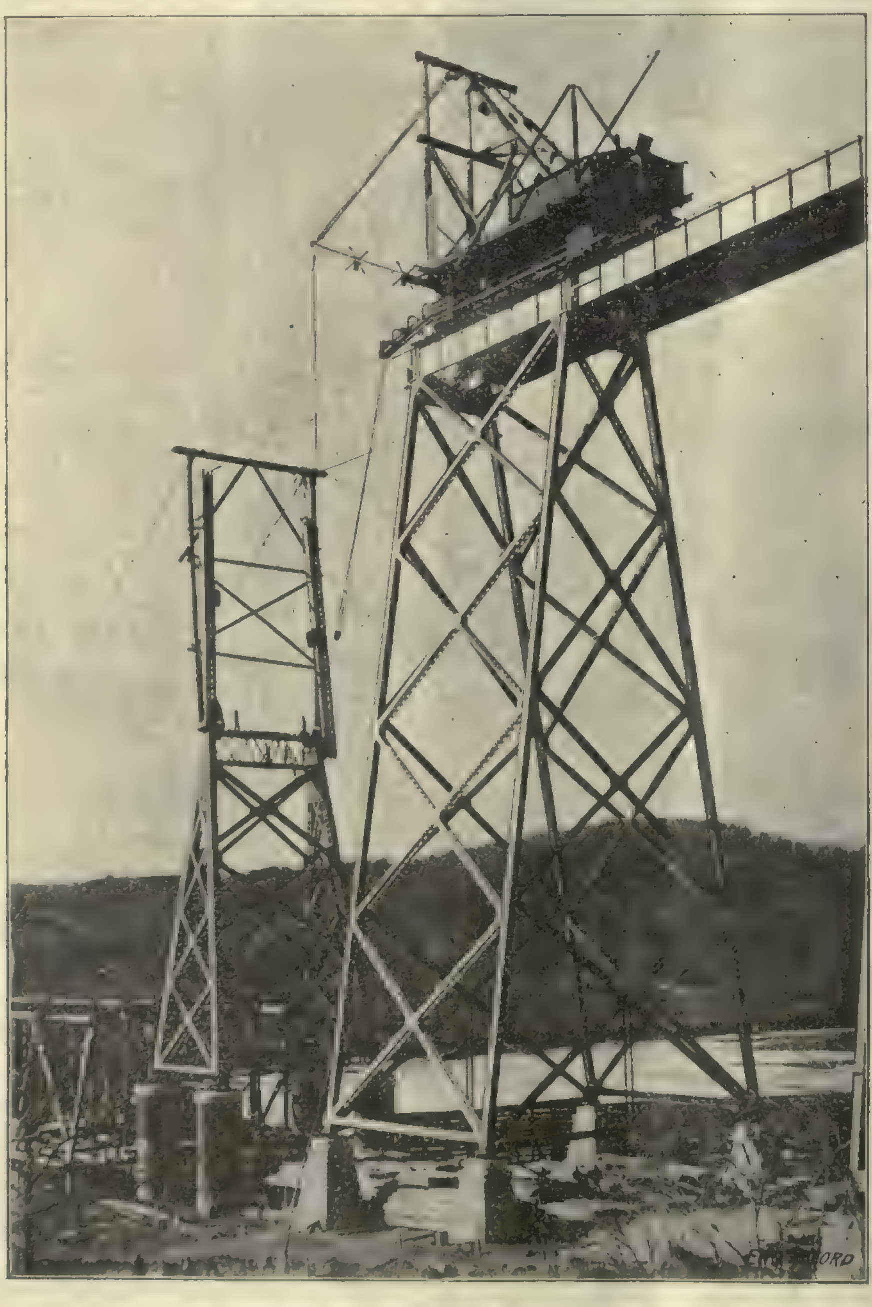
Lat. L's at Fixed End.
" Pl. " Exp. "
½" Pl.
5"x3"x⅜" L's Lacing.
½" Pl. Top
and Bottom.
22"
6"x3½"x⅜" L.
U0
10" Pin.
Chord 4-6"x4"x¾" L's 2-30"x¾" Pl's 2-18"x½" Pl's outside.
30¼"
Center Web of Chord. 1-Pl. 30"x½" 4-6"x4"x½" L's 2-18"x½" Pin Pl's 2-28½"x¾" " "
Diaphragm. 4-4"x3½"x⅜" L's ⅜" Web Pl.
Post 4-6"x4"x¾" L's 2-30"x¾" " Outside. 2-18"x¾" " 4-6"x4"x½" L's Inside. 2-18"x½" Pl's " Lacing 5"x3"x⅜" L's.
4" Diam. Pin with Recess Nuts.
M0.
2-12" [s 25#
Lacing 2½"x⅜"
⅜" Pl's
13"
30¼"
Center Web of Post. 1-30"x⅜" Pl. 4-6"x6"x½" L's 6-½" Pin Pl's.
Slotted Pin Hole at Expansion End
10" Pin.
L0
4-4"x4"x½" L's 2-24"x½" Pl's.
24¼"
4'0"
Packing Ring ½" thick
2-4"x3½" ⅜" L's
½" Pl.
U2
2⅜" Pl's
2½" Pin
⅜" Pl.
Lacing 5"x3⅜"
16"
2⅜" Pl's.
2½" Pin.
15"
⅜" Pl.
M2
2½" Pin.
2⅜" Pl's.
2⅜" Pl's
2½" Pin
⅜" Pl.
Lacing, 5"x3"x⅜" L's
½" Pl.
22"
Chord 2-30"x¾" Pl's 2-18"x½" Pl's Outside. 4-6"x4"x¾" L's
9" Pin. U2
30¼"
Splice Pl. ¾"
2-7"x1⅛"
4-10"x1⅞"
Chord 2-30"x¾" Pl's 2-18"x¾" " Outside. 4-6"x4"x¾" L's " 4-6"x4"x9/16" " Inside.
Post 2 Pl's 28"x⅝" 4-4"x4"x½" L's 2 Pl's 20"x¾" Outside
2-12" [s 25#
M2
Lacing 2½"x⅜" Top and Bottom.
4-10"x2⅛"
24¼"
4-10"x1⅞"
L2
Chord 4-4"x4"x½" L's 2-24"x½" Pl's.
Lacing 3"x⅜"
22"
⅜" Pl.
24¼"
2-4"x3½"x⅜" L's 1-⅜" Pl.
L3
2⅜" Pin
2-⅜" Pl's
½" Pl.
2½" Pin.
2-⅜" Pl's.
Lacing 6"x3"x⅜" L's
⅜" Pl.
Packing Ring ½" thick.
Center Web. 4-22½"x¾" Pl's 1-22½"x⅜" Pl. 2-6"x4"x⅜" L's.
Outside Web. 4-22½"x¾" Pl's. 1-34"x⅜" Hinge Pl. 2-6"x4"x⅜" L's
Base Pl. 38"x1"x4'0"
Diaphragm 1-Pl. 3½"x⅜"x1'6" 2-3½"x3½"x⅜" L's.
31½"
THE ENGINEERING RECORD

Details of the 300-Foot Channel Span.

The 300-foot channel span has two deck Pratt trusses with the panels divided by sub-verticals which support the middles of the top-chord sections. The main diagonals are made in two lengths, pin-connected to the sub-vertical posts, struts and floorbeam suspenders, and having increased cross-section in the upper bars. All panel and sub-panel points are pin-connected, but the horizontal longitudinal struts in the centers of alternate panels are riveted to the main vertical posts. The top chords have no cover plates, but are latticed top and bottom and are field-spliced 3 feet from the main panel points. At each end of the bridge there is a stiff bottom chord, similar in cross-section to the top chord and extending for two panels; the remainder of the bottom chord is composed of 10-inch eyebars in double panel lengths with 9-inch pins. The middle of each eyebar is supported on a notched plate riveted across the bottom of a vertical suspender connected to the middle of the main diagonal. The suspender is made of two pairs of angles latticed and braced at the bottom by a light transverse strut.

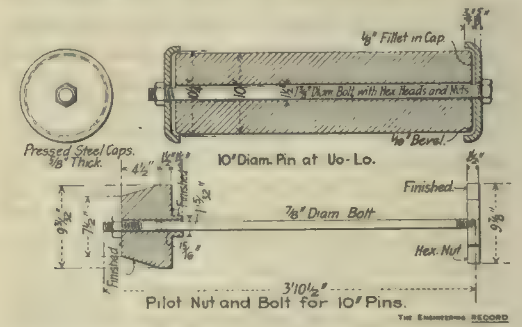

The Boone Viaduct During Erection.

The floorbeams are seated across the top chord to which they are knee-braced by bent angles riveted to each side at both ends, and their bottom flanges are riveted to horizontal tie-plates projecting inside the top chords and receiving the pairs of angles which form the top lateral diagonals. The main vertical posts are braced at the middle points by horizontal transverse struts with vertical end plates field-riveted to the post webs. The bottoms of the main vertical posts are braced by transverse struts which have at each end a horizontal bottom-flange plate riveted across the lower end of the post outside the lower-chord eyebar heads, and a vertical gusset plate which is riveted to its upper flange and to the inside web of the post. The lower lateral rods are pin-connected to the plates on the bottoms of the main posts, and the sway-brace rods are pin-connected to the connection plates at the ends of the transverse struts. At the upper end of the vertical post there is no transverse strut and the sway rods are connected there to a U-shaped vertical transverse plate, cut to clear the top chord and riveted with flange angles to the web of the vertical post and to the lower flange of the floorbeam.


Erecting the End Post of the 300-Foot Span.

The trusses are seated on ordinary shoes, which are pin-connected to the lower ends of the end vertical posts and are riveted to the tops of the steel towers. The ends of the stiff lower chords engage the 10-inch shoe pins with slotted holes 14½ inches long which permit temperature elongations. The end longitudinal struts have also slotted holes for the pins through the middles of the vertical posts, but there is no provision for expansion adjustment in the top chords. The end posts of the trusses therefore act as rocker bents, fixed at the bottom and moving longitudinally back and forth at the top.

Each of the main truss pins has a 1½-inch hole drilled through the center from end to end, and through it passes a 1⅜-inch bolt with a nut at each end. The nut secures a flanged steel disk which covers the end of the pin instead of a nut and leaves the pin a plain cylinder without shoulders or threads. For erection purposes the disks were removed and at one end of the pin a short frustum of a cone was set with a shoulder fitting the center hole to serve as a pilot nut. It was secured to the pin by a ⅞-inch bolt with an ordinary nut bearing on its point and a large, thin hexagonal nut on the opposite end which bears on the end of the pin.

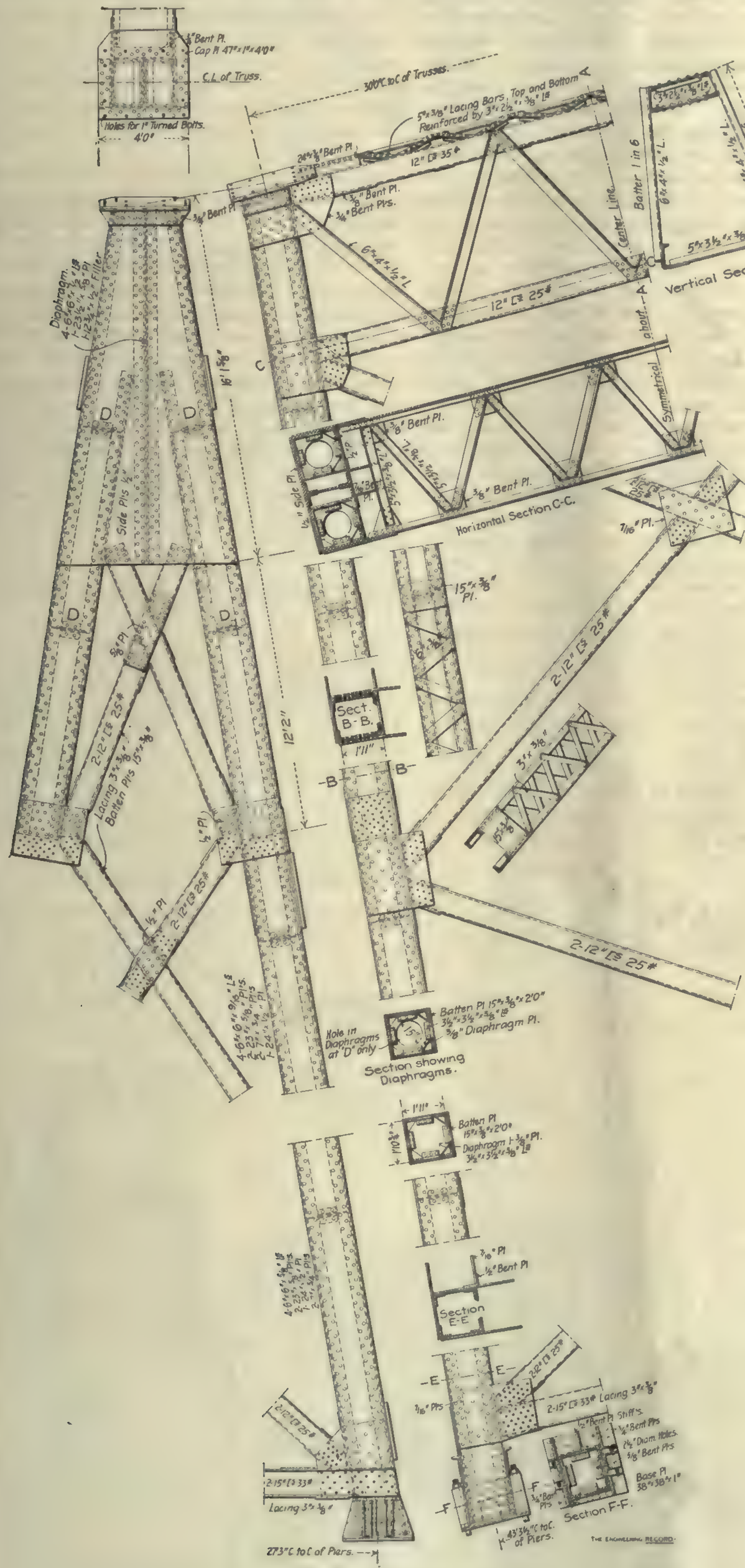


10" Diam. Pin at Uo-Lo.

Pilot Nut and Bolt for 10" Pins.

The viaduct was erected from both ends simultaneously by overhead travelers running on top of the completed structure and assembling it one panel in advance in the usual manner.

The travelers were alike and each had a horizontal floor platform elevated 9 feet above the rail level on four pairs of standard-gauge trucks on tracks 13 feet apart on centers. At the forward end of the platform there was a transverse bent with three vertical steel posts 50 feet high, capped and braced to the rear of the platform by two inclined posts from near the middle of the cap, and by guy rods from the ends of the cap. An intermediate horizontal strut, with inclined posts from the ends to the rear of the platform, divided the bent into two vertical panels, each of which was braced by sway diagonals. A boom was seated on the sill of the vertical bent on each side of the center post. One of them, 90 feet long, was made of two 9-inch channels, latticed together and trussed by rods running from end to end over two sets of intermediate spreaders on each of the four sides. This boom was raised and lowered by a topping lift and could swing through about 75 degrees horizontally and vertically. It was swung by hand lines and had a capacity of 10 tons. The other boom was made of two 18-inch I-beams 51 feet long, on the upper flanges of which were two trolley hoists. It had a capacity of 16 tons at the extremity and was swung about 30 degrees horizontally by hand lines. It was not adjustable vertically but was supported at the end and at two intermediate points by fixed guys to the top of the vertical bent. The traveler was counterbalanced by the hoisting engine, boiler, coal, water, etc., and when in service was blocked up off the wheels and anchor-bolted to the girders of the assembled viaduct. The viaduct members were received at grade at both ends of the structure and brought on cars which ran underneath the traveler platform and delivered to the trolley hoists of the 51-foot boom, which set the plate girders in position and lowered the tower members to the ground, whence they were raised and set in place by the 90-foot boom.



Tower of 300-Foot Span.

For the erection of the 300-foot channel span transverse rows of six vertical piles each were driven in the river bed under each panel point, and capped just above water level. On these caps were set three-story framed bents of Oregon fir with four vertical and two batter posts each. Each bent had transverse X-bracing, and was held longitudinally by the 8 x 16-inch stringers and by lines of horizontal timbers at the bottom of each story. The two end panels and one intermediate panel of the falsework were farther braced by single crossed diagonal struts in each story in the planes of the batter posts, thus making three towers and five unbraced panels, one of the latter having X-bracing in the lower story only. The span was erected on top of the falsework by one of the viaduct travelers running on the top chords of the assembled trusses and setting two panels in advance. The field rivets were driven by pneumatic hammers operated by air provided by gasoline compressors.

The bridge was designed and constructed under the direction of Mr. E. C. Carter, chief engineer, and Mr. W. H. Finley, principal assistant engineer of the Chicago & Northwestern Railway Company, and Mr. G. S. Morison, consulting engineer. It was built by the Chicago Branch of the American Bridge Company, and was erected under the supervision of Mr. T. W. Cartledge.

A Gauging Orifice is used in the Albany filter plant for measuring the effluent of each filter. It is 4 inches high and 24 inches long, and is made in a ¼-inch brass plate, the sides of the opening being beveled away to a 1/32-inch edge. A year ago, Mr. G. I. Bailey, superintendent of the Water Bureau, and Mr. Allen Hazen, designer of the filters, made a series of gaugings of the discharge of the orifice. It was found that with heads of 6 to 18 inches, averaging 1 foot, the coefficient of discharge was very close to 0.630, whether the discharge was free or submerged.

The Driving of the Simplon Tunnel kept pace with the contract requirements up to the close of last year, according to a report just published by the State Department. At that date the permanent ventilation system was installed at the southern portal, but the northern plant was unfinished; a temporary plant had been installed, however. The total work in feet done up to the beginning of the current year was as follows:

End.	North.	South.	Total.
Tunnel 1	13,510	10,325	23,835
Tunnel 2	13,395	10,332	23,727
Complete excavation, 1	10,667	7,708	18,375
Complete lining, 1	9,423	6,626	16,049

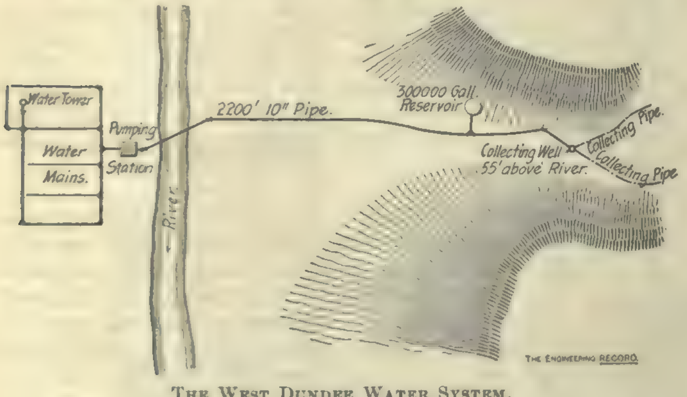
The advance in tunnel 1 during 1900 was 30.5 feet daily, half a foot less than in 1899. There was a working force in December, 1900, of 1,252 men outside and 2,663 inside the tunnel. The total expenditure up to the end of the second working year on September 30, 1900, was $3,474,000.

A Large Hydraulic Ram.

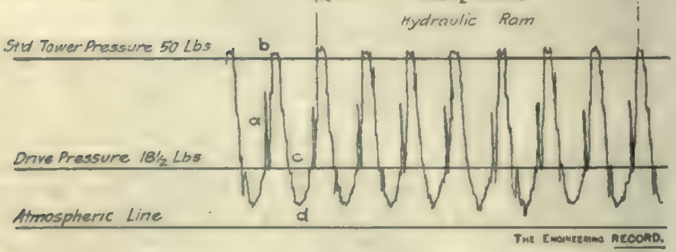
By Daniel W. Mead, M. Am. Soc. C. E.

The village of West Dundee, Ill., lies on the west side of the Fox River, about six miles above the city of Elgin, and has a population of about 1,600. The water-works system of the village was designed by the writer and constructed during 1895, and has been in successful operation since that date. The water supply is drawn from a series of springs that are found between the hills on the east side of the Fox River, and discharged at a height of about 55 feet above the river surface. The water has been collected by laying a series of 12-inch sewer pipe with open joints through the underlying gravel, from which the water of the springs is derived. The clay which underlies the gravel comes to the surface at this point, thus forcing the water to the surface and creating springs. The drain tiles, of which there are two lines, empty into a brick chamber provided with an overflow. From this chamber a 10-inch cast-iron pipe extends to a storage reservoir of a capacity of 300,000 gallons. This reservoir is circular in outline, 55 feet in diameter and of a depth of 20 feet. It has a cone roof supported by a truss with bearings on the walls. From the reservoir the water is carried in a 10-inch pipe under the Fox River to the pumping station, which is located near the river and on the low ground in West Dundee.

The system of distributing mains consists of a 10-inch line through the main part of the city, with an 8-inch main running to the park and connected with the water-tower which is located at that point. The balance of the pipe system is 6-inch and 8-inch; no pipes smaller than 6-inch being used in the system. There are about four and one-half miles of pipe line. The water-tower is on the higher ground, being about 30 feet above the pumping station or 40 feet above the river. The tower consists of eight columns 30 feet in length, built of Z-bars and supporting a tank 40 feet in height and 20 feet in diameter. The bottom of the tank is conical and self-supporting. The 8-inch rising pipe is carefully wrapped and made as nearly frost-proof as possible, the wrappings being covered by wrought-iron casing pipe 18 inches in diameter, supported by an ornamental cast-iron base. The lower portion of the bracing is arched between the columns to allow the passage of pedestrians, for the water-tower is in the middle of the park and the crosswalks pass diagonally under it.



The West Dundee Water System.



Card Taken from Hydraulic Ram.

To force the water into the tower, a hydraulic ram was designed and built, and has been in operation with practically no repairs since its construction. The ram stands some 20 feet in height, the principal height being taken up by a wrought-iron air chamber about 12 feet high and 22 inches in diameter. The water from the springs is brought to this ram in a 10-inch cast-iron pipe. The waste or pulse valve of the ram is 8 inches in diameter, and is raised from its seat by a heavy spiral spring made from ⅝-inch square steel. The lift of this valve is about ¼ inch. The pulsations are very slow, running from twelve to fourteen a minute. The check or discharge valve consists of an enlarged valve chamber, in which are placed a large number of the regulation pump valves having bronze seats, rubber valves, bronze guards and cylindrical bronze springs. The free water-way of the valves is greater than that of a 10-inch pipe, so that the resistance to flow is small, amounting apparently to less than 2 pounds. This ram is capable of pumping all of the water needed by the village for about nine months in the year, and during the winter months is usually operated during the night and shut down during the day, so that the tank may be filled at night and emptied in the day, to cause a circulation into and from the water-tower. During the hot summer months the ram is unable to pump the amount of water used for sprinkling purposes, and the fire pumps are operated for two or three hours a day during that period. To take care of the sprinkling period, and to provide for fire service, there have been installed two Otto gasoline engines of 35 horse-power each. These are direct-connected by friction clutches with two Deming pumps of a capacity of one-half million gallons per day each. These pumps receive the water from the storage reservoir under pressure, and discharge it into the mains and stand-pipe.

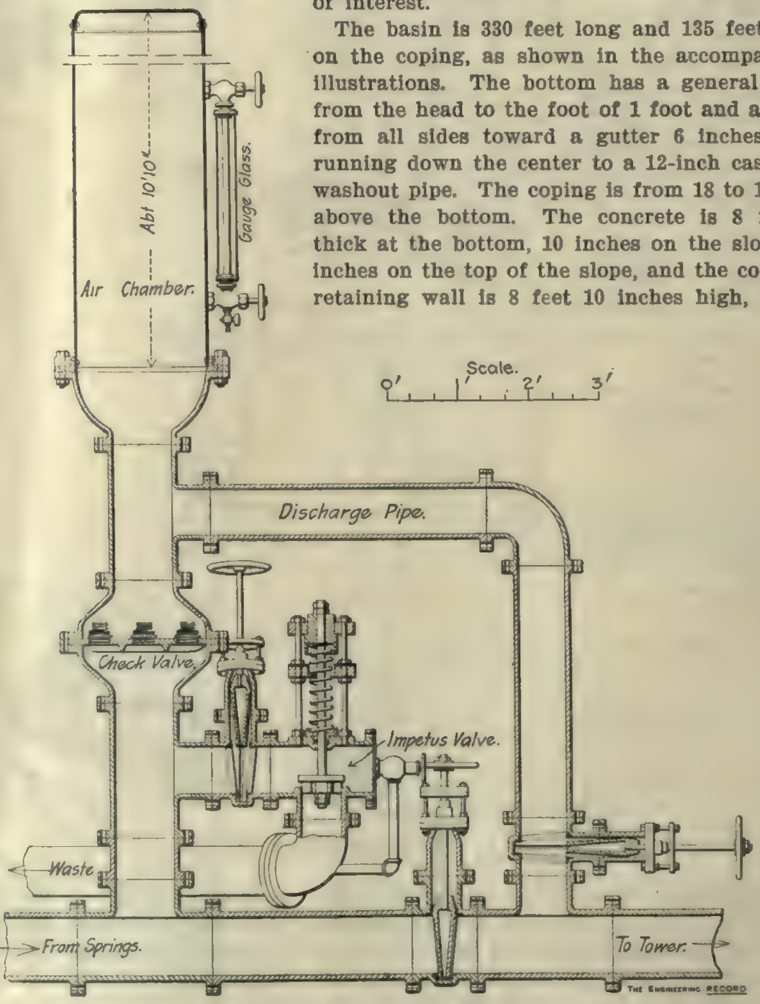
In order to permit of greater fire pressure, a Dousman automatic valve is used in the base of the water-tower, and relief valves are attached to each of the pumps. At times of fire the stand-pipe valves are closed, and the pumps discharge directly into the mains. Should more water be pumped than is used for fire service, the excess amount is discharged through the relief valves, which are set at the pressure it is desired to carry. The relief valves are placed on the discharge of the pumps and inside of the gate valve. With this arrangement it will be seen that should the gate valves be closed and the pump suddenly thrown in motion, the relief valve will waste the water instead of breaking the pump, as would be the case without the use of the relief valves.

It may be noted that, while an air chamber is used on both the discharge and suction pipes of the pump, the air chamber on the hydraulic ram also acts as an air chamber on both the suction and discharge sides, thus relieving the pump when taking water under pressure. In order to keep the air chambers in the pump system full, a small hydraulic air pump is installed and connected up to the various air chambers. Gauge glasses are also placed on each air chamber so that the relation of air and water can be readily seen. The pumps were so arranged that the suction and discharge could be connected by the opening of a valve. This was done, and a study made of pump friction in these pumps. Indicator cards were also taken from the ram, to study its action.

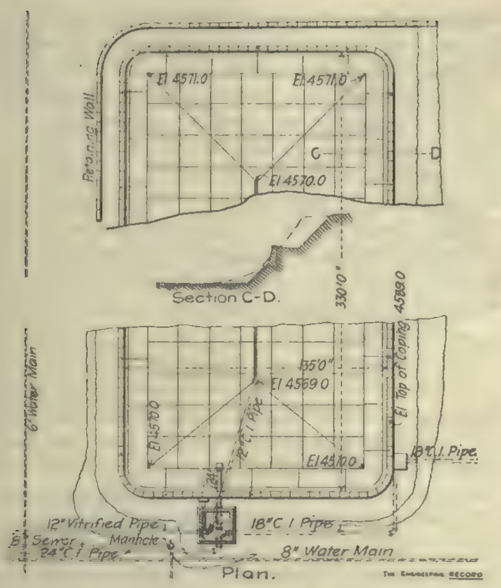
A Concrete Reservoir Lining at Salt Lake City, Utah.

About twelve years ago excavation was begun for a distribution reservoir for Salt Lake City and some of the pipe connections for the work were laid. Operations were suspended for a number of years but were finally resumed from revised plans prepared by Mr. F. C. Kelsey, city engineer. The reservoir has a heavy concrete lining on the bottom and slopes and a concrete retaining wall which have a numbers of features of interest.

The basin is 330 feet long and 135 feet wide on the coping, as shown in the accompanying illustrations. The bottom has a general slope from the head to the foot of 1 foot and a slope from all sides toward a gutter 6 inches deep running down the center to a 12-inch cast-iron washout pipe. The coping is from 18 to 19 feet above the bottom. The concrete is 8 inches thick at the bottom, 10 inches on the slope, 14 inches on the top of the slope, and the concrete retaining wall is 8 feet 10 inches high, 2 feet



Construction of the Hydraulic Ram.

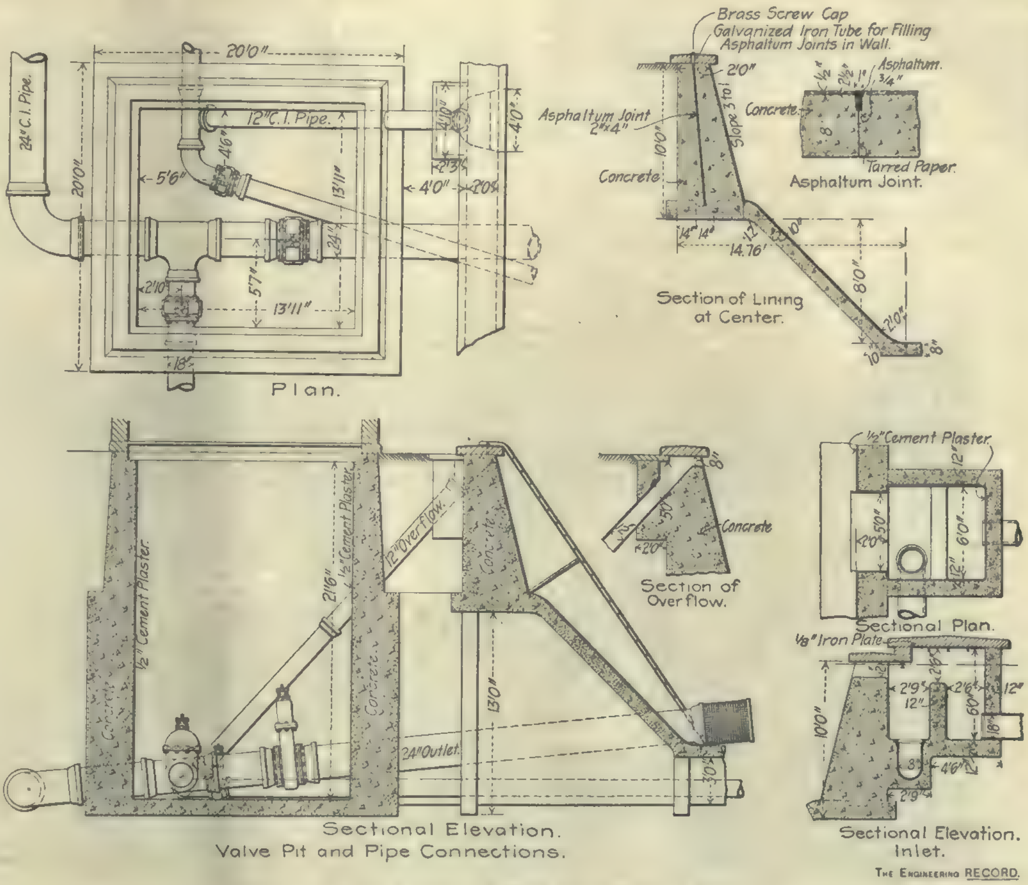


GENERAL ARRANGEMENT OF BASIN.

wide at the top and has a vertical back and a face with a batter of 3 inches to 1 foot. The water is brought to the reservoir through an 18-inch vitrified pipe line on a 9.56 per cent. grade, the last 48 feet being a cast-iron pipe which enters an inlet of which the general dimensions are shown in the cuts. There is an 18-inch branch from this inlet running around the end of the reservoir to a connection with the main 24-inch outlet pipe. The water is drawn off through a pipe terminating in a cylindrical screen 3 feet long and 2.67 feet in diameter, the screen proper consisting of brass wire cloth with a ¼-inch mesh, made of No. 10 wire. The washout pipe and the overflow pipe unite and are connected by a short length of 12-inch cast-iron pipe with a 12-inch vitrified drain running to a free discharge on the side hill about 300 feet away. There is also a connection from this washout pipe to a parallel 8-inch sewer pipe, which enables the latter to be flushed at any time.

The entire concrete construction was carried out with Portland cement. The proportions were one barrel of cement, 17.6 cubic feet of sand and 22 cubic feet of wet gravel from ¼ to 1½ inches in size, well washed before use. It was placed in layers from 4 to 6 inches thick and was required to be of such a consistency that it would not quake when rammed. Each batch had to be placed and rammed within 30 minutes after the cement was wet. All concrete was kept wet for 6 days after being put in place and light frames covered with cloth were used freely to shield it from the direct rays of the sun while it was green.

Work was begun first on the lining of the slopes. The earth was trimmed and smoothed to the proper grade and the concrete was laid in two courses. The platforms on which the men stood were so arranged that they could be held at different heights above the bottom by struts, the main weight coming against that part of the concrete which was already in place; such a platform is shown in the background of the view of the partially completed slope lining and wall. The concrete was carried up over the top of the slope to form the foundation of the retaining wall and was allowed to harden before any further work was done. A groove 14 inches wide and 4 inches deep was left in the top of this level bench to form the joint with the retaining wall. The latter was constructed in molds which were braced at the toe as shown in one of the illustrations. The wall was built in sections 48 feet long. The concrete coping was made in place on the wall in lengths of 5 feet. The edges and the under side of the projection were of equal parts of sand and cement placed to a depth of 1 inch in the mold when the con-



DETAILS OF THE SALT LAKE CITY DISTRIBUTING RESERVOIR.

VIEWS OF THE CONCRETE-LINED DISTRIBUTING RESERVOIR, SALT LAKE CITY.

F. C. KELSEY, CITY ENGINEER DURING CONSTRUCTION.

crete was laid. The upper surface of the coping was covered with half an inch of cement plaster. The abutting ends of the blocks forming the retaining wall had grooves, which together measured 2 x 4 inches in cross-section and were filled with asphaltum put in place while hot through a pipe left for the purpose in the coping, as shown in one of the detail drawings.

The bottom was built in blocks about 16 feet square with a lath in the upper part which left a groove 2½ inches deep and ¾ to 1 inch wide, which was afterward filled, like the wall joints, with hot asphaltum. The concrete blocks were constructed alternately so that one set had a chance to harden before those adjoining were made. The entire concrete lining on the bottom and slopes was covered with half an inch of plaster made in the proportion of one barrel of cement to 4.4 cubic feet of sand. The surface of the concrete was cleaned and moistened before the plaster was put in place, and the latter was trowelled and brought to a smooth surface. It was kept wet for 6 days after being put in place.

If a block of the lining or a section of the wall was left unfinished for half an hour or more, the unfinished surface was roughened and coated with neat cement mortar before the work progressed. All joints in the layers of concrete were broken by a lap of at least 12 inches.

Making the Concrete Slabs for the Central Row.

The Main Drainage of Woking, England.

Abstract of a paper by Mr. Nicholas Maughan, published by the Institution of Civil Engineers.

Woking, Surrey, is situated within 25 miles of London, and is divided into five wards, having a total area of 8,889 acres. When the scheme of main drainage described in the paper was definitely decided upon by the urban district council, in 1897, the total population of the parish was 13,825, including 2,750 inmates of public institutions. The scheme includes the drainage of the whole of the parish, with the exception of one ward, which then had a population of only 1,100, of a rural character. The engineers appointed to design and carry out the whole of the system were Messrs. John Taylor, Sons & Santo Crimp, and they succeeded in perfecting a scheme by which about 80 per cent. of the whole of the sewage is discharged at the outfall-works, by gravitation, at a level sufficiently high to irrigate the whole of the sewage-farm. It was found necessary to pump the remaining 20 per cent. of the sewage, and for this purpose the low-lying areas were divided into four separate districts, each furnished with automatic pumps, driven by power generated at a central pumping station situated at the outfall works. The automatic pumps are driven by hydraulic power at a pressure of 200 pounds per square inch, and arrangements have been made, which will be more fully described later, whereby the water, after it has done its work, can be discharged into large cast-iron tanks and used for road-watering and flushing purposes. The site selected for the outfall works is naturally drained by several small streams and ditches, which ultimately discharge into the River Wey. The top soil is of a light sandy nature and extends to a depth varying between 3 and 4 feet, beneath which is a bed of gravel about 6 feet in depth; the total area of land acquired for the purposes of sewage-disposal is nearly 43 acres.

The main high-level intercepting sewer is nearly 6 miles in length, and from the outfall works traverses the entire parish. It is circular in section throughout, varying in diameter between 2 feet at the outfall and 8 inches at the termination, and is constructed of concrete tubes, iron pipes with both lead and turned and bored joints, and stoneware pipes with Portland cement joints, or, in the case of water-logged ground, with Hassall double-lined or Sutton flush joints. The collecting or branch sewers vary in diameter between 8 and 15 inches, and are constructed, as is the main sewer, of both iron and stoneware pipes, according to the nature of the ground and the depth at which they are laid. By far the greater part of the work had to be carried out in waterlogged ground, and the soil throughout the district being generally fine sand, great care had to be exercised in the construction of the sewers to ensure a sound foundation being obtained. Tunnelling was resorted to whenever possible, where the pipes had to be laid at a greater depth than 14 feet, and some miles of sewers were laid by this means. In a few cases, where water was found within a few inches of ground-level, it was considered advisable to carry up lateral drains, for the purposes of house-connections, from the main sewer to the boundary of the properties on either side of the road, during the construction of the sewer. These branch drains were all laid with pipes having patent joints and bedded on concrete, and, as the subsoil water was necessarily kept down for the construction of the main sewer, they could be laid in a practically dry trench, which would have been impossible at any other time.

Storage-sewers, constructed of iron pipes, were laid for some distance from the pump-wells in the low-lying areas, in order to provide accommodation for the sewage, and thus avoid the necessity for running the pumps at night; and the branch sewers in these districts gravitating to the storage-sewer were kept at a sufficiently high level to prevent them becoming surcharged. The gradients of all sewers throughout the scheme were kept sufficiently sharp to ensure a minimum velocity in the sewers of 2 feet per second, and in setting out the works the following gradients were strictly observed by the author as being the flattest permissible. For 15-inch pipes, 1 in 800; for 12-inch pipes, 1 in 600; for 9-inch pipes, 1 in 350; and for 8-inch pipes, 1 in 300.

The main outfall gravitation-sewer is laid at a gradient of 1 in 1,000 where it is 2 feet in diameter, the gradient increasing as the diameter of the sewer decreases. At this gradient it is capable of discharging 3,480 gallons per minute. The manholes were constructed of 9-inch brickwork, except in the case of those built in very bad ground, or at a considerable depth, when the thickness of the brickwork was increased to 14 inches. In order to guard against leakage through the brickwork, a 1-inch space was left in the 14-inch walls, and was filled in with Portland-cement grout. The lamp-holes were constructed of 8-inch stoneware pipes surrounded with a block of cement concrete 2 feet 6 inches square. Both the manhole and lamphole covers were provided with removable plates screwed to the under side, and could thus be kept sealed or used as fresh-air inlets; galvanized iron dirt-pans were included with every cover, but were only necessary when the plates were removed. Flushing tanks, having a capacity of over 720 gallons, were constructed at nearly all the high points of the system, or where the sewer had a dead end. They are fitted with Field automatic siphons which empty the tank in about 2 minutes. Disk-valves are also provided at several points along the main intercepting sewer, and furnish a means of flushing each section by allowing the sewage to head up, when it can be suddenly released with a head of 3 or 4 feet; overflows from the manhole into the sewer below the disk-valve prevent any accident arising in the event of a valve having been closed and forgotten.

The automatic pumping-stations vary in size according to the quantity of sewage to be lifted. The largest station not only lifts the sewage from the district immediately surrounding it, but also receives the sewage from another station. The rising main from the pumps discharges into a 12-inch sewer gravitating to the outfall works and terminating in a 30-inch cast-iron storage sewer, 440 feet in length. From this the sewage is lifted by centrifugal pumps into the settling tanks. The pump wells are 11 feet 9 inches to 8 feet 4 inches in diameter. The depths vary according to the level of the sewer discharging into the well, the average being 16 to 20 feet. All four wells are constructed of brickwork on a concrete foundation, are circular in plan, and are built of 18-inch walls up to the level of the main girders carrying the pump-barrels. These girders, three in number, were built in as the work proceeded, special stone templates being inserted in the walls to distribute the weight. The thickness of the walls above this level is 14 inches, and a stone coping is fixed above the brickwork at a level with the floor of the pumping-station. Each building is 19 feet 10½ inches by 15 feet 7½ inches in interior dimensions.

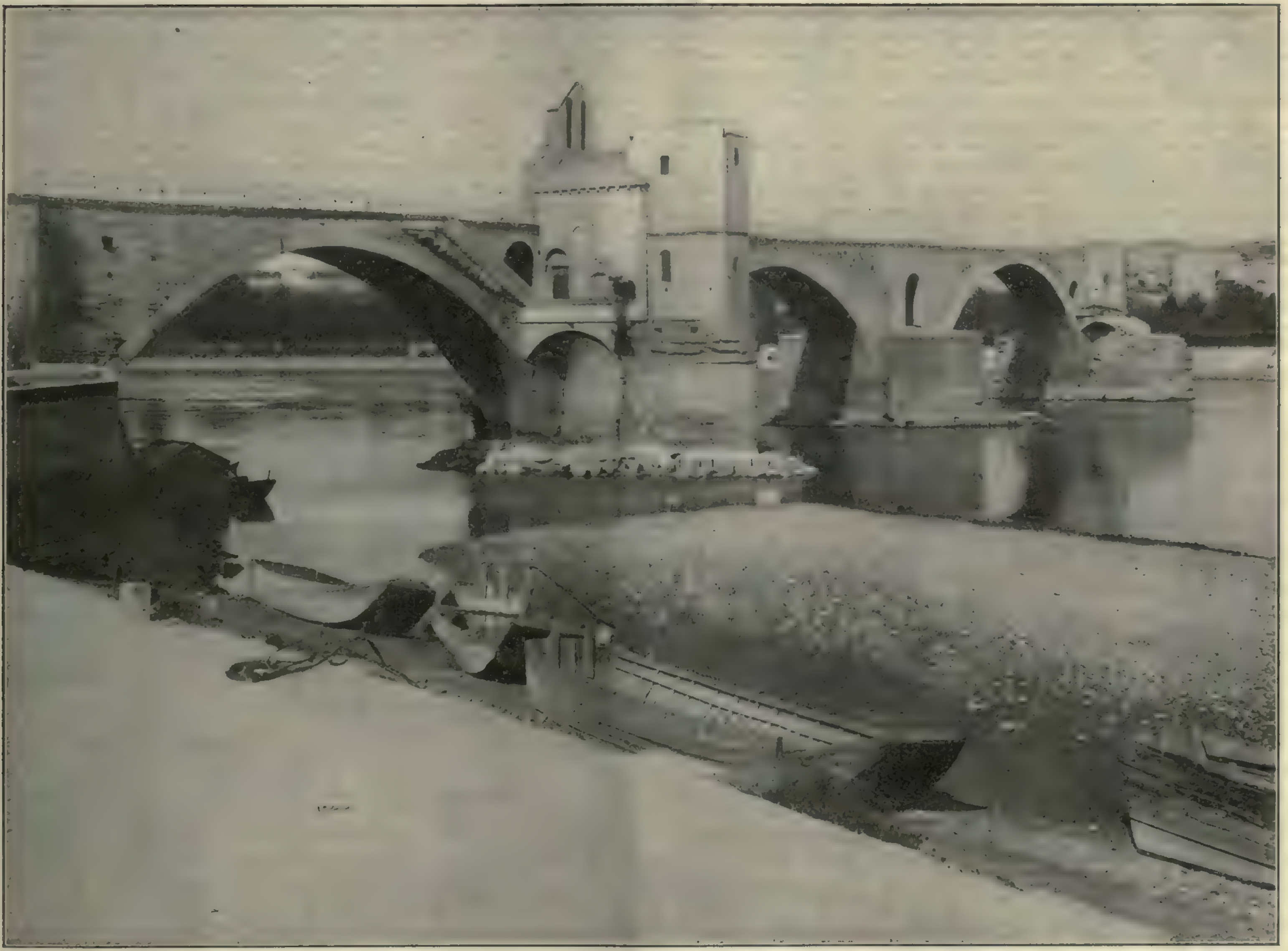
At each station the pumps are in duplicate and entirely automatic, being actuated by means of counterbalanced floats, which start and stop the pumps according to the level of the sewage in the well, and are so arranged that the pumps do not start until the maximum quantity of sewage is in the well, and correspondingly do not stop until the sewage has been reduced to its minimum level. The pumps are single-acting, the plungers being forced downward by means of a fixed operating-ram, within which slides an operating cylinder. This ram is alternately placed in communication with the pressure-water and with the exhaust, by means of a slide-valve worked by hydraulic pressure. The upward stroke is accomplished by means of two side rams constantly open to the pressure. The suction and delivery valves are simple flaps with india rubber faces falling on gun-metal seats, and are not likely to get out of order or to be impeded in their work by foreign matter in the sewage. Air-vessels are fixed on each delivery-pipe, and are supplied with an air-cock on the top. The average lift is 16 feet and the quantity of pressure water required to raise 1,000 gallons 1 foot is about 8 gallons. At two of the stations the exhaust water is discharged into the sewage, and at the other two it is discharged into overhead cast-iron tanks from which it can be drawn for street sprinkling. These tanks have a connection to the street main also. Each tank is provided with an overflow, either directly into the pump-well or to a surface-water drain outside the building, and also with an outlet which passes downward through the interior of the building, a valve being fixed at this point, and thence by a 3-inch pipe to a standpost in the street. Considerable saving is thus effected in the expense of street-watering and flushing, as for either purpose it would otherwise be necessary to purchase water at the rate of 20 cents per 1,000 gallons.

The machinery provided for the purpose of generating the necessary pressure for these hydraulic pumps consists of a pair of horizontal compound steam engines, driving hydraulic pumps directly in line behind the cylinders. Each of these pumps delivers 103 gallons of water per minute against an accumulator pressure of 200 pounds per square inch. The engines work at a boiler-pressure of 140 pounds per square inch, and run at 90 revolutions per minute. The high-pressure cylinders are 6 inches in diameter and the low-pressure cylinders 10½ inches in diameter. The stroke in both cases is 1 foot. The force pumps have 3-inch plungers and 4½-inch pistons. The accumulator ram is 11 inches in diameter, and the stroke is 10 feet.

Steam is automatically admitted to the engines by means of an equilibrium valve, to which is attached a wire rope passing over pulleys bolted to the roof and ending in a weight suspended directly over the accumulator. When the accumulator is at the bottom of its stroke, the weight keeps open the equilibrium valve, and the engines at once start, and continue running until the accumulator is sufficiently high to engage the weight above it, when the valve closes. A relief valve is provided at the foot of the accumulator, arranged to open, by means of a tappet-gear, when the accumulator is within 6 inches of the top of its stroke. This would only come into use in the rare event of the automatic steam valve failing to close.

The water for supplying the hydraulic mains is obtained from a well outside the building, from which it is pumped by means of a two-throw pump into an overhead cast-iron tank. The suction pipes for the hydraulic pumps are coupled directly to the pipe leading from this pump to the tank. A considerable length of unjointed pipes have been laid from the well, through the gravel subsoil, to act as a collecting drain.

The high-level outfall-sewer enters the farm at one corner, and, passing under the buildings, discharges into a hexagonal chamber, into which the sewage from the low-level outfall is pumped. The low-level sewer enters at an adjoining cor-



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXX, AVIGNON, THE BENEZET BRIDGE.
A picturesque old bridge which has been sung by the poets but offers but little architectural suggestion.

ner, and discharges into a screening-tank near the buildings. After passing through a 1-inch screen, the sewage from this sewer flows into the pump-well in the engine room, from which it is pumped into a brick tank outside the building, emptying into the hexagonal chamber. Three 18-inch penstocks and outlets are built into this chamber, and deliver into three settling tanks, the penstocks controlling the entry of the sewage into either tank as required. Each of these tanks measures 100 feet by 30 feet, the average depth being 5 feet. The total tank capacity is nearly 360,000 gallons, which amply provides for 50 per cent. of the daily flow of 20,000 people. The floors of the tanks are constructed with a fall of 2 feet toward the end at which the sewage enters, the sludge outlets being at the deepest part.

Two-thirds of the shallow end of each tank is covered in with galvanized corrugated-iron plates, supported on 7 x 3½-inch wrought-iron joists, and in these plates are drilled 1-inch holes, at a distance of about 4 inches apart. The plates are fixed at a level of about 9 inches below the weir or overflow, and are covered with 6 inches of coarse gravel. At the end of this gravel-bed an iron joist runs right across each tank, and is bolted to the girder carrying the galvanized plates. The top of this joist is at a higher level than the overflow to the effluent-channel. The sewage, on entering the tank, is thus obliged to pass upward through the gravel filter, and thence to the overflow. The solid matter that falls to the bottom of the tank is partly liquefied, and the rest is retained until the tank is cleaned out, when it passes into the sludge culvert. At the present time, with a population of about 8,000 contributing to the works, and with only one tank in operation at a time, it is found necessary to clean out this tank at the end of 10 days, but as house-connections are being made daily it will no doubt soon be more advantageous to use two tanks at once, keeping the third in reserve. The sludge-outlets are covered with ¾-inch gratings, and deliver into a sludge-chamber running along the end of the tanks, and then turning at buildings. The floors of the tanks are of concrete, and the walls of brickwork, 2 feet 3 inches in thickness. The brickwork effluent-weir at the end of the tanks is 2 feet 3 inches in width. The effluent-channel discharges into the main carrier down the center of the farm. From this channel there are three outlets, one opposite the center of each tank, and each consisting of a 6-inch pipe passing down and under the channel and into the tank itself, where it branches into two 4-inch pipes carried along the top end of the tank, each being drilled with small holes at close intervals. By this means the effluent from one tank can be utilized for assisting to clean down the floor of either of the other tanks. Each of these wash-out pipes is controlled by a disk-valve fixed in the effluent-channel. Another outlet is provided for each tank for the purpose of drawing off as much of the liquid from the sludge as possible before it leaves the tank. A narrow channel is built in the floor of each tank, falling slightly from the center toward the shallow end, whence a pipe passes through the tank wall into a circular brick valve-chamber. The three inlet-pipes to this chamber, one from each tank, are each furnished with a valve, and an outlet-pipe and valve communicate with the low-level sewer.

The buildings are divided into four rooms. The first room, which is the engine and boiler-room, contains two locomotive-type boilers, each having a single-cylinder 15-horse-power engine underneath. The engines drive a 3-inch shaft, which runs the whole length of the building and in turn drives a counter-shaft in the press-room. In the engine-room are two centrifugal pumps, each capable of raising 600 gallons of sewage per minute, the lift being about 15 feet. They are fixed on girders directly over the pump-well, into which the low-level sewage is discharged. The pumps are independent of each other, and, being provided with fast and loose pulleys, are driven by belts from the main shaft. In this room also is fixed a two-throw plunger-pump, which lifts the water from the well outside the building and pumps it into a cast-iron tank in the tank-room. This pump is capable of delivering 9,600 gallons of water per hour at a height not exceeding 28 feet.

In the second room are fixed the engines and accumulator for the hydraulic pumps; the exhaust steam, from both engines, can either be discharged through the roof into the atmosphere, or by branch pipes into a condenser in the boiler-room. This is a jet-condenser and air-pump, having a steam cylinder 5½ inches in diameter, the air-pump cylinder being 8 inches in diameter, and both having a stroke of 7 inches. The third or tank-room contains the cast-iron tank already mentioned, and is also used as a lime store. The tank is carried on four girders built into the walls and strengthened by a cross-girder carried on two cast-iron columns. The capacity of the tank is 6,480 gallons. The fourth or press-room contains the whole of the plant necessary for compressing the sludge into cake. This comprises two filter-presses, two sludge-receivers, from which the sludge is forced into the presses by compressed air, the air receiver and compressor, and a chain pump for lifting the sludge from the sludge-well and discharging it into a wrought-iron mixing tank. This chain pump is 4 inches in diameter, and is supported over the sludge-well on two wrought-iron joists. It is worked by means of a belt from the counter-shaft, which also drives all the necessary machinery in this room. The sludge is discharged, about 10 feet above the floor-level, into a cast-iron chute delivering into the mixing-tank. It is here mixed with milk of lime, added perfectly fresh. Revolving stirring-rods are meanwhile kept constantly working. The sludge then gravitates into the receivers, which are below the floor-level. Each of these has an internal dip-pipe reaching to within 3 inches of the bottom, and, upon compressed air being admitted, the sludge is forced up these pipes into the presses. Both the presses and receivers can be worked either simultaneously or separately. The receivers are 4 feet 6 inches in diameter and 9 feet in depth, and are constructed of mild steel plates, 7/16 inch thick. The presses are supported on four cast-iron columns carrying a framework of girders to which they are securely bolted. Each press consists of twenty-four plates, 3 feet square, capable of producing cakes 1½ inches in thickness. Side drainage outlets are provided, discharging into cast-iron troughs, from which a 4-inch cast-iron pipe conducts to the high-level outfall. The cake from the presses is empted into a wrought-iron tip-truck, running on rails, and the truck can be run directly under either press. The air-compressor has two water-jacketed cylinders, and is driven by a belt from the countershaft. The compressed air is stored in an air-receiver, 3 feet 3 inches in diameter and 10 feet in height, constructed of ⅜-inch steel plates. The air can be drawn off as required.

The land which has been acquired for the purpose of purifying the sewage consists of two fields known as the upper and lower fields. At the present time the upper field only has been laid out for sewage-disposal. This has an area of about 24 acres, 4 acres of which are occupied by the tanks and buildings, and also by the cottages for the men in charge of the works. The remaining 20 acres have been laid out in level beds of 6 to 7 acres each, there being a fall of 3 inches between one bed and the next. A roadway has been constructed through the center of the field, and the main carrier runs close beside it on one side. Cast-iron pipes are laid under the road at intervals of about 100 feet, in order to convey the sewage from the carrier to the land on the north side of the road. A drain has been laid for a distance of 600 feet under the road at a depth of about 6 feet, and discharges the effluent into the river. A valve controls the rate at which the subsoil water is discharged into the river through this drain. A few branch-drains have also been connected to this main-drain, which are carried under the land at intervals of about 200 feet. At the present time about 8,000 people are connected with the works, the quantity of sewage per head being well under 36 gallons per 24 hours. This is greatly due to the small amount of leakage in the sewers, which is considerably less than 1 gallon per head per 24 hours, and this rate will, of course, decrease as the population increases. The farm is, therefore, now dealing with the sewage of about 400 persons per acre, and the effluent obtained is remarkably good.

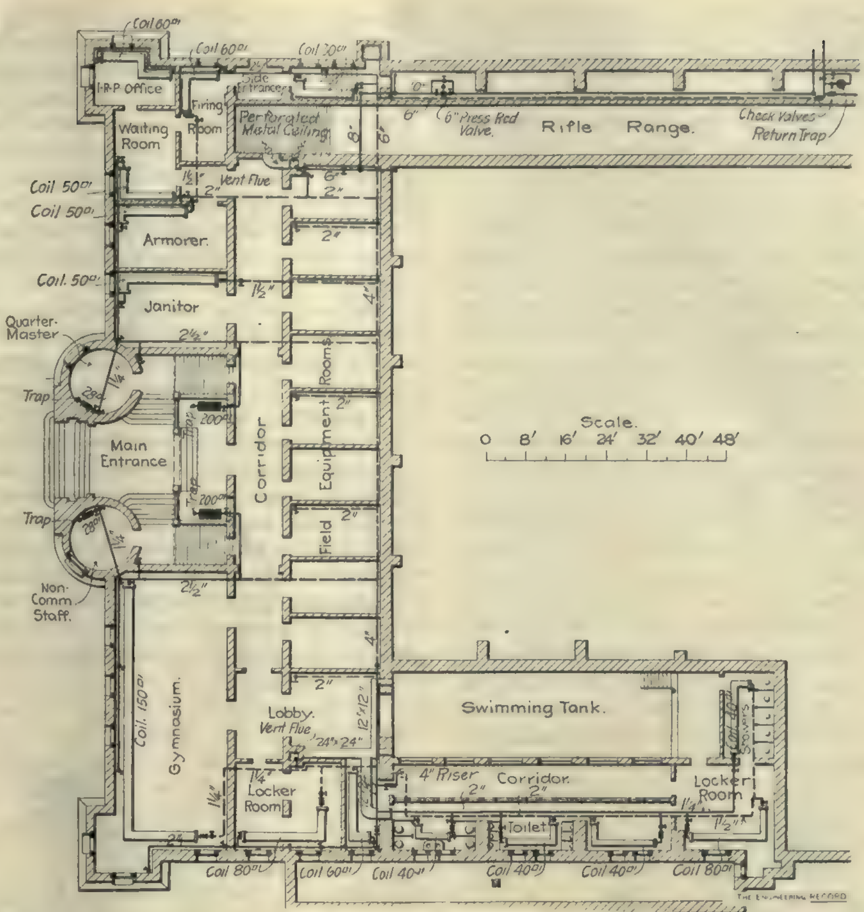
The author acted as resident engineer during the construction of the works.

The Royal Commission on Sewage Disposal which has been investigating the subject in Great Britain for three years, has just filed an interim report of which a brief notice has been printed in "Engineering." It is of marked importance because of the recommendation to the Local Government Board to relax, under proper safeguards, its present rulings regarding the application of sewage to land. Existing scientific knowledge, the Commission states, is not as yet sufficiently complete for fixing the degree of purification necessary for the proper protection of streams. Some authorities, guided by medical considerations only, might be inclined to insist on a degree of purification greater than is really necessary, while others, from motives of economy, might fail to reach a sufficiently high standard in this matter. The Commissioners therefore advise the creation of a separate department of the Local Government Board to act as a supreme rivers authority, with power to protect streams where the local authorities fail to do their duty.

The Willis Avenue Bridge across the Harlem River at 127th Street, New York, recently finished, is expected to be one of the principal links between the boroughs of Manhattan and the Bronx. It is an unusually large and heavy highway structure which was commenced over three years ago and has cost about $2,350,000. It is 2,507 feet long and 66½ feet wide, with a 42-foot roadway and two 9-foot sidewalks paved with asphalt. It has a 304-foot draw span; a 246 2/3-foot fixed river span, five 113½-foot land spans and 1,402 feet of plate girder viaduct approaches, besides 545 feet of embankment approaches. The main span trusses have curved top chords and triple-intersection riveted diagonal web members. They are proportioned for a very heavy live load and carry the pavements on a solid buckle plate floor. The superstructure is supported at two points only from the 60-foot turntable drum on which the load is equally distributed at twenty points. The pivot pier has annular masonry walls 11 feet thick and 70 feet in external diameter, with a pneumatic caisson foundation. The bridge is raised and locked by hydraulic apparatus and has its own steam plant for operating the turning gear and the electric lighting plant, as described in The Engineering Record of November 17, 1900. The bridge was designed by the late Mr. T. C. Clarke, consulting engineer, and the superstructure was built by the Edge Moor Bridge Company.

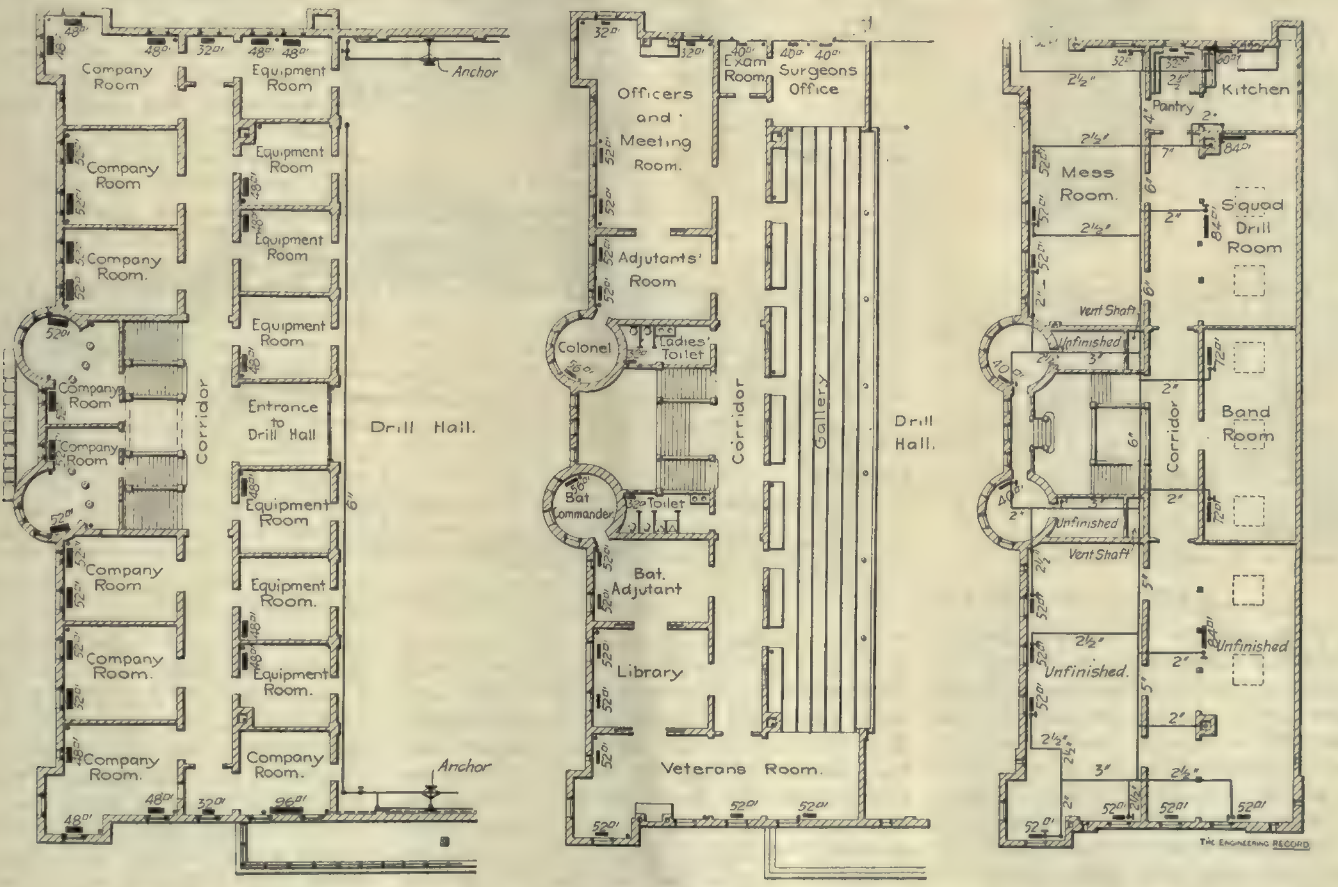
The Thirteenth Regiment Armory, Scranton, Pa.

The Thirteenth Regiment, National Guard of Pennsylvania, has recently built an armory at Scranton, Pa., which is interesting in the convenient arrangement and large number of rooms, in the large arched truss roof over the drill hall and in the provisions for heating. It occupies a plot of ground 160 feet along Adams Avenue and 316 feet along Myrtle Street to Jefferson Avenue. It consists of the usual administrative portion, so-called, about 56 feet deep and the full width of the property, and of a drill hall, covering the rest of the ground area and having an unbroken floor space of 35,000 square feet of asphalt. The street grade at Adams Avenue is 30 feet lower than that at Jefferson Avenue, and while the drill-room floor is 15 feet above the street level in one case it is 15 feet below it in the other.



FIRST FLOOR PLAN, ADMINISTRATION BUILDING.

The administrative building is four stories in height and the ridge of the drill-room roof is level with its roof. The first floor is practically at street level, the drill room at this end is at the second story level and the gallery, one of which there is at each end of the drill hall, is reached from the third story. The gallery at the other end of the drill hall is about at the level of Jefferson Avenue, which gives direct access to it. The front is broken by towers at either end and on each side of the main entrance. There is a tower at the rear street corner and midway along the block on Myrtle Street two others flanking a gateway. The side walls of the building are carried about 5 feet above the point where the roof meets them, and alongside this wall is a walk where soldiers can patrol from one tower to another, should it ever become necessary to defend the armory to that extent. The base courses of the building are gray, rough-hewn stone, as are also the trimmings and cappings of the turrets. The body of the building is selected red brick.



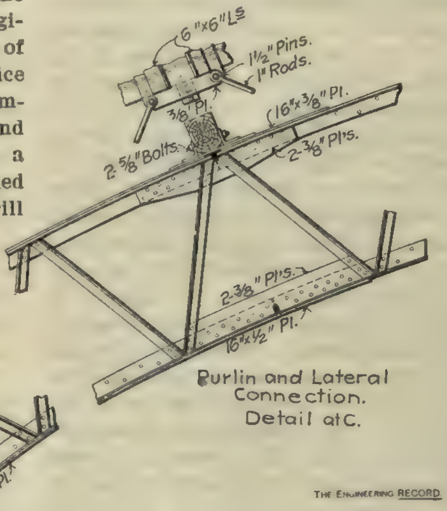
SECOND FLOOR PLAN. THIRD FLOOR PLAN. FOURTH FLOOR PLAN.

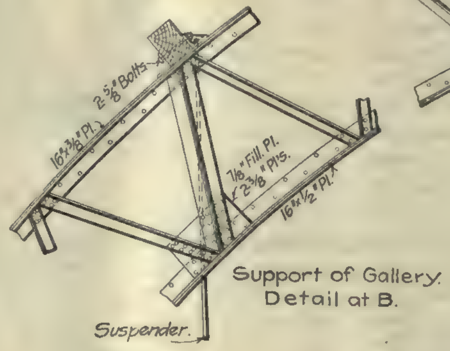
THE ARMORY OF THE THIRTEENTH REGIMENT AT SCRANTON, PA.

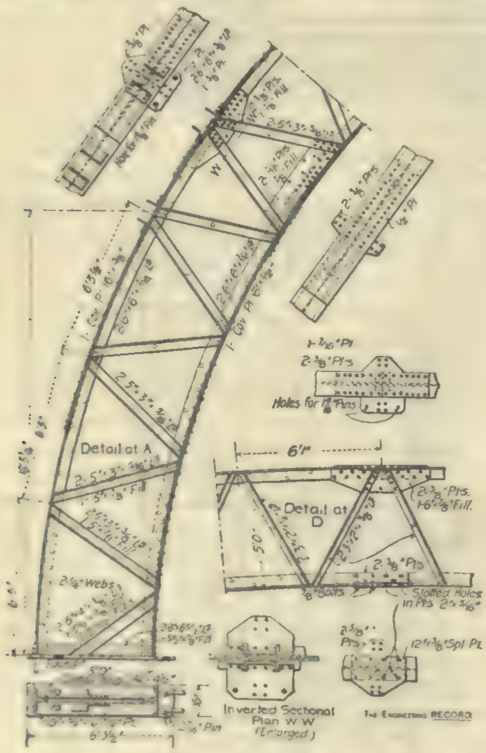
L. C. HOLDEN, ARCHITECT; CONRAD SCHROEDER, CONTRACTOR.

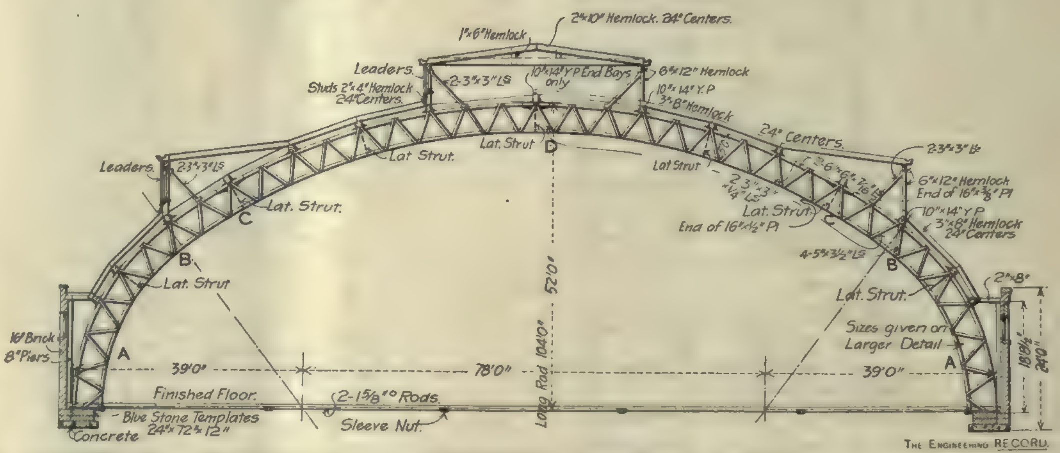
The main entrance is up a few steps into a lobby within the usual high iron grill gates and heavy doors, and from either side rises a broad stairway of iron and slate to the second or drill-room floor. Directly opposite the main entrance are a few steps leading downward to the first floor. On this level one finds a corridor running in opposite directions, longitudinally with the administration building, and here are located a gymnasium, locker rooms and a swimming tank, and the main toilets and the rifle range. These attractive features of membership in the National Guard are thus placed with practically direct street access and may easily be reached without exciting attention should the rest of the armory be in use for some reception and the armory generally thrown open for inspection. The swimming tank has a lobby at one end and a corridor along one side, the walls in both cases being built with arched openings through which spectators may watch the swimmers. A bather passes from the locker rooms through a shower room on his way to the tank.

The rifle range is located along the opposite side of the building and was excavated practically throughout its entire length. It is about 10 feet wide and 308 feet long, and at its head is located a firing room entered from the corridor through a waiting room, off of which also opens an office for the inspector of rifle practice. There is the usual passageway alongside the range through which the markers reach the marking pit, and also a side entrance into this passageway near the firing room. The range is ventilated, chiefly to clear it of smoke, by providing an exit for air through a nearby flue shown on the plans herewith. The ventilating chamber is located above the range at the firing end, the roof of the range, that is, the bottom of the chamber, consisting of 3/16-inch steel plate filled with ½-inch holes aggregating in total area 4 square feet. The plate is fixed flaring, so as to prevent a shot that strikes it from deflecting backward toward the firing point. The chamber is divided into two sections by a girder, which is encased by the steel plate, and from each of these sections a galvanized-iron connection is made with the vent shaft provided. Beneath the wall adjoining the firing room there are four cast-iron grills, to allow a circulation of air into the firing room, each inlet being provided with a damper to regulate the quantity admitted. It is intended to induce a circulation of air through the passageway, through the markers' pit and then forward through the range to give the pit ventilation; and to use an exhaust fan when necessary. Beside iron bullet catchers at the end of the range, of the type having a spiral chambered bottom through which the bullet is brought to rest and saved, there are two intermediate steel screens to intercept stray or wild shots, these plates inclined downward so that the reflected bullet is thrown and caught in a scroll into which the bottom of the intercepting plate is formed. Between the swimming tank and the range are eight rooms, one for each of the eight companies of the regiment which are quartered in Scranton, all opening from the corridor and used for keeping the field equipment.









DETAILS OF THE ROOF TRUSSES OF THE DRILL HALL, THIRTEENTH REGIMENT ARMORY.

The main or drill-room floor is reached, as stated, from the main entrance by a flight of broad stairs rising on each side. Directly opposite the entrance is a short passage, 17 feet wide, which brings the visitor directly on the drill floor. There is a longitudinal corridor in the administration building on this floor, and in front of this along the outside of the building are the eight company rooms. Opposite these across the corridor are eight more company rooms, these for the equipment. The front rooms are furnished as parlors and the others are fitted up with lockers, so that the dressing room is thus entirely cut off from the recreation or reception room. The lockers are of expanded metal, in two tiers, made by Merritt & Company, of Philadelphia, and in these the rifle of each man is kept as well as his uniform.

The third floor, that from which the gallery at the administration end of the drill hall is entered, contains a large veterans' room with a large library opening from it. The colonel's office is located in one of the towers and the battalion commander in the other, with regimental adjutant's office on the left-hand side of the stair hall and the battalion adjutant's office on the other side. There is also a council chamber for the officers and a surgeon's office and examining room. The fourth floor contains a number of large and more or less unfinished rooms, one of which is used for a squad drill room and another for the band, this, it is stated, being admirably chosen for the purpose, having sound-insulated walls broken by no side windows, and receiving light from ceiling skylights. The non-commissioned staff has selected quarters on this floor and there is a large messroom and kitchen, the latter also being of considerable use during social functions which are a feature of the armory's utility, a condition allowable in view of the fact that the building was erected through private subscriptions in Scranton. The kitchen is served from a dumb waiter, to which tradesmen have access through the side entrance to the rifle range.

The gallery at the rear end of the drill room is on the level of Jefferson Avenue, as stated, but the drill floor can also be reached at this end of the building by means of two stairways leading down in areas built for the purpose. There is a broad entrance about midway along each side of the drill room, which provides for an artillery contingent to the regiment, should that be added. The officers have a private entrance to the drill-room floor along Myrtle Street.

The drill hall has a roof supported by twelve steel trusses 20 feet apart on centers, which have a span of 156 feet, out to out, and a rise of 52 feet to the top of the upper chord. The trusses are hingeless arches with horizontal square lower ends seated on top of the abutment piers and connected by horizontal tension members under the floor. The parallel top and bottom chords are 5 feet apart, out to out, and are false ellipses, composed of circular arcs described from three centers with a long radius of 104 feet and two short radii of 39 feet each. The trusses are wholly within the side walls and are seated, just below the floor level, on extensions of the concrete wall footings capped with 2 x 6-foot blue stone pedestals. They are connected by seven lines of longitudinal lattice girder struts 5 feet deep with their webs in radial planes, which are field riveted to lateral connection plates on the top and bottom chord flange angles. The roof trusses are also braced together in alternate panels by lateral diagonal rods in the planes of the top chords, with pin connections and sleeve-nut adjustments.

Both chords of the arch trusses are made throughout of pairs of 6 x 6 x 7/16-inch angles riveted together back to back, and reinforced with 16-inch flange cover plates from the haunches to the springing line. The panel lengths are nearly uniform, varying from about 4 feet 8 inches to 5 feet 10 inches, and all web members are pairs of zigzag angles from 5 x 3 x ⅜ inches at the skewbacks to 3 x 2 x ⅜ inches at the crown. Except where the truss sections are field spliced, all web members are riveted directly to the vertical flanges of the chord angles without connection or gusset plates. Each truss was shipped from the bridge shops in six sections, which were field-riveted together before erection. The splices were made at the panel points in the top chords and in the middles of the opposite panels of the bottom chords, and the joints were covered with flange and double web plates.

The end sections of the trusses are about 20 feet long and have a solid web plate in the two lower panels, as shown in the detail. The ¾-inch planed base plate has two slotted holes for large anchor bolts, and projects beyond the inside of the truss and its pedestal to receive the connection pins for the two 1⅝-inch horizontal bottom tie-rods, which are made in five lengths connected by sleeve nuts. The base plate rests on a 1-inch bed plate nearly 4 feet long, and the anchor-bolt nuts are screwed down tight on ring washers which bear on the bed plates and clear the holes in the base plates, thus preventing any pressure or friction on the base plates. The lateral connection plates are in two pieces at each splice, riveted to the under side of the horizontal flanges of the chord angles, and are notched to clear the web members of the truss as shown in the detail sketch. At the crown splice the top chord joint is riveted solid, but the bottom chord splice is made with cover plates which are riveted fast to one section of the truss and have slotted holes for bolts in the other section so as to allow for temperature displacements. The roof is proportioned for a wind load of 30 pounds per square foot of the vertical projection, and the main trusses are designed for an additional load of 20 tons at each end from the gallery floor, which is calculated for a uniform loading of 150 pounds per square foot.

On every truss, at the sixth panel point from each end, there is riveted to the top chord a cast saddle from which are suspended two 1½-inch vertical pin-connected rods with sleeve-nut adjustments. These rods clear each side of the truss and are bent to join each other under the bottom chord, where they are pin-connected to a single rod 2⅛ inches square, which supports the side gallery. Pairs of short 6 x 6-inch angles are riveted across the top chord at intervals of about two panel lengths and between them are secured by two bolts through their vertical flanges, 10 x 14-inch yellow pine purlins, about 12 feet apart. These purlins support 3 x 8-inch rafters 24 inches apart on centers, which are sheathed with matched 1½-inch spruce boards planed and beaded on the under side. The boards are covered with five-ply slag roofing, laid by the Warren Ehret Company, except where the slopes are steep and in the gutters, where they are tinned, with standing seams.

A ventilator about 36 feet wide and 10 feet high extends in the axis of the building across all the intermediate roof panels. It has a wooden framework with vertical side posts seated on the purlins, and braced from the top with oblique angles running to the next higher panel points of the top chords of the trusses. The sides of the lantern ventilator are glazed, and all the sash are mounted on horizontal pivots, enough of which are commanded from the floor to suffice for ordinary ventilation. A similar row of windows is built into the roof on each side of the haunches. Ventilators of the globe or anchor type are set in the apex of the roof to prevent an accumulation of hot, moist air and consequent condensation and drips. The soffit of the ventilator is ceiled with yellow pine, but the under side of rafters and main roof boards are exposed, and all the walls are of unplastered selected red brick.

The site of the armory is on a side hill, which necessitated a fill over most of the area of the drill hall. Steam ashes were wet and rolled in layers of from 12 to 24 inches with a 20-ton steam roller. The surface of the fill was an average of 10 feet and a maximum of 25 feet above the original ground surface, and was thoroughly grouted. Then 4 inches of concrete was rammed on top and covered with 2 inches of asphalt paving, laid by the Barber Asphalt Paving Company. The surface was graded to six drains at the entrances, at the four corners and in the middles of the long sides, so that the floor can be easily washed down with a hose.

A sectional 80 x 100-foot movable dancing platform has been provided which can readily be set up in any part of the hall and quickly removed and packed away after use. It is made with 2 x 12-inch plank edgewise, set 20 inches apart and covered with matched ⅞-inch boards. The sections are about 10 feet square and are fastened together with horizontal wooden dowels.

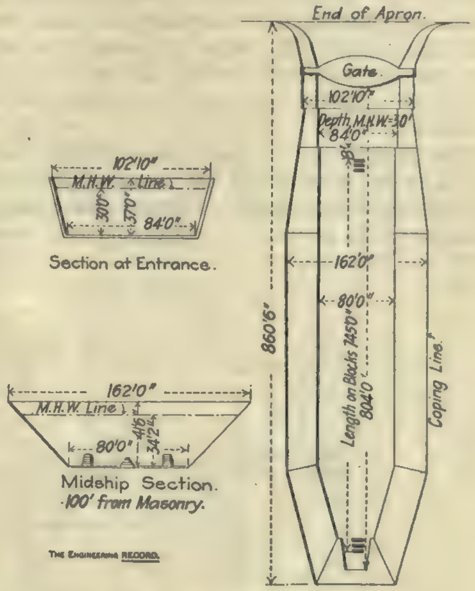
The building is heated by low-pressure steam with an overhead system of distribution and one-pipe radiators for the administration building and pipe coils for the drill room. In the whole plant there are 65 direct radiators, aggregating 3,490 square feet of surface, and 26 coils, aggregating 7,420 square feet of surface, 10,910 square feet of heating surface all told. The steam is supplied from a street supply, from the Economy Heat & Power Company, the steam being moderately high and reduced in pressure for use in the building. It is received at a point in the markers' passageway along the rifle range, at the front end of which is located the reducing valve, feeding a 10-inch heating main. This feeds a 6-inch pipe rising into the drill hall, continues 8 inches in size and subdivides into two 6-inch mains, one rising also into the drill hall and the other to the attic of the administration portion of the armory, this pipe passing upward through the vent flue nearby, so that its hot surface is utilized to cause an upward draft of the more or less vitiated air disposed of in that way.

The drill hall is thus served by two 6-inch pipes from the low-pressure main, rising within a few feet of each other in one corner; from these a horizontal main is continued all around the drill hall, 6 inches in size, making a continuous loop, so that the room may be warmed from either of the two supply risers. This horizontal main, which in total length measures about 765 feet, supplies, all told, about 6,000 square feet of surface, divided into four sections. It is about 240 feet long on each side and 150 feet across the far end. An anchor is located near each end of the side portions and an expansion joint midway between in each case. Changes of length due to contraction and expansion are provided for in the cross portion of the loop by the swing it has from the near anchors in the side portions, the swing parts of the main being 24 feet long. The four sections are formed by valves in the loop main, so that in comparatively mild weather, according to the direction of the wind, either or both sides may be turned on while the end is not used at all. The radiation in the drill hall is in wall coils and each section has a trap, globe and check valve, the latter at least 15 inches below the outlet from the coils and connecting as closely as possible to the main return pipe.

The administration building, as stated, is warmed on the overhead distribution of steam piping. The supply riser passes from the vent shaft at the ceiling of the fourth story, 7 inches in diameter, and feeds a longitudinal main carried overhead and reducing in size as branches are taken off, altogether supplying 21 dropping lines of supply pipes to the radiators, which are connected with the one pipe. These supply drop pipes are continued full size into the ground story and have a valve at the initial point as well as at the bottom, so that any one may be cut when desired or necessary. The main also supplies aspirating surface in the vent shaft not containing the supply riser, the aspirating surface amounting to about 60 square feet. The radiation in the ground story is largely in ceiling coils, but four direct radiators were necessary, at the entrance and in the tower rooms, so that the condensation from these has to be handled by traps. While the steam company does not in general receive the condensation from the radiators of its customers, in this case the proximity of the station made it advisable and simple. The return water is accordingly carried to the point of entrance of the steam main into the building and the water is delivered to the steam company's plant by means of a return trap which has a steam connection with the moderately high-pressure steam brought into the building.

Mr. L. C. Holden, of New York City, was the architect for the building, and Mr. C. F. Winkelman, of his staff, was in charge of the drawings. The general contract for the whole armory was awarded to Mr. Conrad Schroeder, of Scranton, for $128,195, and the contract for the structural steel, amounting to $25,000, was awarded to the Passaic Rolling Mill Company, Mr. G. H. Blakeley, chief engineer. Mr. C. B. Scott was contractor for the heating work.

The New Timber Dry-Dock of the Newport News Shipbuilding & Dry-Dock Company has an extreme length of 860 feet 6 inches, a length on the bottom of 804 feet, a width of 162 feet on the top and 80 feet on the bottom, and a depth of water of 30 feet over the sill at mean high tide. It was designed by Mr. W. A. Post, general superintendent of the company, and constructed under the supervision of Mr. Geo. Y. Alsop, its civil engineer. The entrance is of masonry, resting on a concrete foundation supported by a pile and timber substructure. The pumping plant, designed by Mr. Chas. F. Bailey, chief engineer, consists of two main centrifugal pumps, each with a capacity of about 85,000 gallons per minute, and one 12,000-gallon centrifugal drainage pump. The pump shafts are vertical and are driven electrically; the motors for the large pumps are rated at 1,000 horse-power at 500 volts, and that for the small pump at 350 horse-power at 250 volts. The current is obtained through underground conductors from a main power house about 700 feet away. Arrangements are also being made to pump out the old dock with the same plant. Its length is 638 feet 7 inches on the top and 573 feet on the bottom, the width 130 feet on the top and 50 feet on the bottom, and the depth of water on the sill is 25 feet. The accompanying diagram of the new dock is not drawn to scale.

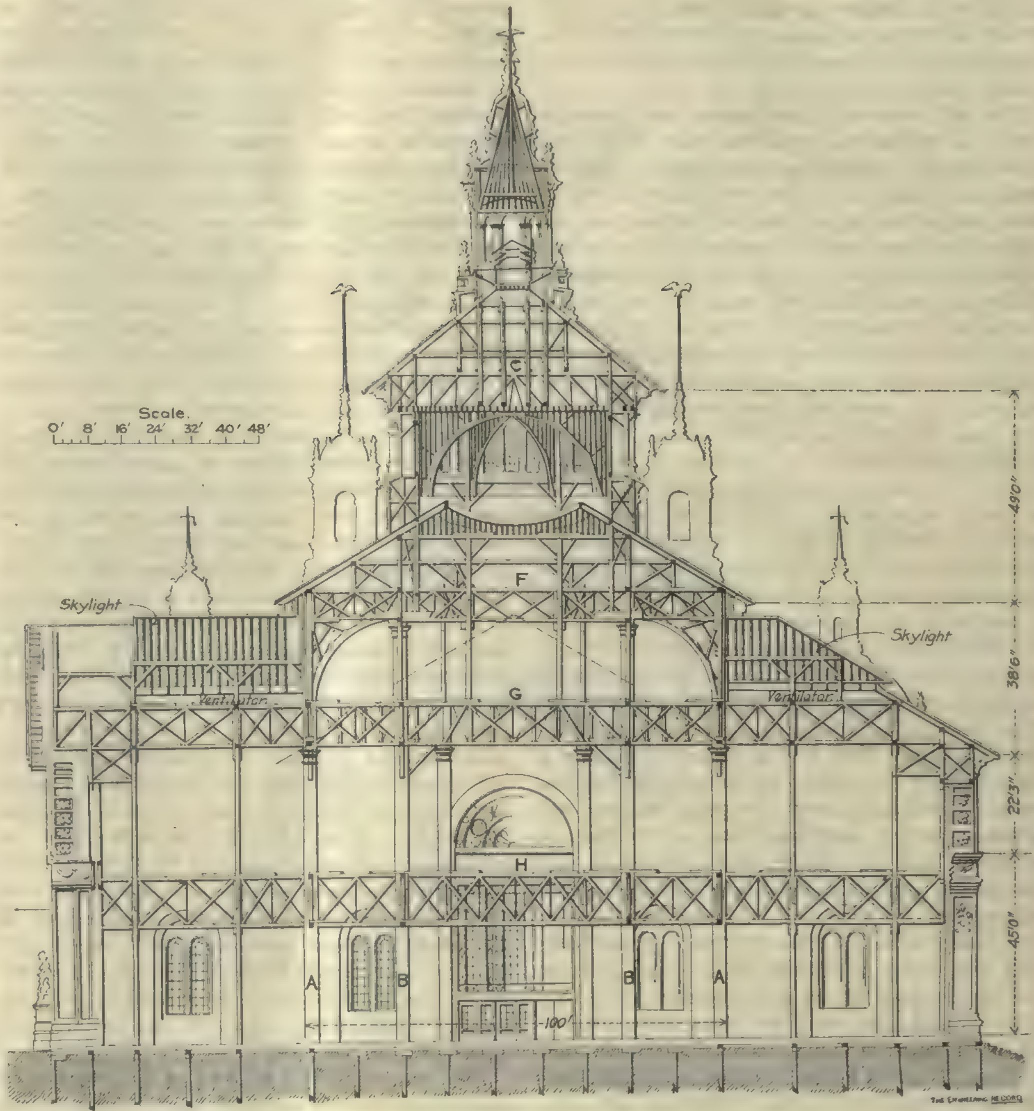


General Dimensions of Dock.

The Horticultural, Forestry and Graphic Arts Buildings of the Pan-American Exposition.

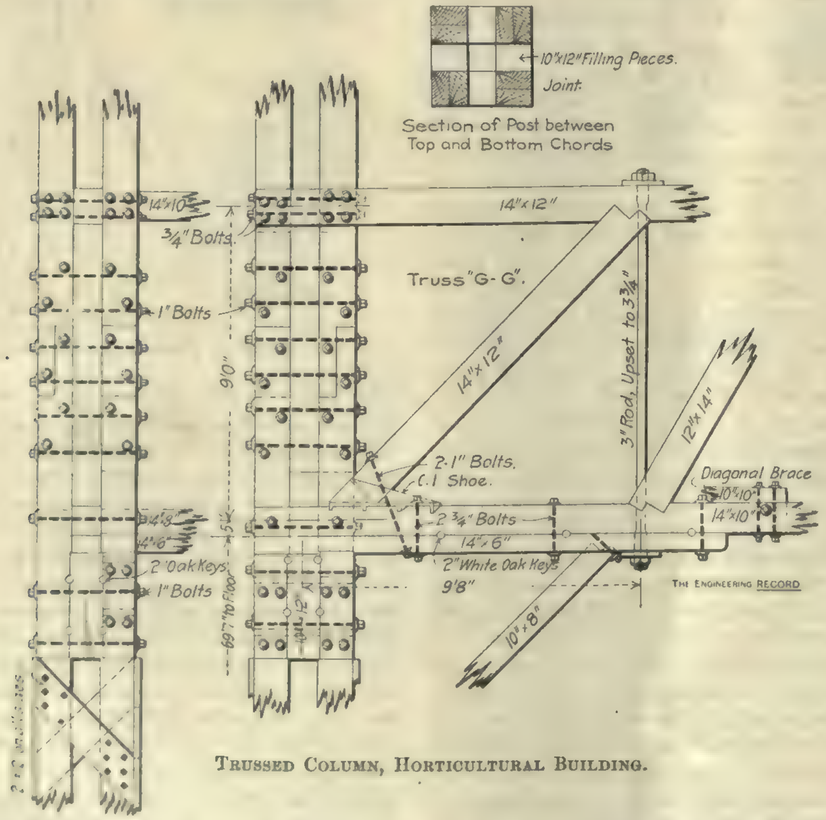
The Horticultural Building stands at the west end of the Esplanade (see large map in The Engineering Record of July 21, 1900), and is about 220 feet square and 67 feet high to the top of the first cornice, 106 feet to the top of the second cornice, 150 feet from the floor to the ceiling of the dome and about 245 feet from grade to the top of the finial above the lantern on the dome. From each side of the east end of the building, two curved wings about 26 feet wide and 30 feet high extend to the Graphic Arts Building and the Forestry Building, twin structures 150 feet square and 48 feet high. There is a fountain in the middle of the semicircular court enclosed by the curved wings and the wings themselves have an ornamental front, decorated with sculpture and mouldings and are used for green houses.

Like most of the other Exposition structures the Horticultural Building is built almost entirely of wood and is elaborately decorated on the exterior with mouldings, relief work and sculpture. Around the outer part of the building there are pitched roofs supported on wall columns and trusses, and extending about 60 feet inward from each of the four outer walls. The central part of the building, 100 feet square, rises above the tops of these roofs and is covered by a pitched roof surmounted by a central tower, dome, and domed lantern. Small pinnacles, spires and domes are arranged on the main roof as indicated by light lines in the sectional elevation, which is taken on the axis of the semicircle about which the three buildings are symmetrical.



Sectional Elevation on Center Line of Horticultural Building.

The foundations of the columns and the supports of the floor-beams are on piles capped at grade and filled around to above the original surface of the ground. The wall columns, about 70 feet high and from 20 to 25 feet apart, are single 12 x 12-inch timbers, lap spliced in the middle and braced together by gallery trusses, H, 12 feet deep, with their bottom chords about 28 feet above the floor. Similar Howe trusses connect the tops of the columns and the twelve main columns, A, which are arranged parallel to the outer walls, on the sides and corners of a 100-foot square in the center of the building. In the center of this square there is another parallel square with 51-foot sides, having main columns, B, on its corners only. These columns are connected together by more 12-foot Howe trusses, G, in the planes of the sides of the squares and at the height of the wall column trusses.

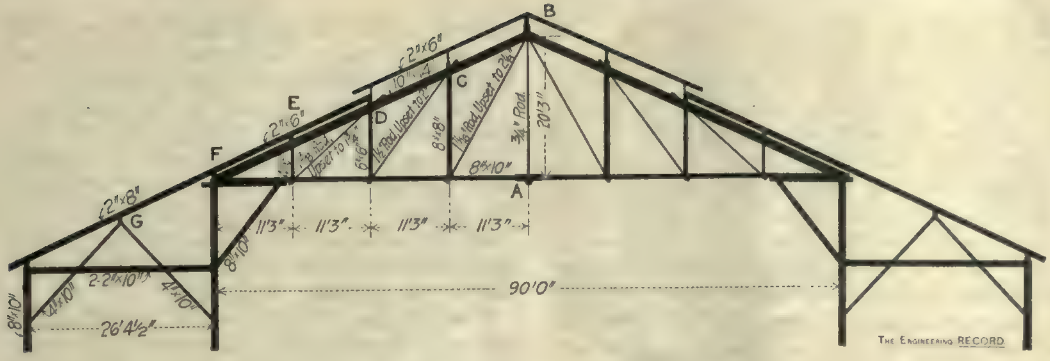


Trussed Column, Horticultural Building.

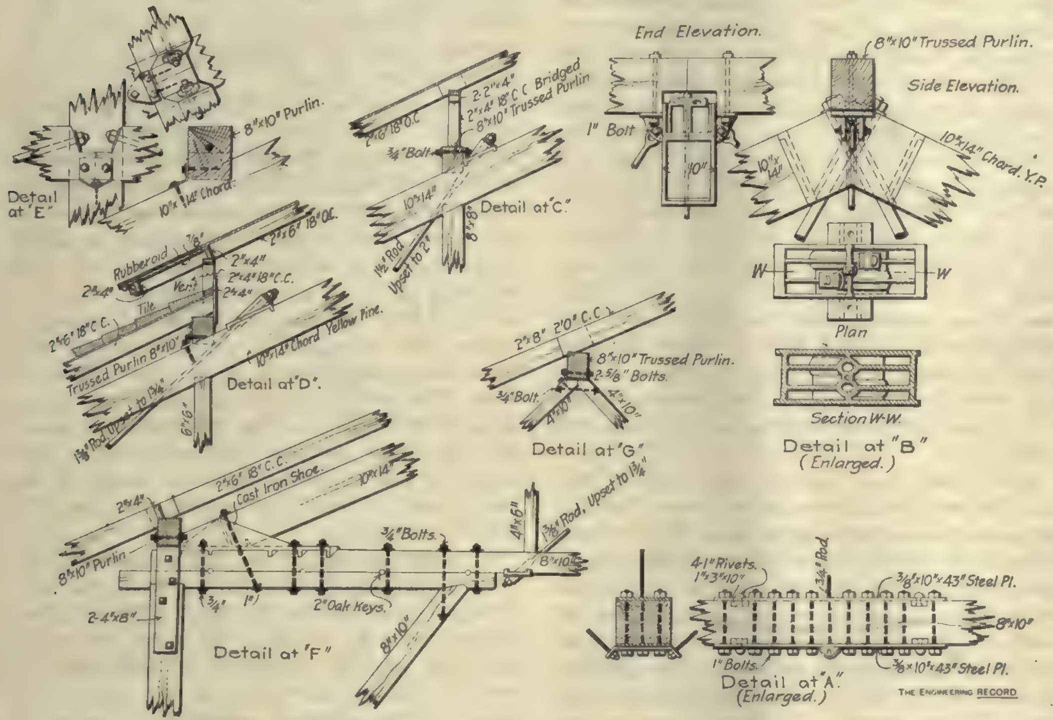
The outer columns extend above the trusses to a height of 108 feet above grade, where they intersect the roof surface. The inner columns terminate at about the same height and are connected with the outer ones by Howe trusses, F, 8 feet deep, with their top chords level with the tops of the columns. Posts and braces on top of these trusses support the pitched roof, about 34 feet wide, on each side of the large square, which overhangs the clere-story wall about 6 feet and terminates at the upper part in the walls of a cylindrical tower, 44 feet in diameter, which are covered by the interior dome.

At the height of the top of the wall trusses, about 80 feet above the floor, the inner sides of the intermediate columns are connected by a cornice molding which forms a 100-foot square from which the coved ceiling springs to a height of 101 feet above the floor. Here it intersects a hollow square, measuring 52 feet on a side, which is formed of a horizontal molding attached to the inner columns, and projects horizontally beyond it toward the center of the building to the intersection with the molding or cornice around the lower edge of the inner wall of the cylindrical tower. Each of the four sides of the coved ceiling is a quadrant of a cylindrical surface of 17¾ feet radius, and is plastered on Byrkitt sheathing attached to double 2 x 12-inch scarf boards braced to the columns and overhead trusses.

The cylindrical tower walls rise to a height of 150 feet above the floor and are covered by a horizontal ceiling supported from the lower chords of the Howe trusses marked C. At the foot of this wall there is a circular inner balcony 4 feet wide, and in the wall are eight arched panels 20 feet high. Just above the tops of these panels there is a heavy cornice molding from which, between the panels, eight solid dome ribs spring to the center of the flat ceil-



Outline of Main Truss of Forestry Building.



Details of Truss Framing in Forestry Building.

ing above. Between each pair of ribs are three glazed windows looking out on the colonnade which surrounds the tower and rests on the pitched roof. In this colonnade there are eight pilasters, and between each pair of pilasters there are two pairs of columns with their tops connected by arches which apparently support the circular tower cornice 155 feet above the floor.

This cornice is about at the center line of the trusses, C, supporting the tower roof, which is the frustum of a cone 70 feet in diameter at the bottom and overhanging the tower about 6 feet. The diameter at the top is 21 feet, and on it is set a circular lantern about 20 feet high having eight exterior ribs or pilasters and sixteen columns, with a window in every panel between columns. Above the windows there is a flat ceiling below the roof trusses which support the hemispherical dome, which has a radius of 13 feet 10 inches. The dome is framed with double scarf boards about 2 feet apart at the bottom, supported on a 6 x 8-inch circular purlin in the middle, and framed at the top to vertical timbers which are seated on the ceiling trusses below and extend up into the upper lantern. The dome is covered with sheathing boards and rubberoid, with staff ribs and ornaments nailed on outside.

The lower sections of the main columns are each made of four 12 x 12-inch timbers set 12 inches apart in the clear on the corners of a square, and latticed from top to bottom on each side with 2-inch planks. They are covered with Byrkitt sheathing and plaster and have chapters at their intersections with the coved ceiling. The eight columns in the walls of the circular tower are 14 x 14-inch timbers enclosed in wide casings furred out to make the exterior pilasters. Where trusses, girders or struts are supported from the sides of the columns, seats for them are provided on the upper ends of short vertical planks bolted to the face of the column and keyed to it with 2-inch oak pins driven into holes which are bored half in the plank and half in the column.

The large Howe trusses are made with corbels and knee-braces under the end panels of the bottom chords; the feet of the inclined end posts are seated in cast-iron shoes which are keyed and bolted to the lower-chord timbers as shown in the details at the end of one of the two trusses, G, which are typical of the truss framing in general. This illustration also shows the standard construction and splicing of a main column, the connection of the truss to the column, and the manner in which most of the truss diagonals are notched into the chord timbers.

In some of the light trusses the bottom chord abuts against the side of the column and is secured by a U-shaped horizontal strap of 2½ x ½-inch iron, with the ends bolted to the chord and the loop engaging the column and tightened by a vertical wedge driven down between it and the backside of the column. Where posts and studs are seated on the top chords of trusses they are generally bolted to the vertical flange of a short angle-clip which is spiked across the chord. Sometimes they are set against a horizontal timber and there are two angle-clips, one outside of each piece, through both of which the same bolt passes. Where angle blocks are used for the web members of the trusses they are made of oak and are similar to those shown in the description of the Agricultural Building and the Music Hall which were published in The Engineering Record of January 12 and February 9, 1900.

The main roof trusses in the Forestry and Graphic Arts Buildings are supported on two longitudinal rows of intermediate columns made of single 10 x 12-inch timbers. They are simple triangular trusses about 91 feet long and 21 feet deep over all, with vertical compression members and single diagonal tension members. The top chords are 10 x 14-inch yellow-pine timbers with cast-iron connection boxes at each end. The bottom chords are single 8 x 10-inch yellow-pine timbers spliced in the middle by two 10 x ⅜-inch steel fish plates with 3 x 1-inch riveted keys and twenty 1⅛-inch bolts. The ends are seated across the tops of the columns and are fastened to them by a pair of side planks bolted to the top of the column and engaging the truss. The diagonal rods are upset at both ends and have nut bearings on the beveled faces of castings gained into the chord timbers.

The 8 x 10-inch purlins, from 28 to 30 feet long, are queen-post trusses with 1-inch upset rods which pass over grooved cast-iron saddles on 4 x 4-inch vertical posts 3 feet long and 10 feet apart, and through oblique holes bored in the ends of the purlins. The purlins are dapped to set horizontally on the inclined top chords, and are bolted to the vertical flanges of short oblique angles bolted to the chords. There are six lines of purlins on each side of the center line of the roof. The lower line is on top of the wall columns and the next line is supported by a pair of inclined braces to the wall and intermediate columns, and is bolted to a bent side plate on top of them, as shown by the detail marked G.

The lower three purlins carry 2 x 8-inch rafters 2 feet apart in the plane of the 2 x 5-inch rafters 18 inches apart, which reach up as high as the middle purlin on the roof trusses. From the middle purlin to the peak of the roof the rafters are parallel to those below, but are elevated on short posts into a plane about 18 inches above them and overlap them so as to form a protected vent opening. The tops of the intermediate columns are braced to the purlins in the same vertical planes by pairs of longitudinal knee-braces on each side, and the lower chords of the main trusses are braced in the middle by diagonal rods to the peaks of the adjacent trusses, making a continuous line of longitudinal sway bracing from end to end of the building. This roof and all of the pitched roofs in the Horticultural Building, are covered with transverse sheathing boards and metallic tiles.

Mr. R. S. Peabody, Boston, Mass., was the architect of this group of buildings, and the construction was detailed and supervised by the staff of the Exposition, Hon. Wm. I. Buchanan, director general, Mr. Newcomb Carlton, director of works; General S. J. Field, chief engineer; Mr. Williams Lansing, supervising architect; Mr. J. H. Murphy, superintendent of building construction, and Mr. Harry Weatherwax, chief draftsman.

Full-Size Arches of the J. W. Rapp iron, brick and concrete flat and segmental types are being tested at the northeast corner of Broadway and 108th Street, New York. The test is under the supervision of the New York Board of Buildings, which has requested the following announcement to be made: "The tests on thin partition blocks and metal and plaster combined partitions, scheduled to be conducted on August 15, will be deferred until August 26. Those concerns that are not ready to test on the latter date will have a further opportunity to test on September 12. The tests of each series will start at 9 A.M."

The Effect of Railway Tunneling on St. Paul's Cathedral, London.

Many statements have been made in recent years concerning the ease with which tunneling can be done in the clay underlying London. A number of articles on the subject, written by engineers, have appeared in this journal. It is with much surprise, therefore, that The Engineering Record learned recently that these tunneling operations have given rise to serious apprehensions concerning the security of St. Paul's Cathedral. The basis and extent of these forebodings are outlined in an official letter on the subject, recently sent to the London "Times" by Mr. Somers Clarke. The great interest in the tunneling and in the Cathedral, one of the best works of its period, warrant the republication here of most of the letter.

Within the first hundred years after the structure of the cathedral was finished the immense weight resting on the foundations of the eight piers which carry the dome and on the foundations of its abutments caused those parts of the structure to sink a little. Most ingeniously spread out as are these foundations, so as to cover the largest possible area, the earth beneath them has consolidated rather more than under those parts of the fabric less heavily loaded. The settlement thus caused has broken the eight arches and the windows of the clerestory over them in the nave, the choir and the north and south transepts, where they abut on the dome piers. In the same way the very great weight of the western towers has caused them to sink. In sinking they have cracked the west front in a vertical direction through the great door, the window above and the vaulted ceiling of the portico. They have also cracked through the wall of the chapel to the east.

Above a hundred years since the development of the before-mentioned settlements gave cause for anxiety a system of great iron ties was introduced into St. Paul's Cathedral. These are placed so as to tie back to the dome piers the fronts of the north and south transepts; to counteract, in fact, the want of continuity caused by the breaking through of the arches and window already referred to.

But another movement was also observed, and ties were introduced to counteract it. The transept fronts were found to be settling away from the main fabric, and also themselves to be settling toward the east and west, this being demonstrated by a crack extending vertically through the windows. The damage in the south transept was greater than in the north, and has since developed. This we can tell by observing the size of the joints between the stones, many of which, after the fashion of the time, were run in with lead, now quite loose and not filling the joints.

Wren was well aware that the substratum on which the cathedral was to rest left much to be desired. The mediæval builders as a rule troubled themselves very little about foundations. Wren took all precautions that were known or practicable in his time.

Examining the site of his new cathedral, he found that, passing through the debris of old London, he came, at a depth of some 15 or 16 feet from the surface, to a layer of clay, or "pot earth," as he terms it. This varied from 6 to 4 feet in thickness. The pot earth rests on a stratum of sand (not at all solid) mixed with gravel stones, the lower part wet. Below this, and some 35 feet to 40 feet from the surface, lies the London clay. Wren thought it out of the question to carry all his foundations down to the London clay. He rejected piles, foreseeing that wells or other things might more or less drain off the water from the clay, and knowing that, unless piles remain always under the same conditions, they must certainly rot. He thought best, by spreading the foundations, to float the cathedral on the bed of "pot earth," and thus he built, never dreaming of the desperate attacks the sandy substratum under the pot earth would have to sustain. Had this substratum been left undisturbed, although there would no doubt have been some movement of the structure on the lines of the chief settlement we now see, there is no reason to apprehend that the movement would have continued.

The very necessary increase of sanitation and of road improvement was probably the first serious attack on the substratum. The ground on which the cathedral stands slopes rapidly toward the south and west. It is fairly level to the east and north. In all directions sewers were made and at various depths. It was proposed in 1832 to bring a sewer at some feet below the surface through the churchyard on the south and east sides of the cathedral. Immediately the danger to the fabric that this would cause was pointed out, the Corporation of London, which has ever shown the greatest consideration for the cathdral, ordered the works to be stopped. The deep drain in these places has never been made. Unfortunately it was carried up Godliman Street almost into the churchyard, and must have done not a little to drain the substratum, especially near the southwest tower. The level of this sewer is considerably below the bottom of the foundation of the cathedral walls.

Some thirty years ago the Metropolitan District Railway was made under Queen Victoria Street, cutting a large gash along the southern slope of the hill on which the cathedral stands. The railway at its nearest point is but 530 feet away; that is, just about the length of the cathedral. The railway is, in fact, a huge trench cutting into the sandy stratum. The disturbance caused by making such a trench was very great. There cannot fail to have been a considerable change in the water-bearing conditions just above the London clay. A cutting once made the water will always follow it. Below the underground railway there has since been pierced the tube for the Waterloo & City Railway.

We find, then, that the southern slope of the hill on which the cathedral stands is fairly riddled with excavations of one sort and another. There are sewers, the underground railway, and a tube at a lower level. The most remote of the railways or tubes is but just 500 feet from the cathedral foundations.

Those who have studied earth movements, the result of deep excavations, know that a great deal of dislocation takes place in a line diagonally right and left of the parts excavated. The fact that the underground railway is 500 feet off does not insure that resultant earth movements do not come much nearer to the cathedral. During the last twenty years fresh indications of settlements have been showing themselves in the walls of the church. The movements are still in progress.

Those most to be observed are on the south side. The worst are in the south transept. The way in which these have moved since the ties of 100 years ago were inserted shows that the settlements are due not to the thrusting of arches in the fabric itself, but to the subsidence of the mass, which at this place consists of a wall from 8 to 10 feet thick, 130 feet long, 130 feet high, and weighs between 12,000 and 13,000 tons.

The arch of the window head is so broken that the great keystone carved with a cherub had dropped more than 2 inches from its place. Before the repairs just completed it was quite loose, and was merely held by the pinch of some stones at the back and by the ironwork of the window. The wall has, in fact, split vertically through the doorway and window over it, sinking gently in two masses right and left.

The coffered window head we see from inside the church is quite out of shape, and the same dislocation in a less degree may be observed over the windows of the clerestory adjoining. The massive iron stanchions intended merely to resist the wind and to give rigidity to the lead glazing are now bent by the weight of the window arches pressing upon them.

If we suppose it possible that the subsoil be left from henceforward untouched, the settlements are of sufficient importance to make it necessary not only to watch them carefully, but to expend considerable sums (out of a very limited income) on their repair. During the last four years the Chapter has had to find the money for such works.

But now comes the attack by the electric railways. One of these—the Victoria, City & Southern Electric Railway—proposes to come under the churchyard, taking a line between the cathedral and the great warehouses on the south. The center line of the tunnel would be about 40 feet from the southwest tower and 50 to 60 feet from the south transept. Another—the Piccadilly & City Railway—proposes to pass under Carter Lane—that is to say, under the first street immediately south of St. Paul's Churchyard. The center line of this tunnel is at a distance of 170 feet both from the southwest tower and the south transept. It would be a little nearer to the cathedral than the width of the west front. It would be but 300 feet from the center of the dome.

We must not forget that the cathedral is already attacked on the north. Here is the tube of the Central London Railway, and this is but 460 feet from the center of the dome. We know that this tunnel, passing as it does close to Bow Church, has already in the few short years since it was pierced, caused the steeple to overhang 1 foot 9 inches toward itself. Bow Church tower is a mere toy compared with the enormous weight of St. Paul's. The area of one of the western towers of St. Paul's is just double the area of Bow Church tower.

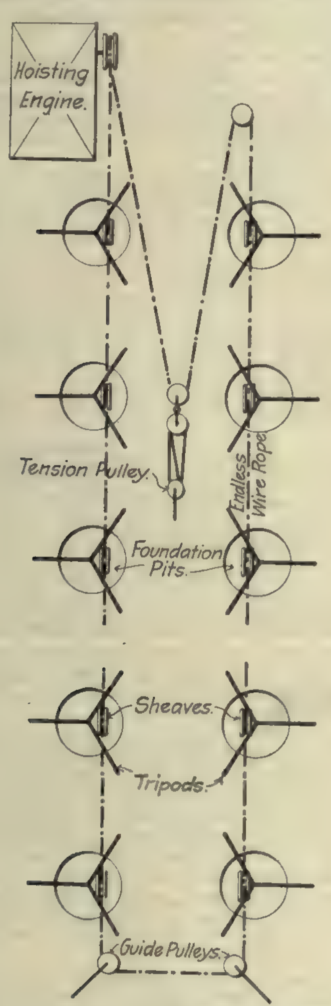
But the chief danger to the cathedral lies by no means only in piercing the tubes or in the vibration from passing trains. The tubes may be sunk ever so far down, the vibration may, and no doubt will be very much reduced, but wherever the tube may be a tremendous hole must be made for the public to get at it. Then when the bottom is reached there are footways, cross passages and all manner of subsidiary excavations. Who knows what underground streams may not be tapped in making these big shafts, or how much superincumbent weight may affect excavations? The Piccadilly & City Railway proposes to place its terminus under the space where Cannon Street is crossed by Queen Victoria Street. The tunnels in which is the terminus must necessarily be of considerable length, and can hardly fail to come within 600 feet of the cathedral.

The great hole and excavations to the east are, however, not more dangerous than would be those to the west on the slope of Ludgate Hill, where a station is projected. There is already, on the north, the Post Office station of the Central London Railway.

Brick Pavements in Grand Rapids, Mich., are now laid on a 1½-inch cushion of fine, soft sand instead of 1 inch of coarse sand, as formerly. City Engineer L. W. Anderson reports that the use of coal-tar pitch filler has been abandoned, except for expansion joints, and Portland cement grout is used instead. Its effect in protecting the edges of the brick from chipping was soon apparent.

A Novel Hoisting Plant.

A rope drive working a series of excavating buckets in foundation pits has been successfully used in preparing foundations for the new Marshall Field Building in Chicago. The old building was torn down to the street level, the first floor being left temporarily for a working platform, below which rows of pits are being sunk through a stiff clay for the concrete piers of the new interior steel columns. There are eight pits, about 20 feet apart in rows separated by distances of 20 feet; the pits are being carried down nearly 100 feet to solid rock. The pits are lined with wooden staves 6 feet in length placed in position, after which interior steel hoops 7 feet in diameter are put in place, this being accomplished as workmen excavate the pit with picks and shovels. A hole is cut in the working platform over each pit and over the hole is a small timber tripod with a horizontal framework connecting two legs, arranged to support a short horizontal shaft. On the outer end of this is a grooved wheel or sheave about 3 feet in diameter. On the inner end of the shaft, inside the legs of the tripod, is a capstan head. The sheaves in each of the tripods in each row are lined up so as to be in the same vertical plane and around each is taken one or two turns of an endless wire rope operated continuously by a hoisting engine placed upon the working platform. By means of guide pulleys beyond the tripod most distant from the hoisting engine, the rope is carried across to the adjacent row of tripods over similar pits, then toward the hoisting engine, operating all of the tripod pulleys in the second row. Pulleys fastened to small uprights on the floor serve to carry the rope. The tension pulley is operated by a horizontal hoisting tackle and serves to keep the proper tension upon the rope drive. From the top of each of the shaft tripods, a hoisting tackle is suspended, and when the bucket of spoil is ready to be hoisted it is fastened by a hook to the rope, the other end of which is carried over the pulley at the top of the tripod, and an attendant, upon the working floor level, takes two or three turns of the fall line around the capstan head and, tailing off the slack, hoists the bucket. Twelve or fourteen pits are thus served simultaneously and continuously by one hoisting engine. Messrs. D. H. Burnham & Co. are the architects, and the T. Nicholson & Sons Company of Chicago are the contractors for the foundations and arranged the plant described.



The Engineering Record

Personal and Obituary Notes.

Mr. C. S. Rigby, city engineer of Benton Harbor, has resigned.

Mr. W. P. Read has been elected general superintendent of the Consolidated Railway & Power Co., Salt Lake City.

Adolf Bleichert, of Leipzig, Germany, inventor of the Bleichert wire-rope tramway, died on July 29 at the age of 56 years.

Mr. F. J. Stout, general manager of the Toledo, Fremont & Norwalk electric line, has been appointed general superintendent of the Everett-Moore electric system between Cleveland and Toledo.

Mr. John Y. Brooks, general superintendent of the Joliet wire mills, has been appointed general manager of the Colorado Fuel & Iron Co., Pueblo, Colo., which has voted to spend large sums for improvements and extensions of its works.

Messrs. Erskine Ramsey and Charles Bowron, chief engineer and assistant chief engineer, respectively, of the Tennessee Coal, Iron & Railroad Co., have resigned. Mr. Charles McCreery, the new general manager, has assumed charge of the Birmingham offices.

Mr. E. A. Benson, of the Pullman Car Company's plant at East Buffalo, N. Y., will assume the duties of mechanical superintendent of the company on September 1. His headquarters will be at Chicago, and he will have charge of the works at East Buffalo, Pullman, Wilmington, Denver, St. Louis and Louisville.

Mr. Byron I. Cook, for 12 years superintendent of the water-works of Woonsocket, R. I., has resigned that office to become inspector for one of the factory insurance corporations. Mr. Cook has conducted his department with much success, and in recognition of this fact, he was elected president of the New England Water-Works Association a few years ago.

Mr. Thos. J. Foster, Assoc. M. Am. Soc. C. E., who has taken charge of the structural department of the National Bridge Co., New York, was formerly head of the firm of Foster & Green, architectural engineers in New York, which designed the steelwork of a number of important buildings in that city. The company proposes to build a complete structural steel plant in New York to care for its local work.

Capt. W. O. Douglas, who died at Binghamton, N. Y., on August 16, was the patentee of the Douglas parabolic elliptical truss bridge. On January 18, 1878, he sold the New England rights for the manufacture and sale of this particular style of bridge to the Corrugated Metal Co., of East Berlin, Conn., taking the position of treasurer and manager of the company. Shortly afterward the name was changed to the Berlin Iron Bridge Co. Mr. Douglas was very active in the affairs of this company, and particularly in pushing the sale of this elliptical truss bridge, which found favor with the town officials and corporate interests throughout New England, so that when a customer had purchased one bridge he was fairly sure to desire another of the same style at some other site. The fact that the bridges built so long ago are still standing and giving good service to the communities where they are erected, is the best recommendation that could be given to them. For many years Captain Douglas gave his time, attention and energy to the company, which greatly prospered during his connection with it.

The Central States Water-Works Association will hold its next convention on October 1-3 at Evansville, Ind. Mr. Wm. Allen Veach, Newark, Ohio, is secretary of the Association.

Bench Marks on Trees change very slightly, according to some notes by Mr. Geo. W. Cooley in the "Annual" of the Minnesota Surveyors' and Engineers' Society. His experiments have lasted many years and were made with benches established in the usual way on linden, hickory, maple and elm trees. The changes are not cumulative. The greatest in 16 years was about 0.02 foot, while an equal or perhaps greater variation occurs frequently in one year.

The American Public Health Association will hold its twenty-ninth annual convention in Buffalo on September 16-20. The headquarters will be at the Niagara Hotel and the meetings at the Seventy-fourth Regiment armory, one block away. Among the topics for general discussion are the pollution of public water supplies and the disposal of refuse material, and the section on bacteriology and chemistry will consider, among other subjects, standard methods of water analysis.

Compressed Air to Prevent Fires from sparking motors is the feature of the combined pneumatic-electric system designed by Hurd for fiery mines. Mr. Ernest K. Scott, in a recent paper presented to the Institution of Civil Engineers on coal-cutting by machinery, refers to it substantially as follows: The electric cables to the cutting machine are carried in 1½-inch iron pipes and a small supply of compressed air at a pressure of about 1 pound per square inch is sent along these pipes and allowed to escape into the working parts of the motor. The armature runs in a current of cool air, which tends to increase its current-carrying capacity, and at the same time prevent any explosive gases from reaching the working parts.

A 36-Inch Ball-and-Socket Joint on a submerged main across the Hackensack River, forming part of the water-works of Jersey City, was pulled open some weeks ago, probably by the anchor of a vessel, and its repair was a tedious job. A heavy anchor was first fixed about 200 feet to one side of the joint and connected by a tackle with the pipe; the end of the rope was carried to a hoisting engine on a scow and by this means the two ends of the main were gradually pulled back approximately into place. The work was done very carefully in order to avoid starting other joints, and as the divers were unable to see on account of the muddy condition of the water, each stage of the operations was necessarily slow. When the ends of the joint were again in place, a heavy cast-iron sleeve, cast in upper and lower halves with flange connections, was bolted over the joint and well calked to the two pipes. As the calking progressed, the pipe was pulled little by little back into place, and when the work was finished it was found to be perfectly tight under a pressure of 55 pounds. Rings of strap iron were then placed about the ends of the sleeve to keep the lead in place, and connected by iron tie rods. When the work was completed it was at once put in service under 75 pounds pressure, which has been steadily maintained up to the present time without signs of leakage. The work was done under the direction of City Engineer C. A. Van Keuren by the Merritt & Chapman Company, New York.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Ryebeach, N. H.—J. W. Kelley, Attorney North Shore Water Co., writes that it is proposed to construct water-works, to cost about $30,000. J. A. Farrington, Engr., Portsmouth, N. H.

Walnut Ridge, Ark.—J. C. Dowell writes that an ordinance is being prepared providing for the construction of water-works and an electric light plant for the town.

Elcampo, Tex.—See "Power Plants, Gas and Electricity."

West Liberty, Ia.—The town is considering the erection of a new water tower. W. M. McFadden, Mayor.

Philadelphia, Pa.—Water bonds amounting to $9,000,000 have been sold. They will be used as needed for the extension of the filtration system and the general improvement of the city water supply.

Pacific, Mo.—A. R. Leber, City Clk., writes that a committee composed of the Town Board and citizens are investigating the probable construction of water-works.

Neligh, Neb.—Press reports state that a bond issue of $3,000 has been voted for extending and improving the water-works.

Carthage, Mo.—The Council has decided to own and operate its own water-works after Feb. 4, 1902.

Mt. Olive, Ill.—Theo. H. Koch writes that the question of water-works is being considered, but nothing definite has been done.

Glenwood, Wis.—The water-works and electric light plant are reported to have been destroyed by fire Aug. 16.

Park River, N. D.—Press reports state that contracts for water-works and an electric light plant, bids for which were opened Aug. 12, are stated to have been awarded to the Allen Black Co., St. Paul, Edmund T. Sykes, Minneapolis, and to the Electric Machinery Co., of Minneapolis. Total amount of contract, $21,000.

Caldwell, N. J.—The Council is stated to have appointed a committee, with Councilman Worthington as chairman, to have charge of the construction of the proposed water-works.

Hendricks, Minn.—Bids are wanted Sept. 3 for constructing water-works, including about 75 tons of cast-iron pipe, specials and hydrants, a gasoline engine, pump, well, a steel tower and tank. J. J. Flather, Engr., Minneapolis.

Muskogee, Ind. Ter.—The Council has cancelled the order for competitive plans for water-works, which were to have been received on Sept. 10.

Trinidad, Colo.—A press report states that about $70,000 will be expended on water-works improvements.

Fresno, Cal.—The Public Utilities Committee of the Board of City Trustees, Mr. Cowan, chairman, together with City Engineer Teilman, is at work on the proposition of acquiring city water and electric light works.

Swea City, Ia.—G. H. Rosenberg, Recorder, writes that it was voted Aug. 9 to issue $3,500 bonds for water-works.

Grand Meadow, Minn.—The citizens are reported to have voted on Aug. 12 to construct water-works.

Coffeyville, Kan.—E. H. Ricksecker, City Engr., writes that the city will lay by day work 2½ miles of 10-in. and 2 miles of 4 and 6-in. pipe.

Plymouth, O.—John I. Beelman, City Clk., writes that it was voted Aug. 14 to issue $20,000 bonds for water-works.

Sault Ste. Marie, Mich.—Water bonds amounting to $120,000 were sold by Council on Aug. 12.

Wharton, Tex.—Wm. Payson is reported interested in the construction of water-works, an electric light plant and an ice plant.

Appleton, Wis.—The Water Works Construction Committee is reported to have adopted the plans of Sturtevant & Todd, of Chicago, Ill., for water-works. The plans call for 28 miles of mains and 300 hydrants.

Windfall, Ind.—The Town Trustees are reported to have adopted plans for water-works and an electric light plant.

Wills Point, Tex.—John W. Maxcy, of Houston, is stated to have secured the contract for constructing water-works for about $35,000.

Sloan, Ia.—The Council is reported to be considering the construction of water-works.

Newark, N. J.—Stewart & Abbott, Times Bldg., New York, N. Y., have received the contract for constructing the reservoir at Cedar Grove, for $581,217; detail bids for which were printed in issue of Engineering Record, Aug. 17.

Glens Falls, N. Y.—Daniel V. Brown, 2d, of Glens Falls, is stated to have secured the contract for raising the Keenan storage dam 4 ft., for $5,827.

Collingwood, Ont.—The citizens are stated to have voted Aug. 16 to issue $15,000 bonds for improving and extending water and lighting systems.

Orange, N. J.—Water bonds amounting to $90,000 have been sold.

Mackinaw, Ill.—Jacob A. Harmon, of Peoria, is stated to have secured the contract for constructing water-works, for $4,494.

Saranac Lake, N. Y.—Water-works improvement bonds amounting to $50,000 have been sold.

Sioux Falls, S. D.—Loweth & Wolff, of St. Paul, Minn., have been employed by the city to prepare plans for water-works. B. B. Howe, City Engr.

Ogden, Utah.—The Utica Light & Power Co., together with farmers in the north of the county, are considering the building of a dam and reservoir in Ogden Canyon.

St. Louis, Que.—It is stated that the Council will receive bids Aug. 27 for extending the water supply to the north side, according to plans prepared by Emile Vanier, Town Engr.; estimated cost, $60,000.

Charles City, Ia.—The Water Supply Committee will, it is said, recommend an artesian well supply and procure a site for a pumping station.

Laurel, Md.—John Fox & Co., of N. Y. City, have received the contract for furnishing 120 tons of C. I. pipe and 2,500 lbs. special castings, etc., for the delivery main for the water-works for which Hill, Quick & Allen, of Baltimore, are engrs.

Grand Rapids, Mich.—The Mayor, Mr. Keegan and Pres. Ball, of the Bd. of Pub. Wks., have been appointed a committee to secure the services of hydraulic engineers in connection with the water-supply question.

Columbus, O.—Local press reports state that the 30-ft. dam in the Scioto River will soon be built, and that $76,000 are now available for that purpose. Mayor Hinkle is endeavoring to provide for laying a 24-in. water main in Long St. connecting the east and west side pumping stations.

Coudersport, Pa.—Reports state that it was voted Aug. 17 to buy or build a municipal water supply plant.

Canonsburg, Pa.—It is stated that the Peoples Water Co. will construct a dam on Chartiers Creek and build a reservoir on one of the North Strabane's hills.

Garden City, Kan.—The Finney County Farmers' Irrigation Association has been incorporated and it is stated will invest $40,000 in ditching the county with a water supply from the Arkansas River. Jas. Craig, Pres.

Puyallup, Wash.—The Puyallup Water-Works Co. is reported incorporated with a capital stock of $75,000 to furnish water, heating and illuminating gas, and electric and other forms of light; C. B. Hurley, F. C. Brewer and T. L. Stiles, of Tacoma, are stated to be Trustees.

Plymouth, Mich.—Field & Hinchman, Engrs., Detroit, write that bids will be received at their office until Sept. 2 for furnishing and laying 4,500 ft. of 12-in. iron pipe in Plymouth.

Garretson, S. D.—Bids are wanted Sept. 11 for a compressed air water-works system, requiring a power station; 2 steel pneumatic compression tanks, 2 ft. diameter; 14-H.-P. gasoline engine; 150-gal. power pump; 2,797 ft. of 4, 6 and 8-in. cast-iron pipe; 7 hydrants, etc., G. H. Vandewater, City Aud.

Phoenix, Ala.—The contract for constructing water-works at Phoenix has been awarded to J. P. Miller & Co., of Chicago, Ill., for $22,524. Albert & Byrne, Birmingham, Ala., Consulting Engrs.

Marshall, Mo.—A. R. James, City Clk., writes that the city is considering the construction of water-works and an electric light plant combined, to cost from $60,000 to $75,000. Hiram Phillips, of St. Louis, is the Engineer.

Lake Charles, La.—The Lake Charles Ice, Light & Water-Works Co. is stated to have submitted a proposition to sell its electric light and water-works plant to the city for $140,000.

Endicott, N. Y.—Bids will be received by Endicott & Johnson, of Endicott, on Sept. 3, for constructing a fire service reservoir, as advertised in The Engineering Record.

Bradford, O.—O. B. Altvater, Corporation Clk., writes that it was voted Aug. 19 to issue $10,000 water bonds.

Ogden, Ia.—Press reports state that the water system is to be extended.

Pocahontas, Ia.—G. H. Heald, Town Clk., writes that it was voted Aug. 19 to issue bonds for water-works.

Geneva, O.—Bids are wanted Sept. 4 for a water-works pumping station and gravity filter plant, as advertised in The Engineering Record.

Richmond, Va.—The Finance Committee is stated to have passed a recommendation endorsed by the Water Comm. for installing 150 fire hydrants.

Longmont, Colo.—Bids are wanted Sept. 20 for furnishing material and constructing a cast-iron pipe line, approximately 46,000 ft. in length, and including valves, specials, etc., for a masonry infiltration gallery; also for furnishing material (excepting such material as said city now has) and constructing a street pipe system, consisting of 60,000 ft. of cast-iron pipe, together with valves, hydrants, specials, etc. Geo. H. Stonex, City Clk.

Barberton, O.—O. C. Barber is said to have made a proposition to build a new water pumping station to obtain water from drilled wells.

Canajoharie, N. Y.—The question of water-works is being considered and J. M. Johnson, Millersburg, Pa. is said to have been consulted.

Rosebud, Tex.—According to press reports the Cameron, Tex., Water-Works Co. has purchased the water-works, will improve them and erect an electric light plant.

Chicago, Ill.—Negotiations are reported in progress toward the purchase of a site near 103d and State Sts., at which $100,000 will be spent in a pumping station and $100,000 in improvements, besides a tunnel to the 68th St. crib at an estimated cost of $1,200,000.

Salt Lake City, Utah.—City Engr. L. C. Kelsey writes that the following bids were opened Aug. 12 for constructing the City Creek Pipe Line:

Items and Quantities.	P. J. Moran.*	Keifer & Rush.	N. P. Glann Con. Co.
Excavating, 9,500 cu. yds.	$.40	$.45	$.56
Backfilling, 6,500 cu. yds.	.15	.15	.10
Furnish and lay C. I. pipe:			
24-in., 5,920 lin. ft.	5.60	5.86	5.69
20-in., 845 lin. ft.	4.50	4.675	4.65
16-in., 790 lin. ft.	3.30	3.305	3.35
Valves:			
24-in., 2	300.00	318.00	300.00
20-in., 1	168.00	200.00	200.00
16-in., 2	87.00	107.00	100.00
Special castings, 6,000 lbs.	.04	.04	.04
Brick masonry, 30 cu. yds.	10.00	9.43	11.00
Concrete masonry, 30 cu. yds.	8.50	9.07	10.00
Cut stone masonry, 30 cu. yds.	25.00	24.75	20.00
Cement plaster, 500 sq. yds.	.33	.45	.50
Totals	$46,989	$49,315	$48,951

*Awarded contract.

SEWERAGE AND SEWAGE DISPOSAL.

Portland, Me.—Bids are wanted Sept. 3 for constructing about 1,120 ft. of 45, 48 and 51-in. brick sewer in India and Fore Sts., as advertised in The Engineering Record.

Cincinnati, O.—Bids are wanted Sept. 10 for sewers and drains in portions of several avenues. Geo. F. Holmes, Clk. Bd. Pub. Service.

Toledo, O.—Bids are wanted Sept. 10 for a circular pipe sewer, 8-in. and 12-in. inside diameter, in Wilson St.; also for a circular pipe sewer, 8-in. and 18-in. inside diameter, in portions of 4 streets. John E. Connell, City Clk.

Portland, Ore.—Local press reports state that City Engineer Chase is preparing plans for an extensive sewer system for the southeastern part of the East Side.

Manchester, Conn.—It is stated that a sewerage system is now being considered.

Swedesboro, N. J.—The Committee on Sewerage System, of which Chas. D. Lippincott is a member, has reported a large proportion of the stock for the purpose subscribed.

Ridgefield, Conn.—The plans of T. H. McKenzie, Engr. of the State Bd. of Health, Hartford, Conn., for a sewerage system, are reported accepted, and a committee composed of R. R. Commr. Wm. O. Seymour, Samuel Keeler and D. Smith Sholes, appointed to make the general layout.

Cincinnati, O.—The Board Public Service is stated to have approved the resolution providing for a complete sewerage system on Price Hill.

Brooklyn, N. Y.—The Borough Construction Co., 189 Montague St., has been awarded the contract for the Tenth Ave. sewer, being the lowest bidder, in total amount, $773,228, according to bids opened June 5 and printed in detail in the issue of June 8.

Bloomington, Ill.—Bids are wanted by the Board of Local Improvements until Aug. 29 for 2,920 ft. of 12, 15, 18 and 20-in. pipe sewers. Elmer Folsom, City Engr.

Circleville, O.—The United States Construction Co., Wm. Quinn, Mgr., Columbus, is said to have offered to construct a sewer system, receiving rental from the city, and providing for the sale of same to the city at the end of 10 years.

Dayton, O.—Bids are wanted Aug. 27 for 700 lin. ft. of 48-in. brick sewer. C. Frank Kuhns, Pres. Bd. City Affairs.

Philadelphia, Pa.—Bids are wanted Aug. 27 for branch sewers; $25,000 is available for this work. Wm. C. Haddock, Dir. Dept. Pub. Wks., Bureau of Surveys.

Paris, Ky.—Bids are wanted Sept. 2 for constructing about 3 miles of sewers. D. C. Parrish, Chmn. Sewer Com., Benj. Thompson, Engr., Chattanooga, Tenn.

Macomb, Ill.—Bids will be received by the Board of Trustees of the Western Illinois State Normal School at Springfield until Aug. 27 for sewerage, power plant, plumbing and gas fitting in a school at Macomb. Robt. Bruce Watson, State Superv. Archt., 1802 Fisher Bldg., Chicago.

Urbana, Ill.—Bids are wanted Aug. 31 for about 806 rods of 14 to 30-in. tile drain in Union Dist. No. 1, towns of Somer and Stanton. G. E. Corson, Commr.

Delray, Mich.—Bids are wanted Aug. 27 for constructing a brick main sewer. Theo. F. Zech, Village Clk.; W. H. Ashwell, Engr., 25 Whitney Opera House Blk., Detroit.

Canyon City, Colo.—L. C. Hall, City Engr., writes that bids will be opened about Oct. 1 for about 12 miles of 8 to 24-in. sewers, to cost about $50,000.

Joplin, Mo.—The Joplin Construction Co. is stated to have secured the contract to construct the E. Joplin St. sewer, 4,225 ft. long, for about $6,000.

Shawano, Wis.—The Council is reported to be considering the question of constructing a sewerage system.

Milton, Pa.—The Council is stated to have been petitioned to extend the sewerage system on Arch and Walnut Sts.

Shreveport, La.—Guild & Co., Chattanooga, Tenn., are reported to have submitted the lowest bid, amount $97,200, for the Allendale and Parkview suburban sewers.

Washington, Pa.—The question of constructing a sewerage system is reported under consideration. J. F. Curran is on the committee.

Camden, N. J.—The Council is stated to have authorized the issue of $50,000 bonds for sewer extensions.

Endicott, N. Y.—Gaylord & Eitapenc are stated to have secured the contract for constructing 1½ miles of sewers at this place.

Mt. Carmel, Pa.—The citizens are stated to have voted to issue $65,000 bonds for a sewerage system.

Woonsocket, R. I.—The contract for laying surface-water drains on Snow St. is stated to have been awarded to Wm. Condry & Sons, of Providence, for $4,140.

Cranford, N. J.—Bids are wanted Aug. 27 for a sewer in Burnside Ave. Geo. S. Everett, Township Clk.

Paw Paw, Mich.—It is stated that bids are wanted Sept. 2 for constructing 13,677 ft. of sewers. L. C. Colburn, Engr., Paw Paw.

Otto, Pa.—Bids are wanted Sept. 7 for a sewer in Monongahela Ave. P. S. McMullen, Boro. Engr., Glassport, Pa.

Glenville, O.—It is stated that bids are wanted Sept. 6 for storm sewers. I. C. Farley, Clk.

Nashville, Tenn.—See "Paving and Roadmaking."

Bay City, Mich.—Bids will be received by Lawrence McHugh, Co. Drain Commr., until Aug. 30 for constructing Smith Creek drain; total length, 17,240 ft.; width of bottom, 8 ft.; average depth of cut, 234 ft.; width of top, 13 ft.

St. Paul, Minn.—Bids are wanted Aug. 29 for sewers in portions of Fairview and Goodrich Aves. C. H. Bronson, Clk. Bd. Pub. Wks.

Vacaville, Cal.—The Trustees are stated to have passed a resolution providing for the construction of a sewerage system, to cost $30,000.

Rochester, Ind.—Edw. E. Murphy, City Clk., writes that plans have been completed for a sewerage system.

Pomona, Cal.—The Council is stated to have passed a resolution providing for the construction of sewers, to cost $50,000. W. H. Sanders, City Engr.

Plainfield, N. J.—Bids are wanted Sept. 9 for 478 ft. 15-in., 1,630 ft. 18-in. and 1,910 ft. 24-in. sewer, 8 manholes, 7 catchbasins, etc. A. J. Gavett, Engr., in charge, 109 Park Ave., Plainfield.

New Castle, Pa.—Irwin Bros., of Greenville, O., are stated to have secured the contract for constructing sewers for about $59,000.

South Fork, Pa.—Bids are wanted Aug. 30 for $6,000 sewer and street improvement bonds. Thos. H. Wicks, Boro. Treas.

New York, N. Y.—Bids are wanted Sept. 4 for sewers in a portion of 12th Ave., Boro. of Manhattan, and several streets in the Boroughs of Bronx and Brooklyn. Matthew F. Donohue, Deputy & Acting Commr. of Sewers.

South Portland, Me.—Two bids are reported received for constructing the Summer St. sewer, as follows: Worster & Wilson, $13,746 for entire sewer; $5,975 for portion to Hoyt St.; R. D. Shannahan, $12,997 for entire sewer; $6,000 for portion to Hoyt St.

Milwaukee, Wis.—The Bd. of Pub. Wks. has awarded Richard Forrestal, 235 15th St., the contract for building the third section of the Kinnickinnic River flushing tunnel, reported at $39.40 per ft.; there are about 1,500 ft. to build.

East St. Louis, Ill.—The City Council is reported considering plans of Mayor M. M. Stephens for draining the city by a sewer parallel with the Mississippi River, into which it is to empty 3 miles below town.

Milwaukee, Wis.—From bonds recently sold, there are now $50,000 available for west side sewer improvements.

Newberry S. C.—W. S. Langford, City Clk., writes that it was voted Aug. 20 to issue $25,000 sewer bonds.

Atlantic City, N. J.—Bids are wanted Aug. 26 for constructing storm water sewers. Approximate quantities: 3,200 lin. ft. wood sewer, 5 ft. x 8 ft., 17 cast iron manhole frames, etc. John W. Hackney, City Surveyor.

Erie, Pa.—The Select Council has adopted the recommendations of the Mill Creek Commission and directed the preparation of an ordinance abolishing the nuisance. In brief, the report states that F. W. Farquhar, of N. Y. City, Geo. S. Pierson, of Kalamazoo, Mich., and Chas. Carroll Brown, of Indianapolis, all agree that sewer or sewers should be built on one or both sides of the creek and that a sewage disposal plant, consisting of septic tanks and filter beds, should be constructed near the mouth, it recommends the erection of a small plant, not to exceed $20,000 in cost, largely for experimental investigations for this purpose, recommends the construction of a brick sewer at a cost of about $17,000 and estimates the cost of the completed sewage disposal works at $170,000.

Melrose, Mass.—The following bids were opened Aug. 21 for constructing sewers: H. A. Hanscom Co., 53 State St., Boston, $16,489; C. E. Trumbull & Co., Tremont Bldg., Boston, $12,667; Seymour & Newell, Springfield, Mass., $12,014; Fred E. Ellis, Melrose, Mass., $11,776. The detail bid of F. E. Ellis on principal items is as follows: 7,582 cu. yds. earth excavation, 0 to 8 ft., at 88 cts. per cu. yd.; 1,117 cu. yds. earth excavation, 8 to 12 ft., at 98 cts.; 303 cu. yds. earth excavation, 12 to 16 ft., at $1.08; 50 cu. yds. rock excavation, 8 to 12 ft., at $5.50 per cu. yd.; 94 cu. yds. brick masonry, at $5 per cu. yd.; 7,700 lin. ft. piles at 15 cts.; 3,820 lin. ft. 10-in. pipe at 7 cts.; 4,345 lin. ft. underdrains at 15 cts.

Springfield, Mass.—City Engr. Chas. M. Slocum writes that the following bids were received for the Mill and Hickory St. brick sewer, 2 ft. 2 in. x 3 ft. 3 in. and 845 ft. long: Michael Curtis, $10,153.50; D. J. Curtis & Son, $9,990.50; Seymour & Newell, awarded contract, $8,702; and Maloney & Peterson, $9,630.50; all bidders of Springfield. The successful bid in detail was as follows: Earth excavation, 2,550 cu. yds. at $1.50; rock excavation, 1,570 cu. yds. at $1.50; brick masonry in Portland cement mortar, 27.5 cu. yds. at $12.50; in Rosendale cement mortar, 193 cu. yds. at $10.25, and 8-in. underdrain, 500 lin. ft. at 40 cts.

Birmingham, Ala.—Julian Kendrick, City Engr., writes that Dunn & Lallade Bros. were on Aug. 7 awarded the contract for building storm sewers; amount, $26,453. The work comprises 200, 2,000 and 1,500 lin. ft. of 12, 15 and 18-in. pipe sewer, respectively, from 0 to 6 ft. deep, for which they bid 50, 65 and 85 cts. per lin. ft., respectively, 1,500, 500, 700, 1,000, 800 and 600 lin. ft. of 3-ft., 3-ft. 3-in., 4-ft., 4-ft. 6-in., 4 ft. 9-in., and 5-ft. 6-in. brick sewer, respectively (with vitrified brick inverts and all two-ring arches, except the smallest, which is one-ring) for which the bids were $1.60, $2.75, $3, $3.50, $4 and $4.50 per lin. ft., respectively; 30 catch basins at $30, 40 inlets at $14, 15 manholes at $27.50, 1,000 cu. yds. solid rock excavation at $1.48, 10,000 cu. yds. earth excavation at 40 cts., 10,000 bricks laid at $15 per M., and 500 lin. ft. relining invert of 4-ft. sewer at $2 per lin. ft.

BRIDGES.

Ft. Gibson, Ind. Ter.—The Muskogee & Western R. R. Co., which is to build from Fort Gibson, I. T., to Shawnee, Okl., via Muskogee, has been granted permission to construct a bridge across the Arkansas River at Ft. Gibson, without a draw, provided that a draw will be put in when needed for navigation.

Eaton, Ind.—The Indiana Bridge Co., Muncie, Ind., is reported to have secured the contract for constructing a bridge at Eaton, for $5,465.

St. Louis, Mo.—The House of Delegates has passed a bill providing for the construction of Chouteau Ave. viaduct at a cost of $25,000.

Vernon, N. Y.—The State Board of Railroad Commissioners has decided to replace the overhead bridge on the Seneca turnpike over the West Shore tracks in Vernon with a steel structure 24 ft. wide, with no sidewalk. The approaches to be 25 ft. wide.

Ottawa, Ont.—The Department of Public Works is contemplating the construction of bridges over the Petewawa River, 14 miles above Pembroke, and across the Madawaska River at Wingle, at a cost of $4,000 and $6,500, respectively.

Portland, Ore.—Lind & Manning are reported to have received the contract for repairing the Vancouver trestle, at $8,360.

Ottawa, Ill.—It is stated that the Ottawa Railway, Light & Power Co. has submitted plans to the Council for the steel bridge to be constructed across the Fox River. L. W. Hees, Mgr.

Washington, D. C.—District Bridge Engineer W. J. Douglas, in his annual report to the Commissioners, makes the following recommendations for the fiscal year ending 1903: For ordinary care of bridges, $4,000; construction and repair of bridges, $25,000; Anacostia bridge (for necessary borings, surveys, estimate and plans), $3,000; reconstructing K St. bridge across Rock Creek, $20,000; for continuing construction on Connecticut Ave. bridge across Rock Creek, $200,000.

Norwalk, Conn.—At a special town meeting, held Aug. 9, a vote was taken in favor of constructing a stone arch bridge to replace present Broad River structure, cost not to exceed $5,000.

Zanesville, O.—Bids are wanted Sept. 9 (re-advertisement) for constructing the superstructure of drawspan at the easterly end of the new "Y" bridge at Zanesville. Jas. L. Starkey, Co. Aud.

Topeka, Kan.—A. M. McLouth is reported to have received the contract for constructing a bridge at Sardou Ave., at $17,424.

Ventura, Cal.—The Board of Supervisors has authorized the County Surveyor to correspond with bridge companies to procure designs and to ascertain cost of bridges across the Sespe River.

Cloverdale, Cal.—The San Francisco Bridge Co., of San Francisco, is reported to have received the contract for constructing a bridge across Russia River at Cloverdale for $9,942.

Kansas City, Mo.—Local press reports state that the Union Depot, Bridge & Terminal Co., Theo. C. Bates, Pres., will ask for bids at once, for constructing a 3-deck bridge across Missouri River.

Morristown, N. Y.—O. P. Phillips, Village Clk., writes that a stock company is being formed to construct a bridge across Black Lake, about 5 miles from Morristown. Probable cost, $30,000.

Appleton, Wis.—Press reports state that the Chicago & Northwestern R. R. will rebuild its bridge crossing the Fox River in this city.

Raton, N. Mex.—Bids are wanted Sept. 2 for constructing a steel bridge having a 76-ft. span across Ponil Creek. M. M. Dawson, Clk. Bd. Co. Commrs.

Coraopolis, Pa.—Bids are wanted Aug. 26 for a culvert on State St. Edeburn, Cooper & Co., Boro. Engrs., 410 Grant St., Pittsburg.

Springfield, O.—Plans, specifications and bids are wanted Sept. 7 for constructing a steel or iron bridge, having a span 164½ ft. clear, across Mad River on the Dayton and Mad River Valley Turnpike. A. K. Hahn, Co. Aud.

Everett, Wash.—Press reports state that the Great Northern Ry. will construct 8 steel bridges in this city, including one at Hewett Ave., to have 2 driveways, each 25 ft. wide, and 2 walks, each 10 ft. wide.

Battleford, N. W. T.—F. Gilman, Sec'y Dept. Pub. Wks., Ottawa, Ont., writes that the Dominion Bridge Co., Limited, of Montreal, Que., has received the contract for constructing the superstructure of a steel highway bridge across Battle River, near Battleford.

Riverdale, O.—It is stated that bids will soon be asked for building the stone abutments, pier, etc., for a bridge to cross the hydraulic race at Linwood St.

Connellsville, Pa.—A. I. Totten, Gen. Supt. of Construction of the Pittsburg, McKeesport & Connellsville Ry. Co., writes that it is proposed to erect some bridges. Not yet ready for bids.

Cleveland, O.—The King Bridge Co. is stated to have submitted the lowest bid for constructing the superstructure of Harvard St. bridge, at $18,640. The lowest bid for the substructure is reported submitted by Williams Bros. & Morse, at $4,284.

Richmond, Va.—Press reports state that the Virginia Union University and other property owners propose to build a $5,000 bridge over Bacon's Quarter Branch at the northern end of Lombardy St.

Oneida, N. Y.—Plans have been submitted to the City Council providing for a viaduct, 24½ ft. wide, to be constructed at Oneida Castle. Probable cost, $36,000.

Bangor, Mich.—The town board of Bangor Township is said to be preparing to build a $4,000 bridge across the Kawkawlin River at Henry St.

Ypsilanti, Mich.—Bids are wanted Aug. 26 for constructing a concrete, concrete and steel or an all-steel bridge across Huron River at Forest Ave. W. E. McLeod, City Clk.

Chicago, Ill.—Local press reports state that the South Park Board has decided to construct a $25,000 red granite and concrete bridge at the south end of Wooded Island, in Jackson Park, and that bids for same will soon be asked.

The Joint Committee on Engineering and Finance reported to the Sanitary Trustees in favor of awarding contracts for the superstructure of State and Harrison St. bridges to the American Bridge Co., of New York, at $86,400 and $93,500, respectively; and the contracts for the substructure to Lydon, Drews & Co., at $58,846 and $55,275, respectively. For list of bids received, see The Engineering Record of Aug. 3.

PAVING AND ROADMAKING.

Moline, Ill.—H. G. Paddock, City Engr., writes that the Tri-City Construction Co., of Davenport, Ia., has been awarded three contracts for brick paving, amounting altogether to $11,280.

Philadelphia, Pa.—Bids are wanted Aug. 28 for grading, paving with sheet asphaltum, vitrified fire-clay bricks or blocks, granite, Pennsylvania or Lambertville blocks, regrading, repairing, etc., on several streets; repairing with broken stone, Upsal St.; constructing rubble gutters on Nicetown lane, etc. Wm. C. Haddock, Dir. Dept. Pub. Wks., Bureau of Highways.

Newburg, O.—Bids are wanted Aug. 31 for grading, curbing and paving with brick on Miles Ave., in Newburg hamlet. Julius C. Dorn, Clk. Bd. Co. Commrs., Cleveland.

Des Moines, Ia.—Bids are wanted Sept. 5 for 1,922 sq. yds. brick paving on a 6-in. concrete foundation, with Portland cement top filler, in 2 alleys; also for 1,530 lin. ft. of Portland cement curbing on Atkins St. G. A. Eberhart, Chmn. Bd. Pub. Wks.

Buffalo, N. Y.—Bids are wanted Aug. 29 for improving Hamburg Turnpike. R. G. Parsons, Secy. Bd. Pub. Wks.

Green Bay, Wis.—Bids are wanted Sept. 9 for improving certain streets. F. E. Murray, Clk.

Kenosha, Wis.—Bids are wanted Sept. 3 for about 4,385 lin. ft. of grading, curbing and paving with brick on a crushed-stone foundation in Milwaukee Ave. Jas. Gorman, Chmn. St. Assessment Com.

East Cleveland, O.—Bids are wanted Sept. 7 for sewering, grading, curbing and paving with brick on Lake Front Ave. H. B. Chapman, Village Clk.

Denver, Colo.—Plans have been completed for grading 9 miles of streets and for constructing 77,830 lin. ft. of concrete curbing and gutter on said streets. Bids will be asked for same in the near future. H. F. Meryweather, Asst. Engr., Dept. Pub. Wks.

Newport News, Va.—The citizens are reported to have voted on Aug. 15 to issue $100,000 paving bonds.

Atchison, Kan.—Fredk. Gidding, City Engr., writes that it is proposed to pave with vitrified brick an alley requiring the following quantities: 1,757 sq. yds. brick paving on sand foundation, 752 lin. ft. concrete curb, 5½ and 20-in., 3,600 sq. ft. brick sidewalk.

Washington, N. J.—Jas. A. Stanley, of Little Falls, is said to have presented the only bid for the $9,000 stone-road bridge approaches in Washington Ave.

Columbus, O.—Local press reports state that N. B. Abbott, local representative for the Barber Asphalt Paving Co., has received the contract for paving King Ave. with Nelsonville block, for $13,349.

Wilkesbarre, Pa.—Bolton G. Coon & Co., Kingston, Pa., are stated to have received contracts for brick paving on 3 streets, at 56 and 58 cts. per sq. yd. for the paving.

Wabash, Ind.—Barber Asphalt Paving Co. has received the contract for 11,000 sq. yds. asphalt, at $1.95, and 6,000 lin. ft. of curb and gutter at 75 cts.

Conneaut, O.—Geo. B. Pike, City Engr., writes that bids will be received about Sept. 24 for brick paving on Buffalo, Sandusky and Day Sts. and Park Ave., estimated to cost $45,000. Paving bonds to the amount of $65,000 will soon be sold.

Milwaukee, Wis.—Chas. J. Poetsch, City Engr., writes that R. J. Hickey, of Milwaukee, has been awarded the contract for paving Johnson St. with brick on a concrete foundation, for $2.23 per sq. yd. with Lane block.

Pittsburg, Pa.—The following bids are reported opened by the County Commrs. for improving the Steubenville pike: Booth & Flinn, Ltd., 1942 Forbes Ave., awarded contract, $92,720; Keeling, Ridge & Co., 2014 Josephine St., $99,089; J. C. McSpadden, 326 4th Ave., $105,980.

East Newark, N. J.—C. M. Borrie, Boro. Engr., writes that the Barber Asphalt Paving Co. has been awarded the contract for paving 5,450 sq. yds. of Central Ave. with asphalt, for $12,489.

Boise, Idaho.—Local reports state that John Pilmer has been employed to estimate the cost of building the Thunder Mountain road.

St. Paul, Minn.—City Engr. Oscar Claussen has submitted estimates for asphalt paving of Payne Ave., from Beaumont to Jessamine St., replacing cedar block, $33,345, or $4.47 per front ft.; from Jessamine to Maryland St., replacing a macadam pavement, $10,400, or $6.80 per front ft.

Topeka, Kan.—The County is reported considering extending the macadam road west of Washburn College for a distance of 2½ miles.

Washington, Ia.—It is stated that the Council has passed an ordinance to provide for paving a number of streets with brick or concrete. Hugh McCreery, Clk.

Chagrin Falls, O.—Press reports state that the Council has passed ordinances providing for paving Main St. with vitrified brick, and that bonds will be sold for the purpose on Sept. 16.

New Haven, Conn.—Local press reports state that the New England Improvement Co., N. W. Kendall, Pres., and the Boston Asphalt Co., presented bids for paving Church St., at $2.81 and $2.92 per sq. yd., respectively, but any further action awaits the decision of the Bd. of Aldermen, which on Aug. 5 ordered the advertisement of the work stopped.

Worcester, Mass.—The Worcester Consolidated St. Ry. is reported to have agreed to pave its roadway between Chandler St. and Lincoln Sq.

Atlanta, Ga.—E. S. McCandless, of Atlanta, is reported to have received the contract for paving Whitehall St. with asphalt at $2.08 per sq. yd.; estimated quantity about 15,000 sq. yds.

Boston, Mass.—The Bd. of Street Commrs. is stated to have voted to construct Rutherford Ave., from Chapman St. to City Sq., Charlestown, 60 ft. wide, and involving 44,754 sq. ft. of work, for which $300,000 is available.

Hoboken, N. J.—It is stated that the stockholders of the Jersey City, Hoboken & Paterson St. Ry. have approved the action of the Directors in assuming responsibility for the issue of $1,000,000 in bonds by the Bergen Turnpike Co., to be used in reconstructing the turnpike from this place to Hackensack and building trolley lines along the route.

Rochester, N. Y.—A brick paving award is reported made Aug. 16 to Whitmore, Rauber & Vicinus, for Grape St.; amount, $13,810.

San Francisco, Cal.—The Bd. of Pub. Wks. has been authorized to contract for the following paving: Basalt blocks on concrete; bituminous rock on cobbles, with a binder course; bituminous rock; and asphalt on basalt block, the last work estimated to cost $23,690.

Cincinnati, O.—Bids are wanted Sept. 2 for brick paving on Stephenson and Avery alleys; also Sept. 4 for paving Pugh alley. Geo. F. Holmes, Clk. Bd. Pub. Service.

Nashville, Tenn.—Local press reports state that the Bond Commission will sell on Sept. 3 $100,000 paving, also $100,000 sewer bonds.

Barberton, O.—Press reports state that bids will be received about Sept. 9 for paving Tuscarawas and 2d Sts.

Bay City, Mich.—The Pere Marquette R. R. Co. has agreed to construct a vitrified brick pavement 20 ft. wide on Jefferson St. on 6 ins. of concrete.

White Plains, N. Y.—Bids are wanted Sept. 3 for improving, including grading, curbing and macadamizing, portions of several streets, in all about 3 miles. Wm. B. Sutherland, Village Clk.

South Fork, Pa.—See "Sewerage and Sewage Disposal."

Guthrie, Okla. Ter.—About 1,000,000 or more vitrified paving brick and seconds are needed in Guthrie for sidewalk and well curb construction. Mail prices f. o. b. Guthrie, to T. A. White, City Engr.

Alliance, O.—Bids are wanted Sept. 14 for improving portions of several streets. J. H. McConnell, City Clk.

Milwaukee, Wis.—Bids are wanted Aug. 27 for asphalt pavement and curbing on a portion of E. Water St.; also for cement sidewalks on Fifth Ave. Chas. J. Poetsch, City Engr.

Youngstown, O.—Bids are wanted Sept. 14 for paving portions of 4 streets. C. E. Cross, Clk. City Commrs.

Chagrin Falls, O.—Bids are wanted Sept. 20 for 9,557 sq. yds. of brick or block pavement, 2,460 lin. ft. of curbing, etc., on 3 streets. L. E. Chapin, Consulting Engr., Canton; E. P. Wilmot, Mayor.

Upper Alton, Ill.—The Bd. of Pub. Improvements is considering the paving of College Ave.

Detroit, Mich.—The E. K. Roberts Co. is reported to have received the contract for paving 19th St., for $15,000; $1.58 per yd.; and with Berea curb.

Sioux City, Ia.—The following bids are reported opened Aug. 13 for repaving the 4th St. viaduct and approaches: C. F. Lytle, $18,374; M. L. Flinn, $19,027; Hanson Bros., $20,144. There are 1,133 sq. yds. of paving of viaduct proper and 4,677 sq. yds. in the approaches; the bids per sq. yd. of the three contractors in the order named are $4.30 and $2.03, $4.41 and $2, and $4.65 and $2.15.

St. Paul, Minn.—Preliminary orders have been passed by the Council for paving Jackson St. and Central Park with asphalt. The City Engr. has estimated the cost of paving South Wabasha St. with brick to be $32,000 and Lafayette Ave. and Collins St. with brick, $26,000.

Elizabeth, N. J.—The contract for paving Division St. with 3,500 sq. yds. of block has been awarded to Chas. Wayne, at $1.71 per sq. yd.

Emporia, Kan.—The Council is said to have ordered the City Surveyor to prepare estimates for paving Commercial St.

Indianapolis, Ind.—Bids are wanted Aug. 28 for paving First Alley with brick, on a 6-in. concrete foundation; Albert Sahn, Chmn. Bd. Pub. Wks.

Two bids were received for paving New York St. with asphalt: The Western Constn. Co., Indianapolis, $3.52 per lin. ft.; Barber Asphalt Paving Co., $3.58 per lin. ft.

Buffalo, N. Y.—The Bd. of Pub. Wks. has been directed to advertise for bids for paving Grace and Ryan Sts.

Chelsea, Mass.—The State Highway Commission is said to have received the surveys for a portion of Eastern Ave. and that contracts for improving the street as a State highway will soon be let.

Wausau, Wis.—The City Council has voted to macadamize two streets.

Atchison, Kan.—City Engr. Fred Giddings writes that O. E. Seip & Co., Atchison, and L. Wines, Atchison, have been awarded the Third and Kearney St. paving contracts, respectively. O. E. Seip & Co.'s bid in detail is, in principal items, as follows: 5,574 cu. yds. grading, at 20 cts.; 3,357 lin. ft. curb, at 42 cts.; 247 lin. ft. resetting curb, at 15 cts.; 3,000 lbs. C. I. bridge plates at 1.5 cts.; 6 catch basins at $15; 5,078 sq. yds. paving at 82.5 cts.; 13,649 sq. ft. brick sidewalk at 5 cts.; 3,240 sq, ft. brick sidewalk relaid at 1¼ cts.

Mansfield, O.—Bids for improving E. 4th St. are reported as follows: Gandert Bros., 12 bids, from $6,112 with Wooster standard brick to $14,896 with block asphalt; Peter Straub, 6 bids, from $7,851 with Wooster shale to $16,799 with block asphalt; Herring & Son, 7 bids, from $6,654 with Bolen's wire cut brick to $14,848 with block asphalt; Ayers Asphalt Co., Townsend block, $11,565 with concrete filler and $9,885 without filler; Barber Asphalt Co., Bolen's granite, $10,894 with concrete filler and $9,366 without filler. Gandert Bros. have been awarded the contract for paving. E 4th St., at $6,964, for Gold Medal block.

Baltimore, Md.—The following bids were opened Aug. 14 for paving Bayard St. with asphalt block: Maryland Pavement Co., Equitable Bldg., Baltimore, $2.50 per sq. yd. for the asphalt, including 4-in. concrete base, 30 cts. per sq. yd. for Belgian block repaving and 75 cts. per lin. ft. for 5-in. curb and circles; Washington Asphalt Block & Tile Co., 664 B. St., S. E., Washington, D. C., $2.65 for asphalt, $1 for Belgian block repaving and 90 cts. for new curbing. The totals are: Maryland Pavt. Co., $9,430, awarded contract; Washington Asph. Block & Tile Co., $10,179.

New York, N. Y.—The following bids were opened Aug. 20 by Jas. P. Keating, Commr. of Highways, for paving with asphalt on a concrete foundation: A, Fruin Bambrick Pavg. Co.; B, Asphalt Construction Co.; C, Barber Asphalt Paving Co.; D, Sicilian Asphalt Paving Co.; E, Uvalde Asphalt Co:

Freeman St., from 169th to Southern Boulevard.

	A.	B.	C.
Asphalt pavt., 6,925 sq. yds....	$2.44	$2.71	$2.69
Concrete pavt., 1,410 cu. yds....	5.55	6.60	6.70
Old curb, 2,500 lin. ft............	.98	1.00	1.00
Total	$27,173	$30,573	$30,575

Varick and Carmine Streets.

	A.	C.	D.	E.
Asp. pavt., 14,100 sq. yds.	$4.07	$3.74	$3.83	$3.77
Old stone pavt., 14,350 sq. yds....................	.55	.58	.59	61
New curb, 5,540 lin. ft....	1.09	1.05	1.08	1.05
Old curb, 790 lin. ft......	.60	.49	.55	.50
Manhole covers, 41........	23.50	24.00	24.50	23.50
Totals	$72,756	$68,245	$69,892	$69,086

Birmingham, Ala.—Julian Kendrick, City Engr., writes that the following awards were made Aug. 7 for macadam paving: C. M. Burkhalter & Co., $10,245 for Avenue F, including 8,000 cu. yds. excavation at 30 cts.; 4,000 cu. yds. slag at 70 cts.; 4,000 cu. yds. chert at $1.10 and 100 cu. yds. excavation under water pipes at $2, and $24,370 for 13th and 14th Sts., including 25,000 cu. yds. excavation at 25 cts., 8,000 cu. yds. slag at 70 cts., 8,000 cu. yds. chert at $1.10, 100 cu. yds. solid rock at $1.50 and 6,000 lin. ft. 6-in. straight granite curb at 48 cts.; Dunn & Lallaude Bros., $25,386 for 2d, 3d, 5th and 7th Aves., including 18,000 cu. yds. excavation at 27½ cts., 6,000 cu. yds. slag at 65 cts., 6,000 cu. yds. chert at $1.12, 100 cu. yds. excavation under water pipes at $2.25, 17,000 lin. ft. 6-in. straight granite curb at 50 cts., and 1,000 lin. ft. 6-in. granite curb corners at 62 cts.; B. O. Watkins, $34,905 for 15th, 16th and 17th Sts., and Aves H, I, J and M, including 25,000 cu. yds. excavation at 32½ cts., 7,000 cu. yds. slag at 80 cts., 7,000 cu. yds. chert at $1.20, 100 cu. yds. excavation under water pipes at $2, 23,000 lin. ft. 6-in. straight granite curb at 50cts., and 1,000 6-in. granite curb corners at 60 cts.; J. E. Donelson, $9,328 for 2d and 3d Aves., E. 20th and E. 24th Sts., and Aves. G and I, including 4,000 cu. yds. excavation at 30 cts., 1,300 cu. yds. slag at 60 cts., 1,300 cu. yds. chert at $1.05, 10,000 lin. ft. 6-in. straight granite curbing at 50 cts., 600 lin. ft. 6-in. granite curb corners at 58 cts.; Byron Sonders, $7,235 for sidewalks, comprising 7,000 sq. yds. cement paving at 96½ cts., and 400 sq. yds. vitrified brick paving at $1.20.

Muscatine, Ia.—City Engr. Jas. J. Ryan writes that the following bids were opened Aug. 13 for brick paving, bidders offering Galesburg brick: A, Wm. Horrabin, Iowa City; B, E. Baker, Muscatine; C, Fuller Bros., Muscatine, awarded contract:

	A	B	C
Excavation, 11,000 cu. yds........	$.27	$.215	$.23
Curb, 4 x 22-in., 8,600 lin. ft......	.48	.49	.48
Curb, 4 x 18-in., 4,800 lin. ft......	.43	.36	.34
Br. pav. on sand, 20,000 sq. yds.	1.23	1.225	1.195
Totals	$33,762	$32,807	$32,190

Cleveland, O.—The Cleveland Trinidad Paving Co. has been awarded the contract for paving Lorain St., the work including 2,000 cu. yds. excavation, 9,000 sq. ft. Medina block, 9,140 sq. ft. 6-in. concrete foundation and 3,972 lin. ft. 5-in. Medina stone curb. The successful bid was $22,143 for the work with a deduction of $4,269 which the contractor offered to pay for 74,000 sq. ft. old paving stone and 3,972 lin. ft. old curb, making a net bid of $17,874; the Barber Asphalt Paving Co., 11 B'way, N. Y. City, bid $19,777 for the work and allowed $1,365 for old stone and curb, making the net bid $18,412.

POWER PLANTS, GAS AND ELECTRICITY.

Poughkeepsie, N. Y.—Bids are wanted Aug. 31 for installing engines and dynamos at the Hudson River State Hospital, Poughkeepsie, as advertised in The Engineering Record.

Lewes, Del.—The contract for the electric light plant, for which T. Chalkley Hatton, of Wilmington, is engineer, has been awarded to the American Supply & Construction Co., of N. Y. City, for $8,500.

Huntington, W. Va.—Dr. L. V. Guthrie, Supt. Asylum for Incurables, writes that R. Shore & Co., of Huntington, has received the contract for the power and electric light plant, for $3,235.

Wharton, Tex.—See "Water."

Bowling Green, O.—The Council has granted E. H. McKnight a franchise for a hot water heating plant.

Windfall, Ind.—See "Water."

Long Island City (L. I.), N. Y.—The New Amsterdam Gas Co. has filed plans with Commissioner of Buildings for a new gas generator house to be built on Freeman St., Ravenswood. It will be a steel frame structure 104 x 97 ft., 69 ft. high, with a peaked roof; estimated cost $25,000.

Collingwood, Ont.—See "Water."

Muskegon, Mich.—Sargent & Lundy, Monadnock Blk., Chicago, Ill., are stated to have prepared plans for an electric plant for the Muskegon Traction Co., to cost about $100,000.

Fresno, Cal.—See "Water."

Chicago, Ill.—The South Park Board is stated to have decided to expend about $23,000 for new machinery for the Washington Park power house.

Stewartville, Minn.—The Council is stated to have granted Mr. Johnson, of Leroy, a franchise for an electric light plant.

Grand Rapids, Minn.—Bids are wanted Aug. 31 for $25,000 bonds to be used to construct a lighting plant. F. A. King, Village Recorder.

Bristol, Conn.—Chas. W. Eaton writes that plans are being prepared for a co-operative plant of from 400 to 600 incandescent 16-c.p. lights.

Hartington, Neb.—The City Clerk writes that it was voted Aug. 12 to issue $5,800 bonds for a gas plant.

Oakgrove, Pa.—The Oakgrove Electric Co. is stated to have been incorporated to supply the town with electric light, heat and power.

American Falls, Idaho.—R. W. Faris is reported to be preparing plans for a power plant to be installed here by J. H. Brady, owner of the electric lighting plant at Pocatello, Idaho. It will cost about $150,000, and will develop 3,000 H. P.

Park River, S. D.—See "Water."

Bernardsville, N. J.—The Bernardsville Light, Heat & Power Co. is stated to have been incorporated with a capital of $100,000 by Grant B. Schley, C. Leyard Blair and others.

Glenwood, Wis.—See "Water."

Wadesboro, N. C.—Fredk. J. Cox, of Wadesboro, writes that it is proposed to organize a company to develop Bullitt's Falls for electrical purposes. About 2,000 H. P. is available.

Lima, O.—The Council is stated to have granted Joseph Mayer, Pres. Lima Electric Light & St. Ry. Co., a franchise for laying pipes for heating and power purposes.

Elcampo, Tex.—The County Commissioners are stated to have granted R. A. Scott, of Orange, Tex., and Levi Paul, of Elcampo, a franchise to erect poles, string wires and lay water mains through Elcampo. They will construct an electric light and power plant here at a cost of $50,000; also furnish the town with water-works.

Rosebud, Tex.—See "Water."

Orange, N. J.—The Hazleton Gas Co. has been incorporated, with a capital of $100,000, to manufacture and distribute gas, electricity and steam from different products, for the purpose of lighting, heating, fuel and power. Local office is at 271 Main St., Orange. Incorporators: H. O. Meeker, Elizabeth, and Isaac R. Loyd and Frank W. Hills, of Orange.

San Bernardino, Cal.—The San Bernardino Power Co. has been incorporated, with a capital of $300,000, to construct and operate an electric line from Third and E Sts. to Highland Ave., and also to construct and operate an electric light and gas plant for heating, lighting and manufacturing purposes. It is also proposed to construct and maintain water ditches and reservoirs and to engage in any business appurtenant thereto. Incorporators: H. E. Harris, Stephen F. Kelley and others, of San Bernardino.

Centerville, Ia.—It is stated that the Citizens' Electric Light & Gas Co. is about to petition the Council for permission to construct an electric railway.

Redlands, Cal.—The California Power Co., H. H. Sinclair, pres., will build 8½ miles of canal, mostly tunnel, and a power house with six units of 2,500 kw. each, driven by impulse wheels. A 116-mile transmission line will be built to Los Angeles. F. C. Finkle is Ch. Engr.

McIntosh, Minn.—Bids will be received by the Village Council until Sept. 9 for a 20-year franchise for an electric light plant having a capacity of 800 or more lights. Owen Nelson, Village Recorder.

Shepherdstown, W. Va.—The Jacob G. Schaff Electric Co., of Chambersburg, Pa., is stated to have secured the contract for constructing the electric light plant, for $4,350.

Moulton, Ia.—Ora Vaught, of Centerville, Ia., is stated to have received a franchise for an electric light plant.

Camden, N. J.—The Willard Oil & Gas Co. is stated to have been incorporated with a capital of $300,000.

Media, Pa.—Bids are wanted Sept. 3 for furnishing and installing engine, dynamos and apparatus for an electric lighting plant, as advertised in The Engineering Record.

ELECTRIC RAILWAYS.

Jersey Shore, Pa.—The Council is stated to have granted a franchise to the Jersey Shore St. Ry. Co.

Columbus, O.—The County Commissioners are stated to have granted the Columbus, Delaware & Marion Electric Ry. Co. a franchise to construct a line from Worthington to Flint.

Richmond, Va.—It is stated that the Virginia Electrical Ry. & Development Co. will expend about $200,000 in improvements.

Thibodaux, La.—C. P. Young, of New Orleans, is stated to have received a franchise to construct an electric railway through Lafourche Parish.

Chambersburg, Pa.—The Council is stated to have granted a franchise to the Chambersburg, Greencastle & Waynesboro Electric Ry. Co.

Whittier, Cal.—T. E. Newlin, of Los Angeles, is stated to have petitioned the Council for a franchise.

Charleston, W. Va.—A charter has been granted to the Charleston & Kanawha Valley Power & Ry. Co., with a capital of $50,000, to construct an electric railway to Montgomery and St. Albans, with probable extension to Kanawha Falls. Incorporators: Howard T. Goodwin, Philadelphia, Pa.; Ed. R. Sutton, Wilmington, Del., and T. J. Carmack, of Charleston.

Mineral Wells, Tex.—The Council is stated to have granted a franchise to W. A. Mercer.

Plymouth, Pa.—The Township Commissioners are stated to have granted the Plymouth & Larksville St. Ry. Co. a franchise to extend its line to Harveys Creek.

Bloomsburg, Pa.—The Bloomsburg & Catawissa Electric R. R. Co., with a capital of $42,000, has been organized to construct an electric road through Bloomsburg, Rupert and Catawissa. Directors: W. S. Moyer, Bloomsburg; W. H. Rhawn, Catawissa, and others.

Santa Cruz, Cal.—Fred W. Swanton is stated to have petitioned the Supervisors for a franchise for an electric railway from Santa Cruz to Watsonville, with branches to Capitola and Corralitos.

Colfax, Ia.—The citizens are stated to have voted to grant a franchise to the Des Moines, Colfax & Eastern Ry. Co., and also voted a tax to aid in its construction.

Canajoharie, N. Y.—The Village Trustees are stated to have granted a franchise to the Mohawk River Traction Co.

Mt. Pleasant, S. C.—J. S. Hartzell, Town Treas., would like to purchase second-hand rails for a line 40 miles in length.

Morrisville, N. J.—The Morrisville & Yardley Trolley Co. is stated to have received permission to extend its line from Morrisville to Bristol, a distance of about 10 miles. Wm. F. Sadler, Pres., Trenton.

Janesville, Wis.—Philip Spooner, of Madison, is stated to have petitioned the Council for a franchise.

Excelsior Springs, Mo.—E. L. Morse is stated to have petitioned the Council for franchises for an electric light and power plant, and an electric railway.

Granite City, Ill.—The Council is stated to have granted a franchise to the Venice, Madison & Granite City St. Ry. Co. G. Miller, Supt., Venice, Ill.

Hamilton, O.—The Butler County Commissioners are stated to have granted the Dayton, Germantown & Middleton Electric Ry. Co. a franchise through the county.

Cincinnati, O.—G. R. Scrugham, Pres. Rapid Ry. Co., is stated to have petitioned the County Commissioners for a franchise over certain roads in Hamilton County.

Norwalk, O.—Sherman Culp, representing the Buckeye Traction Co., is stated to have petitioned Council for a franchise from the south line of Norwalk along Norwood Ave. to Benedict Ave. This company will build a line from Norwalk to Bucyrus, a distance of 47 miles.

Toledo, O.—The Toledo Rys. & Light Co. is stated to have purchased the lines of the Toledo Traction Co. Some improvements are contemplated. A. E. Lang, Pres.

Ottawa, Ill.—The Illinois River Ry. Co., of Ottawa, has been incorporated, with a capital of $150,000. Incorporators: Louis W. Hess, Jacob I. Warner and Henry A. Shorman.

Lansing, Mich.—Robt. Gordon, of St. Marys, O., has received a franchise for an electric railway to be constructed from Battle Creek to Charlotte and Lansing.

Wapakoneta, O.—The Auglaize County Commissioners are stated to have granted a franchise to the Toledo, Columbus, Springfield & Cincinnati Ry. Co.

Lewiston, Idaho.—An electric line 80 miles long is talked of between Grangeville, Idaho, and Lewiston, Idaho. Walter Hill will have charge of the surveys. Power to be obtained from the Smoke River, Salmon River or Clearwater River.

Everett, Wash.—A. W. Frater, of Seattle, and John T. Frater, of Brainerd, Minn., are reported interested in the construction of an electric railway between Everett and Seattle.

Portland, Ore.—The West Side & Suburban Ry. Co. has been incorporated, with a capital of $250,000, to construct an electric railway from Portland to Forest Grove. Incorporators: W. N. Sayre, J. W. Selover and others.

Newhope, Pa.—The Council is stated to have granted a right of way through the town to the Doylestown & Newhope Ry. Co.

Edgerton, Wis.—J. M. Clancy, of Stoughton, is stated to have petitioned the Council for a franchise for a syndicate which proposes to construct an electric railway from Janesville to Madison.

P. L. Spooner has also petitioned the Council for a franchise.

Washington, D. C.—The Washington, Leonardtown & Point Lookout Ry. Co. is reported to have been formed, with a capital of $1,000,000 to construct an electric railway about 98 miles in length, from Washington, D. C., to Point Lookout. Directors: Joseph F. Morgan and Francis V. King, of Leonardtown, Md. Jas. A. Flaherty, of Philadelphia, Pa., and others.

East Aurora, N. Y.—The Buffalo, Gardenville & Ebenezer Trolley Co. is stated to have petitioned the Village Trustees for a franchise. If granted the company will construct a line about 11 miles in length.

Penn Yan, N. Y.—The Dundee, Tyrone & Savona R. R. Co. is stated to have petitioned for a franchise in Yates County.

RAILROADS

Poplar Bluff, Mo.—J. P. McCarthy, of Little Rock, Ark., is stated to have secured the contract for constructing about 21 miles of road for the Southern Missouri & Arkansas Ry. Co., from near Poplar Bluff to Pocahontas, Ark.

Galena, Mo.—The Cherokee & Red River Ry. Co. has been incorporated, with a capital of $20,000, to construct a railroad from Galena through Jasper and Newton counties in Missouri and through the Cherokee, Creek, Quapaw and Modoc reservations in Indian Ter., and to Paris, Tex. Directors: Jacob Guthrie, Coffeyville, Kan., David A. Harvey, Wyandotte, Ind. Ter., and others.

Coffeyville, Kan.—A charter is stated to have been granted to the Kansas, Oklahoma City & Western Ry. Co., with a capital of $7,000,000. Principal place of business to be Oklahoma City, Okla. Ter. It is proposed to construct and maintain and operate a line of standard-gauge railway and telegraph and telephone line from Coffeyville and Cherokee, Kan., to Quanah, Tex., and a branch line from Stillwater, Okla., to Okmulgee, I. T., in all about 350 miles.

Cooperstown, N. Y.—The State R. R. Commissioners are stated to have granted the Cooperstown & Mohawk Valley R. R. Co. a franchise to build a 10-mile steam road from Cooperstown to Springfield Center.

Cleveland, O.—Jas. Ritchie, Consulting Engr., of the Grade Crossing Commission, is stated to have completed plans for abolishing certain grade crossings on the Pennsylvania R. R. between St. Clair St. and Woodland Ave.

Onaway, Mich.—The Onaway & North Michigan R. R. Co. has been incorporated, with a capital of $50,000, to construct a railroad from Onaway a distance of about 8 miles in Presque Isle County.

Hickory, N. C.—It is stated that the Ohio River & Charleston R. R. is to be extended from Hickory to Morgantown, N. C. A. N. Molesworth, Ch. Engr., Johnson City, Tenn.

Corsicana, Tex.—C. C. Waller, of Navasota, is reported interested in the construction of a railroad from Corsicana to Sabine Pass.

Enid, Okla. Ter.—A charter has been granted to the Western Railroad Construction Co., of Enid, with a capital of $250,000, to build a railway from Pueblo, Colo., to Fort Smith, Ark. Estimated length of road 1,000 miles, and estimated cost $25,000,000. Incorporators: H. E. Havens, of Enid; H. C. Miller, Salpulpa, Ind. Ter.; C. W. Turner, Muskogee, Ind. Ter., and others.

Weston, O.—The Council is stated to have granted a right of way through the town to the Toledo, Columbus, Springfield & Cincinnati Ry. Co.

Pittsburg, Kan.—The Kansas, Missouri & Southeastern Ry. Co. has been incorporated, with a capital of $10,000, to construct a railroad about 27 miles in length from near Pittsburg to a point on the State line near Galena.

Redlands, Cal.—C. W. A. Cartlidge, Vice-Pres. Redlands St. R. R. Co., writes that the stockholders voted Aug. 15 to increase the bonded indebtedness $150,000 to build additional lines of railway and purchase new equipment for same.

Columbus, O.—Bids are wanted by the Scioto Valley Traction Co., Rm. 42, Bd. of Trade Bldg., Columbus, until Sept. 5, for the grading, culvert and bridge masonry, piling, concrete, etc., for the grade of the company between Valley Crossing and Lancaster, a distance of about 20 miles. A. W. Jones, Ch. Engr.

Lesueur Center, Minn.—The Flick & Johnson Construction Co., of Davenport, Ia., is stated to have received the contract for constructing 56 miles of railway for the Chicago, Milwaukee & St. Paul R. R. Co., from Farmington to Lesueur Center.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Cincinnati, O.—Bids are wanted Sept. 10 for furnishing material and rebuilding the shops in the Work House grounds, recently destroyed by fire. W. H. Harrison, Clk. Bd. Police Commrs.

Harrisburg, Pa.—The Capitol Commission, created by the Legislature to complete the State House within the $4,000,000 appropriation, is reported to have organized Aug. 20, with Gov. Stone as Pres. and Edgar C. Gerwig, Secy. It was decided to advertise for plans and specifications from all Pennsylvania architects for the completion of the building, the plans to be submitted within 30 days.

National Military Home, Ind.—Bids are wanted Sept. 14 for furnishing and setting one 72-in. horizontal tubular steam boiler, one boiler-feed pump and one standard tubular boiler, 44 in. in diameter, at the Marion Branch, National Home of D. V. S. Address Justin H. Chapman, Governor.

Montreal, Que.—The Governors of the Western General Hospital are reported to be discussing plans for the erection of a $100,000 hospital.

Meridian, Miss.—The Supervisors have accepted the plans of Krouse & Hutchinson, of Meridian, for the Lauderdale County jail, to cost about $35,000.

Carthage, O.—Harry J. Rill, 38 Buhl Blk., Detroit, Mich., is reported to be preparing plans for a 4-story brick dormitory 155 x 29 ft. for the House of the Good Shepherd at Carthage, O., to cost about $33,000.

Mayersville, Miss.—A $12,000 jail will be erected here.

Jackson, Miss.—The plans of F. B. and W. S. Hull, of Jackson, are stated to have been accepted for a $75,000 court house for Hinds County.

Sault Ste. Marie, Mich.—J. C. Teague, of Sault Ste. Marie, is stated to have prepared plans for a $20,000 edifice for St. James' Protestant Episcopal congregation.

Laredo, Tex.—The County Commissioners are stated to have authorized the issue of $25,000 bonds to erect a county jail.

Norristown, Pa.—It is reported that bids will be wanted early this fall for an addition to the Norristown Hospital from plans of Baker & Dallett, Crozer Bldg., Philadelphia; estimated cost $125,000.

Grand Forks, N. D.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Lake City, Fla.—The plans of Frank P. Milburn, of Columbia, S. C., are stated to have been accepted for a $35,000 court house.

Dayton, O.—Bids are wanted Sept. 12 for repairing the brick mess hall building at the Central Branch, Natoional Home for D. V. S. Address A. J. Clark, Treas.

Pottsville, Pa.—Bids are wanted by the Pottsville Hospital Association until Aug. 27 for erecting a brick addition to the Pottsville Hospital, including ventilating and steam heating, to cost $30,000. C. T. Mould, Archt., Pottsville.

Jeffersonville, Ind.—Bids are wanted Sept. 3 for a steam heating system in the county jail and sheriff's residence. Geo. W. Badger, Co. Aud.

Lincoln, Ill.—Bids are wanted by the Board of Trustees of the Illinois Asylum for Feeble-Minded Children, until Aug. 26, for erecting a cold-storage and refrigerating plant. Plans and specfications may be obtained from Robt. Bruce Watson, State Superv. Archt., 1802 Fisher Bldg., Chicago.

Macon, Ga.—It is stated that bids are wanted Sept. 3 for erecting a fireproof annex to the Bibb County court house. S. C. Davis, Clk. Co. Commrs.

Escanaba, Mich.—It is proposed to erect a city hall, to cost about $25,000.

Washington, D. C.—The District Commissioners have requested certain architects to submit designs and plans Oct. 15 (according to press reports) for the municipal hospital to be erected on the Ruppert tract on Brighton Road. The buildings for which designs are asked are administration building, service building, ward building, superintendent's residence, nurses' quarters, mortuary building and stable.

New York, N. Y.—Bids are wanted Sept. 4 for erecting 2 pavilions on North Brother Island, Boro. of Bronx. John B. Sexton, Pres. Bd. Health.

BUSINESS BUILDINGS.

Wausau, Wis.—John Andrews, of Wausau, is stated to have received the contract for erecting the Wausau club house for $74,769.

Lasalle, Ill.—Pond & Pond, Steinway Hall, Chicago, are stated to have completed plans for a 3-story brick and stone structure to be erected here for Julius V. Aggehr, at a cost of $40,000.

San Antonio, Tex.—Competitive plans will be received up to Oct. 1 for the Alamo National Bank; probable cost, $60,000. Chas. Hugo, Pres.

Tacoma, Wash.—J. C. Dixon is stated to have received the contract for erecting the stock house of the Pacific Brewery & Malting Co., for about $30,000.

Montreal, Que.—It is stated that the Grand Trunk Ry. Co. will erect new freight offices on Chaboillez Square, at a cost of about $40,000. J. Hobson, Ch. Engr., Montreal.

New York, N. Y.—C. P. H. Gilbert, Archt., 1123 B'way, is stated to have filed plans for a stable to be erected on 70th St. near Park Ave. for D. G. Reid, to cost about $100,000.

St. Paul, Minn.—It is stated that the Northern Pacific will expend about $75,000 in improvements and additions to its Como shops, to include new car shops, 190 x 210 ft.; storage building for iron and coal, 25 x 100 ft.; new turntable, 75 x 130 ft., and several small structures. E. H. McHenry, Ch. Engr., St. Paul.

Watertown, S. D.—It is stated that the Chicago & Northwestern R. R. Co. will erect a depot here. W. D. Cantillon, Div. Supt., Winona.

Minneapolis, Minn.—H. Kelly & Co., 227 S. 3d St., are reported to have received the contract for the ventilating, heating and plumbing system for the Chamber of Commerce Building; cost about $50,000.

Shamokin, Pa.—Bids are wanted by the Building Committee of the Knights of Columbus until Aug. 31 for furnishing material and erecting a 4-story hall and store building 50 x 150 ft. on Independence St. Probable cost $40,000.

Hudson, Wis.—The cold storage plant of the Hudson Produce Co. is reported to have been destroyed by fire Aug. 13.

East St. Louis, Ill.—A press report states that the Chicago, Peoria & St. Louis R. R. will make extensive additions and improvements to its freight terminals in East St. Louis, at a cost of about $125,000. Curtiss Millard, Gen. Mgr., Springfield, Ill.

Sioux City, Ia.—It is stated that J. M. Cohen and J. A. Magoun are to erect a 3-story brick building on 4th and Douglas Sts., at a cost of about $25,000.

Poughkeepsie, N. Y.—Plans have been prepared for a 4-story brick and terra cotta building for Lackey, Platt & Co.

Sewickley, Pa.—It is stated that the Y. M. C. A. will erect a $25,000 building on the Beaver road.

Los Angeles, Cal.—The Howe & Curry Co., of Los Angeles, has received the contract for the plumbing, gas fitting and steam heating of a building for the Conservative Life Insurance Co. and Fredk. H. Rindge, for $15,074.

Boston, Mass.—J. F. McDowell, 787 Tremont St., has had plans prepared for a boarding and livery stable 100 x 90 ft., of brick, to be erected on Worcester St., to accommodate 125 horses.

Beloit, Wis.—The Berlin Machine Works will erect 4 new buildings, one 198 x 100 ft., another 198 x 35 ft., and two 310 x 75 ft. each. P. B. Yates, Pres. & Gen. Mgr., Beloit.

Waynesboro, Pa.—The Geiser Mfg. Co. will erect two 4-story storage buildings, one 46 x 221 ft., the other 50 x 90 ft. D. M. Good, Pres.

St. Louis, Mo.—The Whittaker & Weber Mfg. Co. is about to erect a 2-story brick building north of its present building, on N. 2d St. It will be 177 x 150 ft. and be equipped with a fire sprinkler system, steam heating and also have an electric light plant; cost about $40,000. G. W. Whittaker, Pres.

Atlanta, Ga.—The plans of J. H. Dinwiddie, Equitable Bldg., are stated to have been accepted for a building to be erected on Auburn Ave., for the Atlanta Athletic Club, to cost about $20,000.

Brooklyn, N. Y.—Plans have been filed for interior alterations to the power station on 1st Ave. and 52d St., of the Brooklyn Heights R. R. Co.; cost, $20,000.

Richmond, Va.—One of the buildings of the American Tobacco Co. was burned Aug. 19, and it will be rebuilt at a probable cost of $50,000. Architect, Albert F. Hunt, 1301 E. Main St.

Dallas, Tex.—The Kingman-Texas Implement Co. will build a 7-story warehouse, 100 x 100 ft.; cost, $60,000.

Sanger Bros. will erect a 7-story steel frame fireproof building 50 x 100 ft.; cost, $75,009.

Wichita, Kan.—Jacob Dold & Sons will build a $400,000 packing plant here at once, on the site of plant recently destroyed by fire.

Cleveland, O.—F. M. Osborne, Pres. of the Pittsburg Coal Co., will erect a brick building on Lake and Ontario Sts., at a cost of $25,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

45 to 51 E 11th St, br, iron & stone store & loft bldg; c, $100,000; o, Josof Steiner; a, Geo H Van Auken.

Bway & Maiden Lane, br, stone & terra cotta office bldg; c, $700,000; o, Bway Bldg Co.; a, Clinton & Russell.

256-264 4th Ave, rear extension; c, $35,000; o, Arthur A Carey; a, A G Hoe.

76 Park Ave, rear extension; c, $20,000; o, Mrs H M Corbin; a, Hoppin & Koen.

Liberty, West & Washington Sts, 3 story addition; c, $150,000; o, Central R R of N J; a, Chas T Wells.

DWELLINGS.

Newark, N. J.—Wm. E. Lehman, 224 Market St., is stated to be preparing plans for an 8-story brick apartment house to be erected at Lincoln Park, to cost about $150,000.

Philadelphia, Pa.—Milligan & Webber, 520 Walnut St., are stated to have prepared plans for a 6-story brick apartment house to be erected at 42d St. and Baltimore Ave. for C. H. Taylor.

Chattanooga, Tenn.—Adams & Bearden, Loveman Blk., are preparing plans for a $10,000 residence for J. H. Allison.

Philadelphia, Pa.—Edw. Hazelhurst, Girard Bldg., is reported to be preparing plans for an 8-story apartment house to be erected at 214 and 216 S. 12th St.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

5th Ave & 64th St, 2 br & stone dwellgs; c, $500,000 all; o, John T & James A Farley; a, Warren, Wetmore & Morgan.

213-215 W 63d St, br flat; c, $52,000; o, City & Suburban Homes Co; a, Howells & Stokes.

SCHOOLS.

Hartford, Conn.—Bids are wanted Sept. 3 for erecting a 3-story school on Wethersfield Ave., in the South School Dist. Henry C. Dwight, Chmn. Bldg. Com.

Weatherly, Pa.—Bids are wanted Aug. 29 for erecting a 10-room school. W. P. Long, Pres. School Bd.

Berkley, Va.—Bids are wanted Sept. 2 for erecting 2 brick schools in Berkley and South Norwalk, and for heating same by hot-air system. Capt. M. C. Keeling, Clk. School Bd., Dist. No. 5, Berkley.

Shepherdstown, W. Va.—S. G. Westernhauer, of Martinsburg, is stated to have received the contract for erecting the college here for about $35,000.

Watertown, N. Y.—Smith & Anthony, of Boston, Mass., are stated to have received the contract for ventilating and heating the high school, for $13,764.

Sharon, Pa.—It is stated that a 10-room school will be erected, at a cost of about $40,000.

Houghton, Mich.—The contract for erecting the mining, engineering, chemical and mechanical building for the Michigan School of Mines at Houghton, from plans of Charlton, Gilbert & Demar, of Marquette, is stated to have been awarded to the Northern Construction Co., of Houghton, for $56,560.

Dayton, O.—The Board of Education is stated to have decided to erect a 16-room district building with an assembly hall, at a cost of about $60,000.

Franklin, Pa.—P. Engelskerger, Secy., writes that Owsley & Boucherle, of Youngstown, O., are preparing plans for the $60,000 high school.

Concord, N. H.—Danforth & Forrest, 20 Pleasant St., are stated to have secured the contract for erecting the Rumford School, for $20,977.

Topeka, Kan.—Bids will be received by the Board of Trustees of State Charities and Corrections at Topeka State Hospital, Topeka, until Sept. 4, for erecting a school at the Kansas Institution for the Education of the Blind. Edwin Snyder, Secy. Bd. Trus.

St. Paul, Minn.—Bids are wanted Aug. 27 for plumbing and sewerage system in Grant and Rice schools. J. P. Healy, Secy. Bd. School Inspectors.

Lancaster, N. Y.—Bids are wanted Aug. 30 for $40,000 school bonds. Peter P. Adolf, Clk. Bd. Educ.

Oshkosh, Wis.—Local papers state that the Board of Education on Aug. 10 adopted the plans of Peter Bogart, of Milwaukee, representative of the American Foundry & Furnace Co., who will furnish a complete ventilating and heating system for the new high school, for $9,565.

Mauch Chunk, Pa.—It is stated that bids are wanted by the Building Committee of the School Board until Sept. 15 for erecting a school. Davey & McGlynn, Archts.

Woodcliff, N. J.—Bids will be received by the Board of Education of North Bergen Township until Aug. 30 for erecting a school in Woodcliff, including plumbing, heating, etc. Henry W. Solfleisch, Clk.

New York, N. Y.—The following bids were opened by the Committee on Buildings of Bd. of Educ., N. Y. City, on Aug. 21:

Heating and ventilating apparatus for new addition to public school 133, Borough of the Bronx: E. Rutzler, $16,650; John Neal's Sons, $14,821; Walker & Chambers, $16,050; John Hankin & Bro., 119 E. 13th St., $13,837 (awarded contract); The United Engineering & Contracting Co., $14,934; Blake & Williams, $14,932; Evans, Almirall & Co., $15,672; Williams & Gerstle, $15,230; Frank Dobson, $16,350.

Installing electric light wiring fixtures and electric bell system, etc.: A, Public School 184, The United Engineering & Contracting Co., $8,834 (awarded contract); Frederick Pearce, $11,467; Western Electric Co., $9,248.

B, Wadleigh High School, Frederick Pearce, $25,389; United Engineering & Contracting Co., 13-21 Park Row, $21,563 (awarded contract); Commercial Construction Co., $24,264.

Heating and ventilating apparatus for Wadleigh High School, Borough of Manhattan: Frank Dobson, $55,000; Walker & Chambers, $54,300; The United Engineering & Contracting Co., $53,734; John Neal's Sons, $53,119; Blake & Williams, 362 W. B'way, $52,981 (awarded contract); John Hankin & Bro., $59,897; Williams & Gerstle, $55,900; Evans, Almirall & Co., $56,975; E. Rutzler, $55,000.

Erecting new Public School 80, Greenpoint Ave. and Pearsall St. east of Bradley Ave., Borough of Queens: Alfred Nugent & Son, $91,900; George Hildebrand, $92,437; Rutan & Henningham, $94,000; Thomas Cockerill & Son, $93,000; H. M. Weed & Co., $94,177; Wm. P. McGarry, 236 Huron St., Brooklyn, $87,873 (awarded contract); James A. Stevenson, $114,433; Charles Wille, $102,535.

STREET CLEANING AND GARBAGE DISPOSAL.

Connellsville, Pa.—It is stated that a garbage furnace is talked of.

Uniontown, Pa.—The Uniontown Garbage Co. is reported to have been organized with J. S. Wood as manager, to construct a garbage furnace.

Hamilton, O.—Bids are wanted Sept. 10 for constructing a garbage crematory, capable of destroying 20 tons of garbage every 24 hours. M. O. Burns, City Clk.

GOVERNMENT WORK.

Reedy Island, Del.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 9, for quarters for crews at the U. S. Quarantine Station, Reedy Island, Del., as advertised in The Engineering Record.

St. Louis, Mo.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., until Sept. 10, for installing an ash-handling apparatus in the U. S. Custom House and Post Office at St. Louis, as advertised in The Engineering Record.

West Point, N. Y.—Bids are wanted Sept. 23 for constructing the south wing to Cadet Hospital, West Point, as advertised in The Engineering Record.

Ft. Washington, Md.—Bids will be received at the U. S. Engr. office, Washington, D. C., Sept. 19, for an electric light plant at Ft. Washington, Md., as advertised in The Engineering Record.

Reedy Island, Del.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., Sept. 5, for a heating apparatus for the surgeons' quarters at the U. S. Quarantine Station, Reedy Island, as advertised in The Engineering Record.

Ft. MacKenzie, Wyo.—Bids are wanted Sept. 14 for erecting, plumbing, heating and electric wiring a brick barracks at Ft. MacKenzie. Capt. A. L. Brown, Q. M., Sheridan, Wyo.

Havana, Cuba.—A press report states that Naval Constructor Gilmore, who has examined into the condition of the floating dry dock at Havana, recently purchased by the Government from Spain, estimates that about $40,000 will be required to place the dock in first-class condition.

Fort Du Pont, Del.—Bids are wanted Sept. 17 for repairing wharf at Fort Du Pont. Address Constructing Quartermaster.

Abilene, Tex.—John Bardon, of Ft. Worth, Tex., is stated to have received the contract for the superstructure of the post-office here, for $79,313.

New York, N. Y.—Bids are wanted Aug. 30 for furnishing material and labor for certain construction work, installation of steam heat, etc., Marine Barracks, Navy Yard, New York. Plans, specifications, etc., may be obtained from Boring & Tilton, Archts., 32 B'way, N. Y. City; F. L. Denny, Q. M., U. S. Marine Corps, Washington, D. C.

Norfolk, Va.—The following bids are reported opened Aug. 18 by Admiral Endicott, Chief of the Bureau of Yards & Docks, U. S. N., Washington, D. C., for furnishing a floating derrick: Brown Hoisting Machinery Co., Cleveland, $69,950; Snare & Trieste, New York, $64,950, $63,950 and $63,450; Merritt & Chapman Derrick & Wrecking Co., New York, derrick now in commission, $69,500.

Washington, D. C.—Bids are wanted Aug. 26 for electric light fittings and materials for the Interior Department Buildings, Washington. E. A. Hitchcock, Secy. Dept. of the Interior.

Portland, Ore.—Bids are wanted Oct. 2 for furnishing and placing in position certain combination gas and electric light fixtures in the U. S. Custom House at Portland. H. A. Taylor, Asst. Secy. of the Treas., Treas. Dept., Washington, D. C.

Ft. Rodman, Mass.—Bids are wanted Sept. 11 for erecting 2 single set officers' quarters and one barrack at Ft. Rodman, including plumbing, heating and electric wiring. Capt. H. P. Young, Constructing Q. M., U. S. A., Newport, R. I.

Philadelphia, Pa.—Bids are wanted Sept. 7 for erecting a corrugated galvanized sheet-steel building, 34 x 55 ft., at the Navy Yard, League Island, Pa. Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept.

Washington, D. C.—Bids will be received at the U. S. Engr. office Sept. 23 for furnishing electrically driven pumps, cold drinking water plant, etc., for the new Government Printing Office Building, as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids were opened Aug. 15 at Washington, by Jas. Knox Taylor, Supervising Archt., Treas. Dept., for installing an electric elevator in the U. S. Appraisers' Stores—*a* tandem gear, *b* single gear: Howard Foundry & Machine Works, Philadelphia, *a* $8,573, *b* $8,123; Otis Elevator Co., New York, *a* $6,370, *b* $6,370; Morse, Williams & Co., Philadelphia, *a* $6,800, *b* $6,140; Winslow Elevator Co., Chicago, *b* $8,750.

Ft. H. G. Wright, N. Y.—Bids are wanted Sept. 12 for erecting a barrack at Ft. H. G. Wright, N. Y. Address Constructing Quartermaster, New London, Conn.

Seattle, Wash.—The following bids are reported opened Aug. 13 by Maj. John Mills, Corps of Engrs., U. S. A., for excavating on Lake Washington Canal: Cut to be 10 ft. wide at bottom and varying in depth from 30 to 36 ft.; total estimated amount of excavation, 96,000 cu. yds.: Puget Sound Bridge & Dredging Co., Seattle, 33 cts. per cu. yd.; Seattle Bridge Co., 35 cts.; Smyth & Howard, Portland, Ore., 27 cts.; C. J. Erickson, 31 cts.; Rydstrom & Goerig, 34 cts.; Hennington & Fortner, 28 cts.

MISCELLANEOUS.

Ft. Thomas, Ky.—Bids will be received by Ward Baldwin, 9 W. 4th St., until Aug. 27, for building 4 concrete piers for the Union Light, Heat & Power Co. at Ft. Thomas.

Roswell, N. M.—The Arid Land Reservoir Co. has been incorporated, with a capital of $250,000, to construct 3 canals, one 2¼ miles long, one 18 miles long, and one 13 miles long. Headquarters to be at Roswell. Incorporators: Jas. F. Hinkle, Wendell M. Reed, and others, all of Roswell.

Jersey City, N. J.—Chief Engineer Van Keuren, of Jersey City, is stated to have presented to the Street and Water Board 8 plans for improving the tract of land in the South Cove, granted by the Legislature. The plans contemplate the construction of docks from 5 large piers to 15 small piers, and the estimated cost ranges from $216,000 to $270,000.

Manitowoc, Wis.—The Council is stated to have passed an ordinance providing for the construction of a 1,200-ft. protecting sea wall opposite the Little Manitowoc bridge; cost about $5,000.

The Council is also reported to have decided to dredge a 21-ft. channel up river, at a cost of about $35,000.

Danbury, Conn.—Bids will be received by the Connecticut Construction Co., Danbury, for a topographical survey of about 250 acres, on the shores of Peach Lake, in the towns of North Salem and Southeast, New York.

New Orleans, La.—The project of a large dry-dock plant either at this place or Mobile, involving an investment of $10,000,000, is reported under investigation. S. B. McConnico, Pres. Arizona & Utah R. R., headquarters, N. Y. City; Capt. J. C. Soley, Gen. Mgr., New Orleans Coal, Iron & R. R. Co., with headquarters at Talladega, Ala., and Herbert Jackson, Augusta, are said to be interested.

NEW INDUSTRIAL PLANTS.

The Taunton Locomotive Mfg. Co., Taunton, Mass., will put up a 185 x 45-ft. foundry with 15-ton traveling crane and two core ovens. The crane, foundry blower, elevator and rattlers will be operated electrically and a 500-volt, 75 to 100-kw. generator will probably be required.

The Uneeda Brewing Co., Wheeling, W. Va., Wm. F. Bayha, Sec'y, will build a new brewery.

Geo. B. Naylor, Plainfield, N. J., will put up a 40 x 108-ft. paint mill, using about 50 H.-P.

The Standard Paper Mfg. Co., Richmond, Va., has purchased a mill property now fitted with three water-wheels, which will be replaced by a turbine of about 250 H.-P. on 19-ft. head.

Fred Ahlbrecht & Son, Glencoe, Minn., will put up a 125-bbl. flour mill at Verndale, Minn., and probably install a 75-H.-P. engine and 100-H.-P. boiler. E. M. Britts, Verndale, states that encouragement would be extended to parties building starch and willow basket factories.

J. P. Hartzell, town treasurer, Mt. Pleasant, S. C., wishes to communicate with builders of a gasoline engine suitable for driving 60 passenger cars on a level track at a speed of 20 miles or more.

The Riverside Paper Mfg. Co., Glastonbury, Conn., is putting up a 104 x 68-ft. brick mill for binders' boards, and will install a 75-H.-P. engine and 100-H.-P. boiler.

The new open-hearth plant of the Altoona Foundry & Machine Co., Altoona, Pa., will be in a 50 x 170-ft. building, with the producers and power plant in separate structures. A 40-H.-P. engine and 80-H.-P. boiler are needed.

The Gem City Stove Co., Dayton, O., whose plant was partly burned on Aug. 2, will put up a 2-story, 45 x 100-ft. building for engine and cleaning rooms and plating department, and a 4-story, 60 x 200-ft. building for mounting stoves.

Geo. H. Plowman, Betz Bldg., Philadelphia, is receiving bids for the plant of the Whitney Car Wheel Co. at South Camden. There will be a 100 x 200-ft. foundry, 40 x 40-ft. power house, 2-story 50 x 80-ft. machine and pattern shop, 25 x 25-ft. core shop, and 3-story 20 x 25-ft. office.

The Lebanon Mill Co., Pawtucket, R. I., is erecting a 3-story and basement, 147 x 52-ft. mill from the plans of Wm. T. Henry, Fall River. Mechanical heating and automatic sprinklers will be employed and a 100-H.-P. steam power plant installed.

B. C. Keeley, Wyocena, Wis., will endeavor to furnish electric light and power in two towns 2½ and 5 miles distant, utilizing a water power plant he owns; if contracts are made he will be in the market for the electric outfit.

E. T. Skinkle, 177 La Salle St., Chicago, is receiving bids on a 60-ton ice machine for the Natchez, Miss., Ice Co., which will also add to its plant a 216 x 72-inch boiler.

BUSINESS NOTES.

The Means & Fulton Iron Works, Birmingham, Ala., are rebuilding the steelwork in the present stock-house and erecting that for the new plant of the Thomas, Ala., works of the Republic Iron & Steel Co. The contract includes a 640 x 91-ft. stock-house, 368 x 90-ft. bins, covering for overhead tracks, bin linings, chutes, and other steelwork.

Mr. H. V. Croll, who has been manager of the Spokane, Wash., branch office of the Edward P. Allis Co., has been appointed manager of the branch office to be established at 414 Dooly Blk., Salt Lake City, for the Allis-Chalmers Co., for its business in Utah, Nevada, Montana and Southern Idaho.

The Fisher Governor Co., Marshalltown, Ia., had the largest sales during July of any single month in its history, and its foreign trade is increasing materially.

Messrs. Edward F. and F. Milliken, of New York, and James W. DeGraff, of Plainfield, N. J., have filed in Newark incorporation papers for Milliken Bros., Inc., to construct bridges, ships, piers and tunnels. The capital is placed at $1,000,000.

The Allis-Chalmers Co., is furnishing the 40-ton plant of the Adler Gulch Mining & Milling Co., Virginia City, Mont., consisting of a Dodge crusher, two 3½ Huntington mills, two sets of plates, three Wilfley concentrating tables, and, if tests by Manager Morse B. Davis are favorable, tanks for cyanide treatment of tailings.

The Yorkville Independent Hygeia Ice Co., New York City, has recently purchased an engine from the Ball Engine Co., Erie, Pa., for electric lighting; and the National Carbon Co., Cleveland, O., has purchased from the same builders for electric light and power purposes a 350-H.-P. engine direct-connected to General Electric generator.

Among the recent orders received by the Sprague Electric Co., New York, are the following: 90-Kw. split-pole generator shipped to Bailey, Walker & Co., Buenos Aires, S. A.; 125-Kw. split-pole generator, Steelton Light, Heat & Power Co., Steelton, Pa.; 37½-Kw. split-pole generator, Ft. Wadsworth, Staten Island; 37½-Kw. engine-type generator, Ft. Hancock, N. J.; 80-H.-P. motor, American Linseed Co., Staten Island; 100-Kw. engine-type split-pole generator, Geuder & Paeschke Mfg. Co., Milwaukee; 50-Kw. generator and 15-H.-P. motor, Row & Conover, Newark, N. J.; 85-H.-P. motor, John Stephenson Co., Elizabeth, N. J.; 75-Kw. split-pole generator, Chase Rolling Mill Co., Waterbury, Conn.; 75-Kw. split-pole generator, Fred Miller Brewing Co., Milwaukee; 100-Kw. 550-volt split-pole belted type generator, Plymouth Mills, Plymouth, Mass.; 100-Kw. belted-type split-pole generator, C. S. Ashley, Toledo, O.; 100-Kw. 550-volt, belted-type split-pole generator, and various motors up to 50 H.-P., T. C. Keller, Chicago; a quantity of motors for the mines and refining plant of the Arlington Copper Co., Arlington, N. J.; 100-H.-P. motor, American Locomotive Co., Cooke Works, Paterson, N. J.; 60-Kw. split-pole generator, Fahys Watch Case Co., Sag Harbor, L. I.; two 25-Kw. engine-type split-pole generators for Madison Square Garden, New York, and 100-Kw. split-pole engine-type generator, Leland Hotel, Chicago.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Aug. 27.	Boston, Mass Adv., Eng. Record, Aug. 3 to 17.	Aug. 3
Aug. 27.	Well, Ft. Monroe, Va.	Aug. 10
Aug. 27.	St. Louis, Que	Aug. 24
Aug. 28.	Governor's Island, N. Y. Adv., Eng. Record, Aug. 10 to 24.	Aug. 10
Aug. 28.	Kahoka Mo Adv. Eng. Record, Aug. 17.	Aug. 17
Aug. 28.	Appleton, Wis	Aug. 17
Aug. 28.	Pleasantville, N. Y	Aug. 17
Aug. 29.	Stanley, Wis Adv., Eng. Record, Aug. 17, 24.	Aug. 17
Aug. 29.	Hydrants, etc., New York, N. Y.	Aug. 17
Aug. 30.	Supplies, Minneapolis, Minn	Aug. 10
Sept. 2.	Artesian well, San Jose, Cal	Aug. 10
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 2.	Hopkins, Minn	Aug. 17
Sept. 2.	Pipe, Plymouth, Mich	Aug. 24
Sept. 3.	Hendricks, Minn	Aug. 24
Sept. 3.	Reservoir, Endicott, N. Y Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 4.	Geneva, O Adv., Eng. Record, Aug. 24.	Aug. 17
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Valves, Cleveland, O	Aug. 17
Sept. 10.	Plans, Muskogee, Ind Ter Adv., Eng. Record, Aug. 3.	Aug. 3
Sept. 11.	Garretson, S D.	Aug. 24
Sept. 18.	Socrabaya, Java	July 20
Sept. 20.	Longmont, Colo	Aug 24
Sept. 21.	Washington, D. C	Aug. 17
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29.	June 29
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3

SEWERAGE AND SEWAGE DISPOSAL.

Aug. 26.	Laurel, Del	Aug. 17
Aug. 26.	Atlantic City, N. J	Aug. 24
Aug. 27.	Hammond, Ind	Aug. 17
Aug. 27.	Moorestown, N. J	Aug. 17
Aug. 27.	Cranford, N. J	Aug. 24
Aug. 27.	Dayton, O	Aug. 24
Aug. 27.	Philadelphia, Pa	Aug. 24
Aug. 27.	Macomb, Ill	Aug. 24
Aug. 27.	Delray, Mich	Aug. 24
Aug 28.	Elkhart, Ind	Aug. 3
Aug 28.	Bowling Green, O	Aug. 10
Aug. 29.	Stanley, Wis Adv., Eng. Record, Aug. 17, 24.	Aug 17
Aug. 29.	Bloomington, Ill	Aug. 24
Aug. 29.	St. Paul, Minn	Aug. 24
Aug 30.	Bay City, Mich	Aug. 24
Aug. 31.	Washington, D C Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 31.	Cerrogordo, Ill	Aug. 17
Aug. 31	Urbana, Ill	Aug. 24
Sept. 2.	Paris Ky	Aug. 24
Sept. 2.	Paw Paw, Mich	Aug. 24
Sept. 2.	Glenville, O	Aug. 10
Sept. 2.	Wausau, Wis	Aug. 17
Sept. 2.	Disposal plant, Kings Park, N. Y. Adv., Eng. Record, Aug. 17.	Aug. 17
Sept. 3.	Dayton, O	Aug. 10
Sept. 3.	Portland, Me Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 4.	New York, N. Y	Aug. 24
Sept 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Glenville, O	Aug. 24
Sept. 7.	Otto Pa	Aug. 24
Sept. 9.	Toledo, O	Aug. 24
Sept. 9.	Plainfield, N. J	Aug. 24
Sept. 10.	Cincinnati, O	Aug 24
Sept. 25	Havana Cuba Adv., Eng. Record, June 29 to July 20, Aug. 17, 24.	June 29
Oct. 1.	Canyon City, Colo	Aug. 24

BRIDGES.

Aug. 26	Alexandria, La	Aug. 3
Aug. 26.	Indianapolis, Ind	Aug. 17
Aug. 26.	Substructure, St. Clairsville, O	Aug. 17
Aug. 26.	Ypsilanti, Mich	Aug. 24
Aug. 26.	Coraopolis, Pa	Aug. 24
Aug. 27.	Superstructure, St. Clairsville, O	Aug. 10
Aug. 27.	Binghamton, N. Y	Aug. 17
Aug. 28.	New York, N. Y	Aug. 17
Aug. 29	Doylestown Pa	Aug. 10
Aug. 31.	Melan arch bridge, Washington, D. C. Adv., Eng. Record, Aug. 10.	Aug. 10
Aug. 31.	Steel arch girders, Washington, D. C Adv., Eng. Record, Aug. 10.	Aug 10
Sept. 1.	Souris, Man	Aug. 17
Sept. 2.	Vicksburg, Miss	Aug. 3
Sept. 2.	Decatur, Ind	Aug. 17
Sept. 2.	Raton, N. M	Aug. 24
Sept. 3.	Cambridge, O	Aug. 17
Sept 3.	Toledo, O	Aug. 10
Sept. 3.	Medo, Minn	Aug. 3
Sept. 3.	White Sulphur Springs, Mont	July 27
Sept. 3.	LaMoure, N. D	Aug. 10
Sept. 4.	Olivet, S. D	Aug. 3
Sept. 7.	Springfield, O	Aug 24
Sept. 9.	Indianapolis, Ind	Aug. 17
Sept. 9.	Zanesville, O	Aug. 24
Sept. 30.	Fredericton, N. B Adv., Eng. Record, Aug. 17, 24.	Aug. 17
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
———	St. Petersburg, Russia	Aug. 17

PAVING AND ROADMAKING.

Aug. 26.	Vailsburg, N. J.	Aug. 10
Aug. 26.	Mt. Vernon, N Y	Aug. 17
Aug. 26.	Atlantic City, N. J Adv. Eng. Record, Aug. 17.	Aug. 17
Aug. 27.	Milwaukee, Wis	Aug. 24
Aug. 28.	Madison, Wis	Aug. 10
Aug. 28.	Des Moines, Ia	Aug. 10
Aug. 28.	Philadelphia, Pa	Aug. 24
Aug. 28.	Indianapolis, Ind	Aug. 24
Aug. 29.	Buffalo, N. Y	Aug. 24
Aug. 30.	Knox, Ind	Aug. 17
Aug. 30.	North Judson, Ind	Aug. 17
Aug. 30.	Keokuk, Ia	Aug. 3
Aug. 31.	Cleveland, O	Aug. 3
Aug. 31.	Cincinnati, O	Aug. 3
Aug. 31.	Ashtabula, O Adv., Eng. Record, Aug. 17.	Aug. 10
Aug. 31.	Cambridge, O	Aug. 10
Aug. 31.	Huntington, N. Y	Aug. 17
Aug. 31.	Youngstown, O	Aug. 17
Aug. 31.	Galion, O	Aug. 17
Aug. 31	Newburg, O	Aug 24
Sept. 2.	Cincinnati, O	Aug. 24
Sept. 3.	Elizabeth, N. J	Aug. 17
Sept. 3.	Kenosha, Wis	Aug. 24
Sept. 3.	White Plains, N. Y	Aug. 24
Sept. 4.	Cincinnati, O	Aug 24
Sept. 5.	Des Moines, Ia	Aug. 24
Sept. 5	Findlay, O	Aug. 17
Sept. 5.	Corydon, Ind	Aug. 17
Sept. 7.	Cincinnati, O	Aug. 17
Sept. 7.	Washington, D. C Adv. Eng. Record, Aug. 17.	Aug. 17
Sept. 7.	East Cleveland, O	Aug. 24
Sept. 9.	Green Bay, Wis	Aug. 24
Sept. 9.	Cincinnati, O	Aug. 17
Sept. 9.	Barberton, O	Aug. 24
Sept. 10.	Toledo, O	Aug. 17
Sept. 14.	Alliance, O	Aug. 24
Sept. 14.	Youngstown, O	Aug. 24
Sept. 15.	Marion, Ia	Aug. 10
Sept. 20.	Chagrin Falls, O	Aug. 24
Sept. 24.	Conneaut, O	Aug. 24
Sept. 25.	Havana, Cuba Adv., Eng. Record, June 29 to July 20, Aug. 17, 24.	June 29

POWER, GAS AND ELECTRICITY.

Aug. 28.	Kahoka, Mo Adv., Eng. Record, Aug. 17.	Aug. 17
Aug. 31.	Installing engines and dynamos in hospital, Poughkeepsie, N. Y Adv., Eng. Record, Aug 24.	Aug. 24
Sept. 1.	Jacksonville, Cal	July 20
Sept. 3.	Franchise, San Rafael, Cal	Aug. 10
Sept. 3.	Media, Pa. Adv., Eng. Record, Aug 24.	Aug. 24
Sept. 5.	Cleveland, O	Aug. 17
Sept. 9.	Washington, D. C Adv., Eng. Record, Aug. 10 to 24.	Aug. 10
Sept. 9.	McIntosh, Minn	Aug. 24
Sept. 20.	El Paso, Tex.	Aug. 10
Sept. 21.	Steam generating equipment, Washington, D. C. Adv., Eng. Record, Aug. 3.	Aug. 3

GOVERNMENT WORK.

Aug. 26.	Portland, Me Adv. Eng. Record, Aug 3 to 17.	Aug. 3
Aug. 26.	Bldg., Sitka, Alaska	July 20
Aug. 26.	Philadelphia, Pa Adv., Eng. Record, July 27 to Aug. 24.	July 27
Aug. 26.	Washington, D C	Aug. 24
Aug. 27.	Hydraulic machinery, etc., Philadelphia, Pa	Aug. 3
Aug. 27.	Well, Ft. Monroe, Va	Aug. 10
Aug 28.	Artesian well, Governor's Island N. Y. Adv., Eng. Record, Aug. 10, 17.	Aug. 10
Aug. 29.	Boise, Idaho Adv., Eng. Record, July 6, 13.	July 6
Aug. 29.	Brunswick, Ga Adv., Eng. Record, July 29, Aug. 3.	July 27
Aug. 30.	Arsenal storehouse, Philadelphia, Pa	Aug. 10
Aug. 30.	New York, N. Y	Aug. 24
Aug. 31.	Philadelphia, Pa	Aug. 10
Aug. 31.	Coal towers San Juan, Porto Rico	July 20
Aug 31.	Bremerton, Wash	Aug. 3
Aug. 31.	Algiers, La	Aug. 3
Aug. 31.	Dredging Detroit, Mich	Aug. 17
Sept. 3.	Mechanical equip., San Francisco, Cal. Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Interior finish, San Francisco, Cal Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Canal work, Chicago, Ill. Adv., Eng. Record, Aug 3 to 24.	Aug. 3
Sept. 3	Bldg., Grand Junction, Colo	Aug. 17
Sept. 4.	St. Cloud, Minn Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Sept 4.	Bldg., htg., etc., Ft. Preble, Me	Aug. 17
Sept. 5.	Bldgs., Lawrence, Kan	Aug. 17
Sept. 5.	Bldg., Southport, N. C	Aug. 17
Sept. 5	Htg bldg., Reedy Island, Del. Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 6.	Sea wall, Ft. Monroe, Va Adv., Eng Record, Aug. 17.	Aug. 17
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 7.	New York, N. Y	Aug. 10
Sept. 7.	Bldg., Philadelphia, Pa	Aug. 24
Sept. 9.	Washington, D. C Adv., Eng. Record, Aug. 10 to 24.	Aug 10
Sept. 9.	Mobile, Ala	Aug. 17
Sept. 9.	Bldg., Reedy Island, Del Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 10.	Ash handling apparatus in P. O. bldg., St Louis, Mo Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 11.	Officers' quarters, Ft. Rodman, Mass	Aug. 24
Sept. 12.	Barracks, Ft. H. G. Wright, N. Y.	Aug. 24
Sept. 14.	Bldg., htg., etc., Ft. MacKenzie, Wyo.	Aug. 24
Sept. 16.	Dredging, Savannah, Ga. Adv., Eng. Record, Aug. 17, 24.	Aug. 17
Sept. 16.	Butte, Mont Adv., Eng. Record Aug. 17, 24.	Aug. 17
Sept. 17.	Fort DuPont, Del.	Aug. 24
Sept. 19.	El. light plant, Ft. Washington, Md Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 23.	Pumps, etc., for bldg., Washington, D.C. Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 23.	Bldg., West Point, N. Y. Adv., Eng. Record, Aug. 24.	Aug. 24
Oct. 1.	Galveston, Tex Adv., Eng Record, Aug 10 to 24.	Aug. 10
Oct. 2.	Gas and elec. fixtures, Portland, Ore	Aug. 24
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I.	June 15

BUILDINGS.

Aug. 26.	Coal handling apparatus in hospital, New York, N Y	Aug. 17
Aug. 26.	Pub. bldg., Lincoln, Ill	Aug. 24
Aug. 27.	School, Warrensville, O	Aug. 17
Aug. 27.	Plumbing, etc. in schools, St. Paul, Minn.	Aug 24
Aug. 27	Hospital addition, Pottsville, Pa	Aug. 24
Aug. 29.	School, Weatherly, Pa	Aug. 24
Aug. 29.	Htg. school, Allegheny, Pa	July 27
Aug. 30.	School, New Haven, Conn	Aug. 10
Aug. 30.	City hall, Bellaire, O	Aug. 17
Aug. 30.	School, Woodcliff, N. J.	Aug. 24
Aug. 31	Pub. bldgs., Peoria, Ill	Aug. 17
Aug. 31.	Village Hall, Bellevue, O.	Aug. 10
Aug. 31.	Htg. Pub. bldg., New Westminister, B. C	Aug. 17
Aug. 31.	Bus. bldg., Shamokin, Pa	Aug 24
Sept. 2.	Asylum, Pine Bluff, Ark	July 20
Sept. 2.	College bldgs., Stillwater, Okla. Ter.	Aug. 3
Sept. 2.	Schools, Berkley, Va	Aug. 24
Sept. 3	School, Hartford, Conn	Aug. 24
Sept. 3.	Htg jail, Jeffersonville, Ind	Aug. 24
Sept. 3.	Court house annex, Macon, Ga	Aug. 24
Sept 4.	Pub bldg., New York, N. Y	Aug. 24
Sept. 4.	School, Topeka, Kan	Aug. 24
Sept. 5.	Court house, Lake Charles, La	Aug. 10
Sept. 5.	Jail, Riverside, Cal	Aug. 17
Sept. 7.	Htg. Court house, Bloomington, Ill	Aug. 17
Sept. 7.	School, Redding, Cal	Aug. 17
Sept. 9.	Schools, Cleveland, O	Aug. 17
Sept. 10.	School Flint, Mich	Aug. 3
Sept. 10.	Shops for work house, Cincinnati, O	Aug. 24
Sept. 11.	Jail, Jackson, Minn	Aug. 17
Sept. 12.	Pub bldg. repairs, Dayton, O.	Aug. 24
Sept. 15.	School, Mauch Chunk, Pa	Aug. 24
Sept. 17.	Boilers in pub. bldg., National Military Home, Ind	Aug. 24
Sept. 17.	Court house, Cartersville Ga	Aug. 3
Sept. 24.	Power house, etc., for Capitol, St. Paul, Minn Adv., Eng. Record, Aug. 10, 17.	Aug. 10
Oct. 1.	Bank plans, San Antonio Tex.	Aug. 24

MISCELLANEOUS.

Aug. 27.	Pump, steam fitting, etc., New York, N. Y.	Aug. 17
Aug. 27.	Wharf, New Orleans, La.	Aug. 17
Aug. 27.	Piers, Ft. Thomas, Ky	Aug. 24
Aug. 28.	Canal, Alexandria, La	Aug. 10
Aug. 30.	Wharf, Iona, N. S	Aug. 17
Aug. 30.	Garb. crematory, Salt Lake City, Utah.	Aug. 17
Sept. 3.	Grain elevator, Montreal, Que Adv., Eng. Record, July 20, 27, Aug. 10.	July 20
Sept. 4.	El. Ry. power house, Pittsburg, Pa Adv., Eng. Record, Aug. 10.	Aug. 10
Sept. 4.	Street cleaning, Oakland, Cal	Aug. 17
Sept. 5.	R. R. work, Columbus, O.	Aug. 24
Sept. 10.	Garb. crematory, Hamilton, O.	Aug. 24
Dec. 10.	Rosario, Argentine Repub	Apr. 13
Dec. 31.	Incinerators, Calcutta, India.	Aug. 3
———	Dock, Collingwood, Ont.	Aug. 17
———	Topographical survey, Danbury, Conn.	Aug. 24

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Drafting.

It is generally believed by engineers, mechanical and civil, that the purpose of an engineering drawing is to depict certain objects or relations more clearly than can be done by words. This being the case, why is it that so many drawings are prepared in a manner confusing to the user of them? In many public and private offices the work is excellent, it is true. But we still have the bed-spread sheets which have to be consulted in the far corners with the assistance of a transit instrument, and as a contrast there is the sheet of note paper with lines in carpenter's crayon and lettering done with worn-out pencil stubs. Between these not infrequent monstrosities are sheets of reasonable size where everything must be laboriously scaled if dimensions are wanted and those things on which there has been an expenditure of an hour in drawing and ten hours in lettering and gingerbread work which it is a murder of the English language to call ornamentation. The technical schools have accomplished praiseworthy results in late years in raising the standard of drafting, but it occasionally seems as though their work and teaching were counterbalanced by the carelessness of men who should insist on good workmanship in the drafting room just as strongly as in the shop or the field. In drafting as in other skilled work, the responsibility for the quality of the product rests with the employer, who alone is the judge of what he shall turn out.

It is not enough in these times of keen competition among engineers to have a store of theoretical and practical information at instant command; it is necessary to put that information in shape to be understood by the employer or his agent with as little study on his part as the subject permits. No business man likes to have his desk cumbered with yards of blue-prints where small sheets are equally good, and no workman likes big drawings if he can have equally clear little ones. The engineer draws his fees or his salary for making his particular class of specialized information clear to those who have not acquired it by study and experience. If he does not make these subjects clear, provided his own knowledge is not so muddy as to be incapable of classification, he is taking money which he has not earned.

A satisfactory drawing must fulfill two classes of requirements; it must answer all reasonable inquiries made of it by the user, and it must be produced economically and kept readily. The reasonable use of a drawing is not often borne in mind during the drafting, and valuable time is wasted every working day in the year in producing tracings of an accuracy as ridiculous in view of their purpose as the use of decimals in expressing the result of the test of a 1,000-horse-power steam plant. The same lack of regard for the user of a working drawing leads to the omission of figuring of dimensions; no draftsman has any right to steal another man's time by such neglect, particularly when he knows, if he knows anything about the craft, that the shrinkage and stretching of drawings renders scaling hazardous. Another mark of shiftlessness is careless lettering. Lithographers' Gothic, upright and inclined, can be executed with great rapidity and satisfactory results after a little steady practice, and block letters for main titles, although more difficult to make, can be drawn quickly by anyone who is willing to take the trouble to train his hand and eye. Fancy letters and alleged scrollwork are generally as out of place on an engineer's drawings as elaborate shading and conventional hatching for little-used materials.

The requirements of economy in the drafting room render it desirable to make drawings on sheets of a few standard sizes. Formerly the sizes were very large, but there has been a commendable reduction of these dimensions of late. The value of an engineering design is not proportional to the area of paper on which it is depicted, and a number of engineers who have waked up to this fact are already using sheets of very small size. Everything is indicated in outline in the drawings of assembled parts, figuring being used to give the sizes of all parts, with detail sketches on a larger scale of the portions of the general diagrams requiring further explanation. The simplicity, clearness and handiness of these drawings are in striking contrast to the old-fashioned deserts of paper. Of course, all drawings cannot be made in this manner, but most of the present output can be rendered much simpler and clearer. Usually there are one or two small parts of the machine or structure which are far more complicated than the others, and these are generally allowed to set the size for the entire drawing, making a sheet perhaps 36 inches long. By the up-to-date plan the size of the sheet is fixed by the general outline, and these special features are drawn on a larger scale, generally on the same sheet. This cuts the size of the sheet in two, renders it unnecessary to wear out one's eyesight in reading large drawings, and makes the whole presentation of the subject concise and compact.

The busiest part of the drafting year is now approaching, which is the reason for calling attention at this time to these features of such work. No employer cares to spend money on drafting which is neither economical in first cost nor of the best service when completed. It is an easy matter to give these suggestions a trial, just as it is not difficult to arouse enough interest in their work among the men to have them acquire facility in neat, rapid lettering. It may not be worth the bother in some places, perhaps, but, judging from an acquaintance with the drafting output in all parts of the country, there are opportunities for improvement in many offices, large as well as small.

The Electrical Power Station of the City of Prague.

Early in 1899 the city of Prague undertook the establishment of its own electrical power station, to supply current for public and private lighting and for operating the street railroads. For the latter direct current was necessary, but for the other purposes it was decided to use three-phase alternating current. The system consists of a main power station and two sub-stations, the main station generating alternating current at 3,000 volts, which is transmitted to the city, where part is reduced by static transformers to 120 volts potential and part converted to direct current at 500 to 600 volts in the sub-stations. The current for the portion of the road adjoining the power station is supplied by direct-current generators in the station itself. The latter is located in Holeschowitz, a suburb of Prague, on the left bank of the Moldau River, and lies on a branch of the Austro-Hungarian state railroad, which passes through the yard about 9 feet above the surface. The establishment embraces a boiler and engine house, coal sheds, storehouses, car sheds, shops and an office building. The following notes on the plant are taken from the "Zeitschrift" of the Society of German Engineers.

The engine and boiler house is a one-story and basement structure of brick and steel, 133 feet wide, and will be 480 feet long when completed. It is divided by a longitudinal wall into a 72-foot engine room and a 59-foot boiler room having separate roofs, the trusses of which are 38 and 27 feet above floor level. A hand crane traverses the engine room. In the center of the building as completed is an addition carried up to two stories, furnishing room for the switchboards on the ground floor, laboratory and bath rooms in the basement, and a room for photometry on the second floor. The coal shed is built against the railway embankment, and when completed will be 155 feet long, 43½ feet wide and 20½ feet high. Its capacity is 20,000 tons.

The necessary condensing water is furnished by the Moldau and is taken to the engine house through an arched brick conduit about 6 feet high and 3½ feet wide, a similar conduit 7 x 4¼ feet serving for the waste.

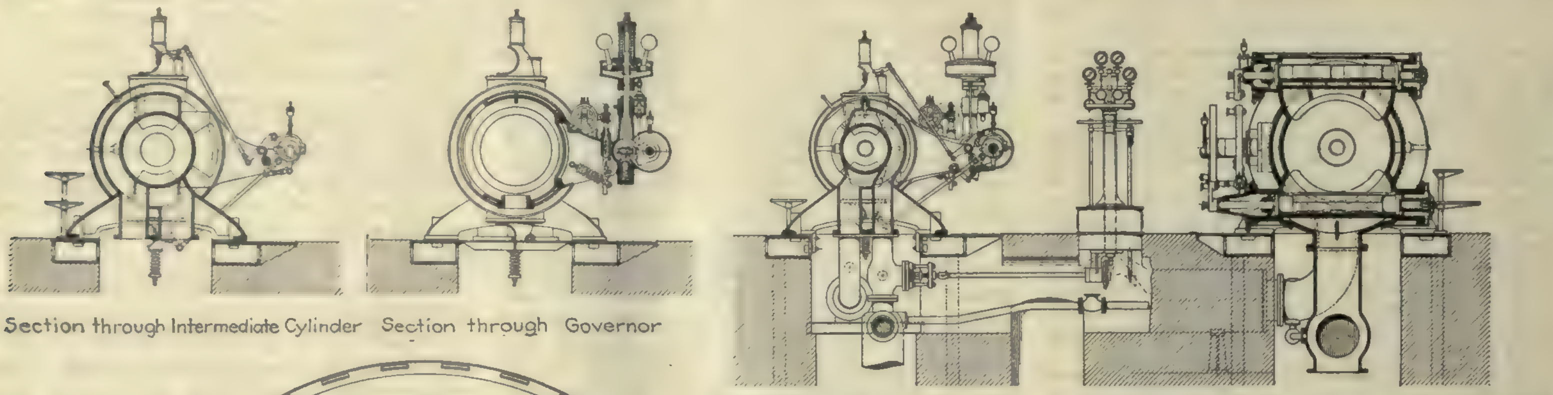
The boiler house is planned for 32 double-deck boilers of 2,700 square feet heating surface each, designed for 175 pounds steam pressure. Behind each boiler is a Schwoerer superheater which brings the temperature of the steam to between 570 and 640 degrees Fahr. The boilers are set in blocks of four with a 7-foot passage between the blocks. The smoke flues from each pair of blocks lead to a separate chimney, so that the whole plan calls for four stacks, of which two are in place. They are 230 feet high, measured from the top of the smoke flue inlet, and are nearly 10 feet in diameter at the top. Of the four blocks of boilers which are in place, three are in constant use, the fourth being in reserve. The feed water is obtained from the condensing water supply, and passed through a purification plant. To raise the water from the conduit there are two electrically-driven rotary pumps, each of a capacity of 1,500 gallons per minute, with place for a third. The purification plant is of 792,000 gallons per minute capacity, and can be doubled. It comprises a 42,000-gallon settling tank, into which the pumps discharge, four filters, and two pure-water reservoirs of 132,000 gallons capacity each. For cleaning the filters there is an electrically-driven washing apparatus placed in an addition at one end of the building. The pure water is fed to the boilers by injectors or by pumps. Of the latter there are three, as shown in the illustrations, space being left for a fourth. They are of the differential type, with compounded steam cylinders, of 8¼ and 14¼ inches diameter and 14 inches stroke. The pump plungers are 3½ and 5 inches in diameter, and the pump makes 60 revolutions per minute, at which speed it delivers 121 gallons per minute, though it can be increased to 100 revolutions. The pumps are supplied with eccentric-driven Riedler valves.

The coal is brought into the boiler house at the end adjoining the storage bin in hopper cars and raised by an electrically-driven elevator to a gallery in front of the boilers, on which are two tracks, one for full cars and one for empty. The coal is dumped from these cars into hoppers, of which there are two for each boiler, and thence falls into Vojacek automatic stokers. The stokers for each block of four boilers are driven independently, a 4-horse-power electric motor being furnished for the purpose. On the basement level there are also two tracks, on which run hopper cars to remove the ashes, as shown in one of the figures. In front of each furnace door and below the floor-level is an ash hopper, from which the ashes are received by a car, raised by an electrically-driven elevator in the middle of the building to the floor level, and so removed from the building.

The steam piping is in the form of a ring-main, the two longer sides being 12-inch pipe and joined by cross-connections of 10-inch pipe. From each steam-dome are two 6-inch pipes, one to the main header, the other to the superheater. Outside of the necessary stop valves, the two mains and the two connections from each boiler are provided with automatic check valves, which, in case of a break, cut off the portion in question. Expansion joints are also provided. The engines usually work condensing, but a free exhaust connection is also provided, carried up the partition wall of the main building to an exhaust head on the roof. The exhaust from the feed pumps is used to warm the feed water in the purifying plant. The feed main is of cast iron, 10 inches in diameter, and is laid in the basement, branches being carried up to the separate boilers. In case the rotary pumps are out of service, the purifying plant is furnished with a city water connection. The condensing water is drawn from the above-mentioned canal by the air pumps, there being also a 28-inch pipe communicating with the city water supply. The condensing water is led directly to the waste canal, but the drip and blow-off connections are led to the overflow of the purifying plant, and so to the waste. All the piping is so arranged that it is accessible throughout; the steam main is carried above the boilers in the boiler room, and in channels below the floor in the engine room.

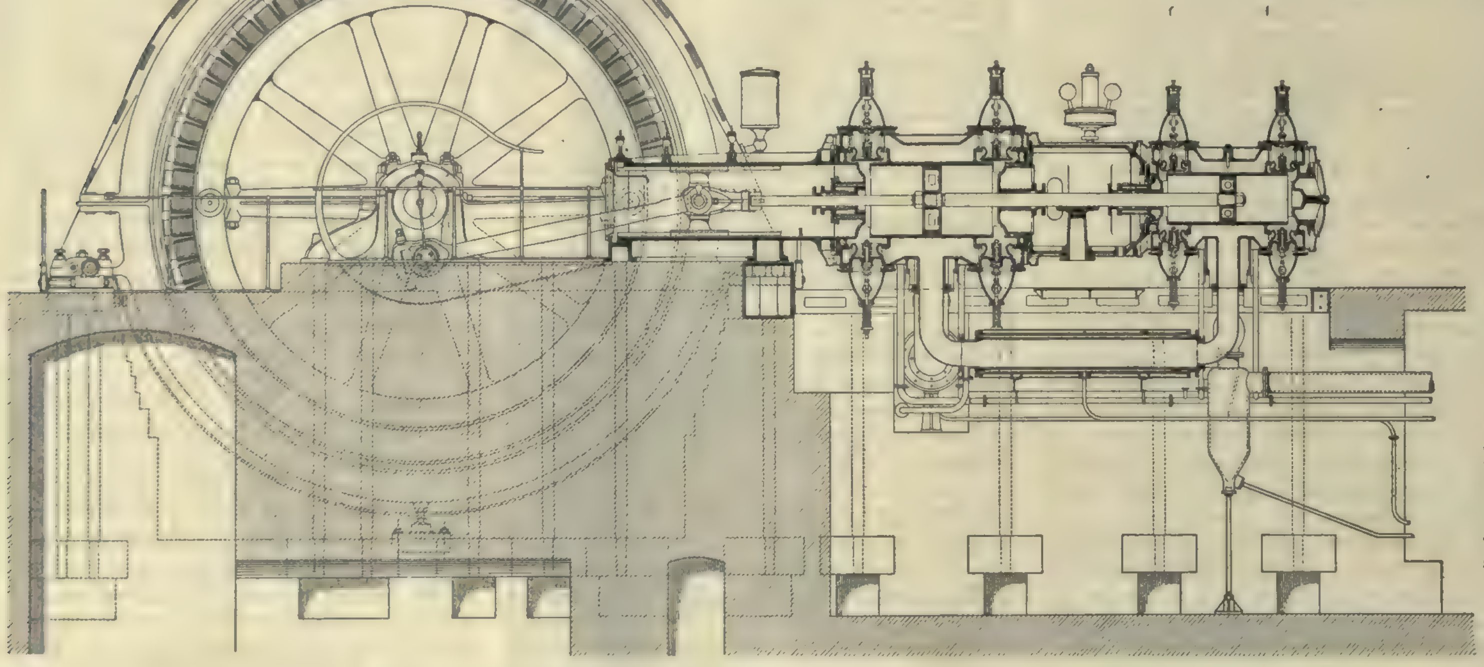
Riveted pipes are used for the larger diameters for superheated steam, Mannesman tubing being used for the smaller sizes; for saturated steam both Mannesman and copper tubing are used, while the small water piping is of copper and the large of cast iron.

The generators are arranged in two groups, namely, those supplying 550-600-volt direct current for the adjoining section of the tramway, and the large alternating-current generators. The former have tandem compound engines with cylinders of 17 and 27½ inches diameter and 27½ inches stroke, and at 162 pounds initial pressure and 125 revolutions develop 400 horse-power. They are direct-coupled to the generators. An air pump is driven from the rear cross-head. Next to these are to be five horizontal units of 750 normal and 1,000 maximum horse-power and five of 1,500 and 2,000 horse-power, of which only the first five are installed. Thus the working capacity of the station is now about 400 horse-power direct-current and 4,000 for alternating, one machine being held in reserve. The main engines are of the triple-expansion type, having cylinders 19.7, 29.5 and 47.4 inches in diameter and 47.4 inches stroke. They were built by the First Boemisch-Mahrischen Machine Works of Prague. In order to prevent overheating of the cross-head when using steam superheated to 530 degrees, the high-pressure cylinder is placed back of the intermediate, whereby also one troublesome high-pressure stuffing box is done away with. On the other side the air pump is placed behind and below the low-pressure cylinder, from which it is driven, as mentioned below; this makes the engine fairly symmetrical in plan. All three cylinders rest on a cast iron bed plate, and the cross-head guides rest on an iron girder that serves at the same time to support the armature ring of the generator. The high-pressure and intermediate cylinders are provided with Zvonicek valve gearing, in which bevel gearing on the main shaft turns a horizontal shaft parallel to the axis of the cylinders and carrying cams and followers which operate poppet valves. Because of the increased dis-



Section through Intermediate Cylinder Section through Governor

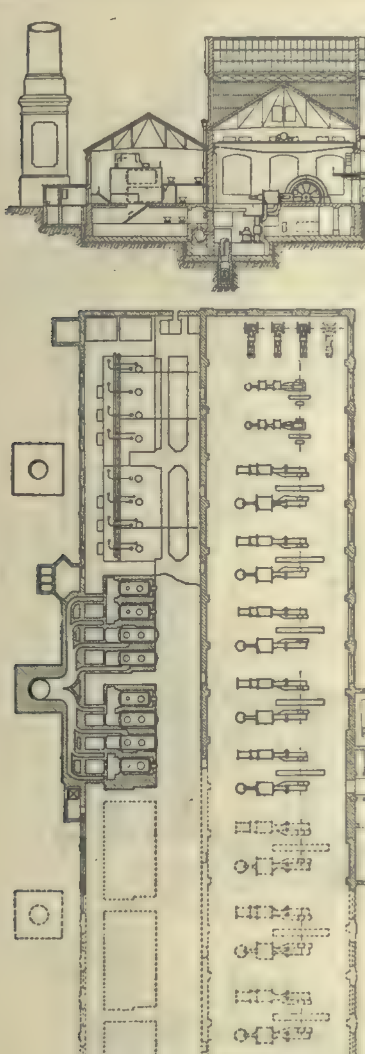
Section through High-Pressure Cylinder Section through Low Pressure Cylinder.



Longitudinal Section through High-Pressure and Intermediate Cylinders.

GENERAL FEATURES OF THE 750-HORSE-POWER ENGINES, PRAGUE ELECTRIC STATION.

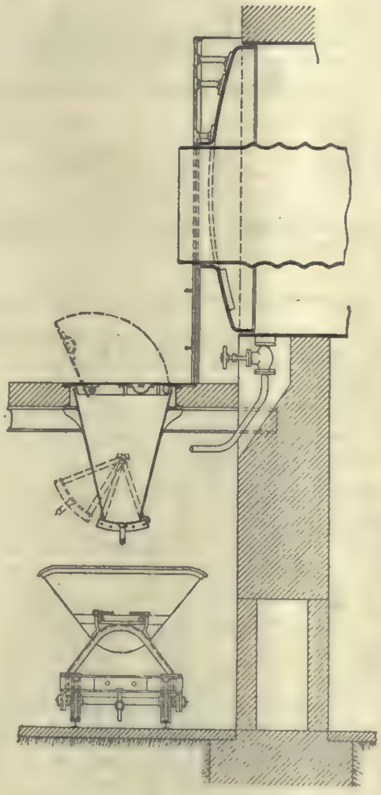
tance between the cam shaft and the cylinder axis, in this case the levers by which the motion is transmitted to the valves are so arranged as to bear on their axes in only one direction, so that when loosened by wear they will still work quietly. The expansion of the cam-shaft due to the heat of the high-pressure cylinder close by does not interfere with the working of the valve mechanism, as the cam slides freely by the follower without binding or affecting the motion. This is particularly advantageous for engines having a long cam-shaft, and using steam at high temperatures, as in this case. The governor is provided with means for slightly changing the speed while in motion, to facilitate working two or more units in parallel. The low-pressure cylinder has four Corliss valves, which can be set to work with compression if the free exhaust is used. The air pump is single-acting, and is placed at the rear of the low-pressure cylinder on the basement floor 20 feet below, and is driven by a bell-crank attached to the end of the piston rod. The foundations of the engines are massive, and ample space is left for access to all parts below floor level.



Arrangement of Station.

The direct-current dynamos are of 270 kilowatts capacity at 550 volts and 125 revolutions, and have 14 poles. They are connected to a three-panel generator switchboard on the ground floor, placed symmetrically with respect to a four-panel switchboard for the feeder lines. These boards consist of marble slabs set in iron frames. Each of the four feeder panels serves for a separate line, and has an ammeter, a wattmeter, a main switch, a non-arcing circuit breaker and a lightning arrester, the latter placed behind the board.

The alternating-current generators are designed for 3,000 volts, making 2,880 alternations and 90 revolutions per minute. They have a fixed armature inside of which is a revolving field having 64 poles. The latter serves as a flywheel as well, its weight being 29 tons. The total weight of the generator is 64 tons. The exciter is driven from the main shaft by a wheel engaging a worm of high pitch, making 400 revolutions per minute, thus making it possible to use an exciting dynamo of small size. It is a four-pole direct-current machine of about 13 kilowatts capacity at 80 volts.



Ash-Removal System.

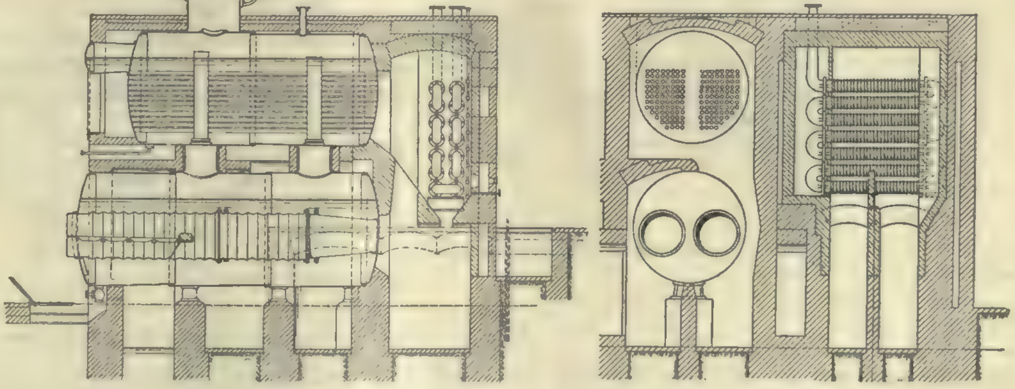
The alternating-current machines, together with their exciters, are connected with a switchboard in the gallery above the direct-current switchboard. In order to facilitate coupling in parallel a 1-horse-power motor is provided by which the engine governors can be controlled from the switchboard direct. The apparatus on the switchboard is so arranged as to prevent the attendants from coming in contact with the high-tension connections. The main switch is placed at the back of the board, and is worked from the front by a long handle. The switchboard for the long-distance feeders is laid out for 16 lines, of which there are eight already installed. Each line is provided with a circuit-breaker and three ammeters. The current needed in the plant itself is supplied through static transformers installed for the purpose.

From the power house the main conductors lead to a distributing station in the center of the city; there is also a line to that part of Prague lying beyond the Moldau, known as Kleinseite, supplying current to two motor-generators for the tramway lines and to static transformers for lighting and power purposes. From the main city distributing station conductors lead to a second sub-station and to all the static transformer stations lying on this side of the Moldau. The second converter substation contains three motor-generators of 450 kilowatts each, and a storage battery of 276 elements, having a capacity of 518 amperes for an hour. Space is provided for two additional motor-generators of the same type. These consist of a synchronous motor direct-coupled to a 550-600-volt railway generator, both carried on the same bedplate, a 6-kilowatt exciter dynamo being mounted on the end of the shaft. To start the converter the current from the storage batteries is used to drive the railway generator, acting as a motor, the load being transferred to the synchronous motor when it is working properly. The switchboard for the motor-generators is divided into two parts, a primary and secondary, for the alternating current and the direct current respectively. From the secondary board two connections are taken, one for the tramway lines, the other for the street lighting, there being 13 panels for the former and three for the latter. The return connection of the lighting circuit is joined to that from the tramway circuit. The station itself is lighted from the storage batteries.

The sub-station located in Kleinseite, to which reference has already been made, contains two motor-generators of the type just described, of 180 kilowatts capacity each, and a storage battery of 276 elements, having a capacity of 296 amperes for one hour. There is also room for a third motor-generator.

As already intimated, the main conductors from the power house to all parts of the city center at the distributing station, with the exception of the direct connection between the power house and the Kleinseite sub-station. This makes possible a number of combinations by which the necessity of cutting off a district because of an accident to a main feeder may be avoided. The tramways receive their current from armored cables laid below the street surface in a bed of sand covered with tile, or where the traffic is very heavy, iron covers are used. These cables are laid 2 feet below the sidewalk and 3 feet below the track level.

The apparatus and machinery were delivered almost exclusively by Prague firms, the design and erection being done by the City authorities.

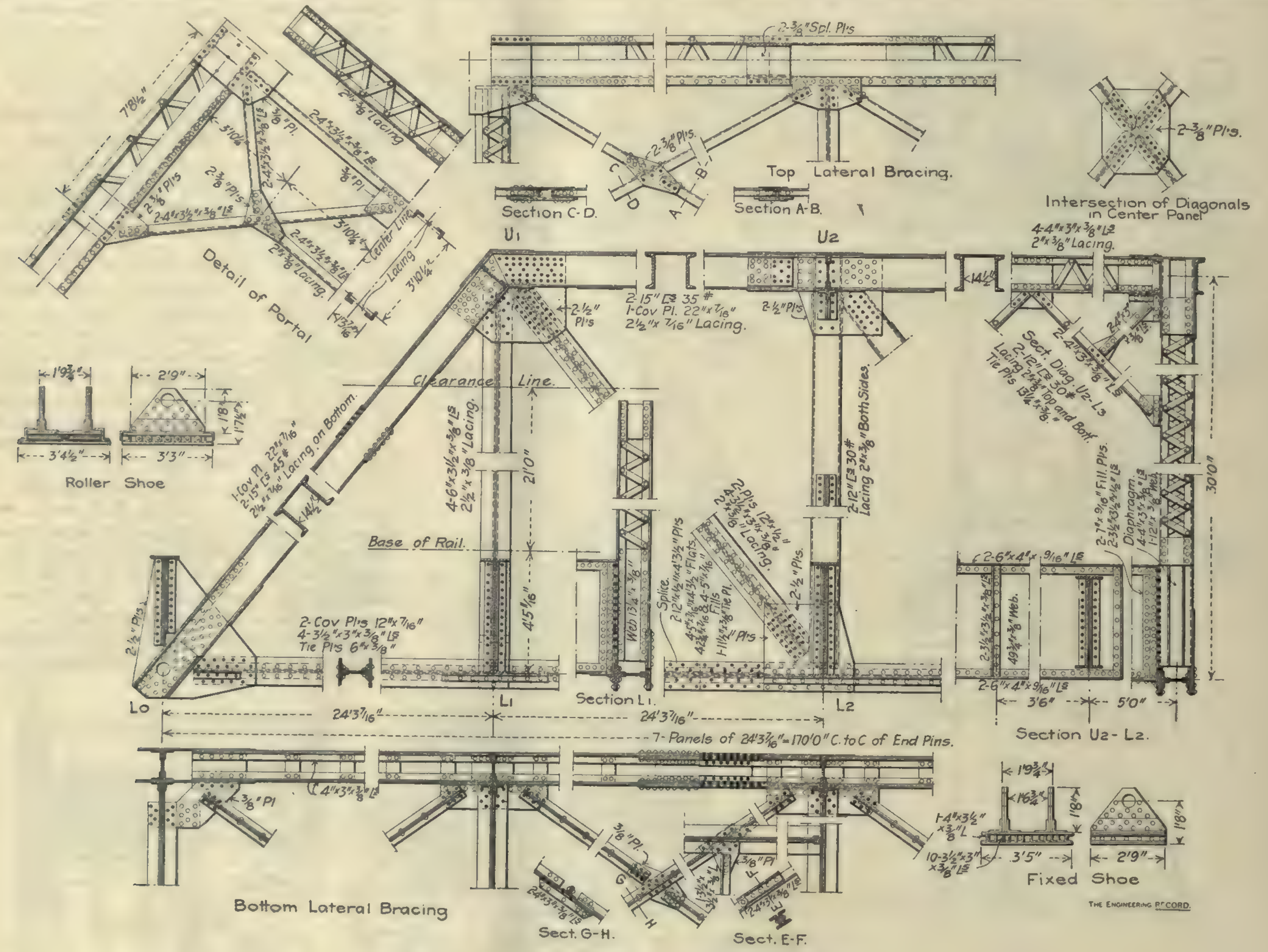


Double-Deck Boiler with Superheater.

American Bridges in Mexico.

A number of bridges and trestles have been manufactured in American shops for the Vera Cruz & Pacific Railroad, which present features of general interest. They were designed by Messrs. Waddell & Hedrick, of Kansas City, for a single standard-gauge track and the live loads specified for Class W in Mr. Waddell's "De Pontibus." The principal river crossings have through Pratt trusses for the channel spans and girder approaches, uniform details being adopted wherever possible. Some of the structures were manufactured by the Pennsylvania Steel Company and some by the Pencoyd Bridge Company.

On a part of the line the grade is high enough to justify the use of pin-connected structures with eye-bars, but elsewhere the lower chords are very close to the high-water mark and stiff members with riveted connections were adopted, so as to give greater rigidity against the impact of drift.



DETAILS OF 170-FOOT SPAN, RIO OBISPO BRIDGE.

WADDELL & HEDRICK, KANSAS CITY, ENGINEERS.

The details of all the through spans correspond essentially with those shown for the 170-foot span, the principal differences being those due to the different dimensions of the parts. The top chords are pairs of channels with cover plates and latticing, and are spliced at every panel. Pairs of large connection plates are shop-riveted to their webs at panel points and receive the field rivets of the web members and top lateral struts. Horizontal connection plates are shop-riveted to the upper sides of the top chords, and receive the lateral struts and diagonals. The struts have the same depth as the top chords, and are each made of two pairs of angles latticed, the diagonals being single angles. At the intersection of each pair of diagonals, one of them is cut to clear the other and is spliced across it with two angle clips and two cover plates, which are riveted to both angles. The portals consist of transverse horizontal struts similar to the intermediate struts, with knee-braces which have horizontal and diagonal struts at their centers.

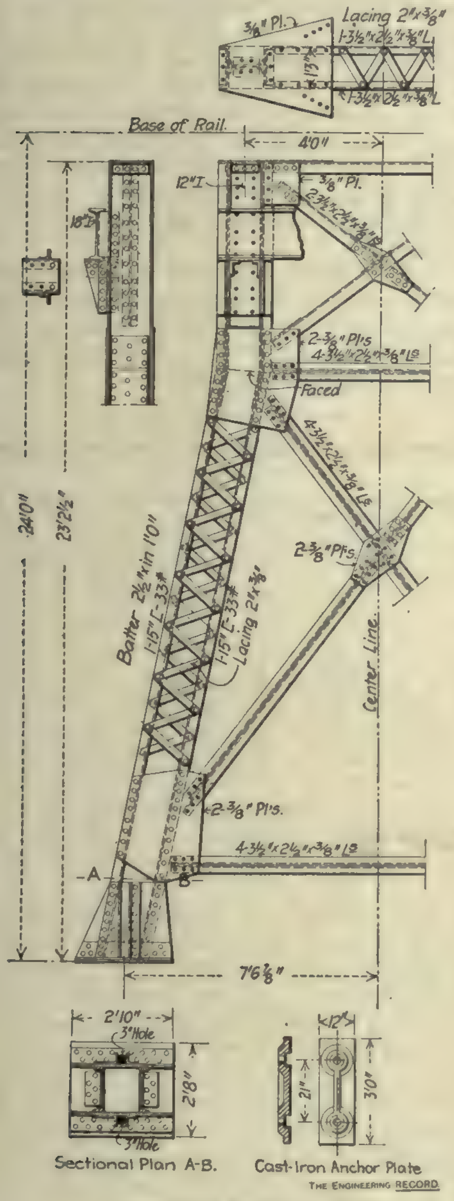
The vertical posts are pairs of latticed channels with their flanges turned inward; their webs are in the planes of the trusses and are stiffened by diaphragms where they are riveted to the ends of the floorbeams. The lower chords have H-shaped cross-sections made up of pairs of angles with horizontal latticing. Only in the longer spans are the flanges reinforced by cover plates in vertical planes. All the main truss posts, diagonals and lower chords have the same thickness, so that they fit uniformly between the double connection plates at every panel point.

The bottom lateral diagonals are pairs of angles riveted together back to back, and spliced with single plates at the intersections. Their horizontal flanges are down, and they are riveted through their vertical flanges to connection angles on the lower flanges of the stringers. Their end connection plates are riveted across the bottom flanges of the floorbeams and to shelf angles in the center of the lower-chord flanges. The end lower-chord connection plates are riveted to the insides of the end-post webs, project above them, and are connected by a transverse diaphragm to receive the end floorbeam. This is built with drop ends, and has its lower flange connected to the lower chord by a special diagonal plate which receives the end lateral diagonal.

The stringers are 40 inches deep, with ⅜-inch webs, 6 x 4 x ½-inch chord angles, and pairs of 3½ x 3½ x ⅜-inch crimped intermediate vertical web stiffeners. They are 7 feet apart, and are connected by zigzag angle braces. Alternate ties project 4 feet beyond the stringers on both sides to carry footwalk planks. The trusses have 6-inch pin bearing in end shoes. The fixed-end shoes rest on the edges of the vertical flanges of angles riveted to masonry plates, and the roller-end shoes are of the usual type, with their roller nests protected by side angles and by Z-bars at the ends riveted to the masonry plates and projecting over the base plates. The ends of all floorbeams, stringers and compression members are faced. All truss members were assembled together in the shops and all field rivet holes reamed to fit and match-marked.

The trestle bents for the plate-girder spans of the Obispo bridge are made with stiff members and riveted connections. Diagonals and cross-struts are riveted between double cover plates on the batter posts, and the latter terminate just below the bottoms of the girders. Vertical sections are spliced to their upper ends and have, in the transverse plane, I-beam diaphragms to which the ends of the plate girders are web-riveted. There are no stringers in the plate-girder spans, but those of the adjacent spans are web-connected to a transverse I-beam, seated on brackets near the tops of the upper sections of the posts. Each post is anchored by two 1½-inch bolts 6 feet long, which bear on special ribbed and countersunk cast-iron plates built into the concrete foundation piers. There are 3-inch anchor bolt holes in the base plates to allow for centering the posts.

There are no unusual features in the standard designs for through and deck plate-girder spans, but the details of the I-beam spans are of interest. Half-deck bridges with spans of 11 feet over all, are each made with four 12-inch 40-pound I-beams. Each rail is supported between an independent pair of beams 2 feet apart, which are connected by a solid trough floor riveted to their webs and resting on beveled fillers on their inside lower flanges. The pairs of beams are 30¾ inches apart in the clear. A 12-foot deck span consists of two 18-inch 55-pound beams 7 feet apart, riveted together with zigzag and transverse angle struts, connected to both top and bottom flanges. In the 20-foot deck spans, each rail is carried by a pair of 18-inch 70-pound I-beams 2 feet apart. Each pair of beams is separate from the other pair, and has double latticing riveted to the inside top and bottom flanges and end transverse diaphragms and base plates.



DETAILS OF STEEL PIER.

The specifications provided that for shipment all lateral angles should be bolted together in pairs and the pairs wired together in bundles, that all open or forked ends or unsupported lateral plates should have heavy timber filler-pieces bolted between them, that portals and bracing frames should be bolted together or reinforced by timber frames, and that all nuts should be screwed tight and the screw ends wrapped with twine wound between the threads.

The dead weight per lineal foot of standard spans of different lengths was assumed as follows: 12-foot deck I-beams, 208 pounds; 20-foot deck plate girders, 326 pounds; 30-foot deck plate girders, 440 pounds; 40-foot deck plate girders, 527 pounds; 50-foot deck plate girders, 633 pounds; 35-foot half-deck plate girders, 839 pounds; 40-foot half deck plate girders, 876 pounds; 45-foot half-deck plate girders, 910 pounds; 50-foot half-deck plate girders, 1,030 pounds. Through riveted fixed spans were assumed as follows: 75-foot, 1,130 pounds per lineal foot; 100-foot, 1,230; 125-foot, 1,330; 150-foot, 1,440; 175-foot, 1,550; and 220-foot, 1,660.

Dissolved Oxygen and Carbonic Acid in Water and Their Effect on Microscopic Organisms.

Abstract of a paper presented by George C. Whipple and Horatio N. Parker to the American Microscopical Society.

The object of the paper is to call attention to the fundamental importance of the relations which exist between the dissolved oxygen and carbonic acid in natural waters and the occurrence of the microscopic organisms; to describe the methods best adapted to determine the amounts of these dissolved gases in water; and to collate the results of the determinations which have been already made, supplemented by original observations and experiments.

The methods recommended for the determination of the dissolved gases are Winkler's for oxygen, and Seyler's for carbonic acid. The amount of oxygen dissolved in water to the point of saturation varies, it is shown, with the temperature, and the amount of dissolved carbonic acid varies with the gaseous pressure of the carbonic acid present in the atmosphere. It is seen that surface waters have what may be called a respiratory process, by which oxygen is breathed in and carbonic acid exhaled, or carbonic acid taken in and oxygen given out—these changes being controlled by laws which govern the equilibrium of the dissolved gases to those present in the atmosphere.

Rain water is practically saturated with oxygen, and contains carbonic acid in amounts varying from 1 to 3 parts per million according to the character of the atmosphere. In the vicinity of cities it may be high, while in the country it is generally low. Surface waters deficient in organic matter and exposed to the air usually contain oxygen nearly to the point of saturation and often are completely saturated; but the amount of carbonic acid is generally small, being seldom more than 3 parts per million. If organic matter is present, however, decomposition may occur, with the result that the oxygen is decreased and the carbonic acid increased. The larger the amount of organic matter and the higher the number of bacteria, the less the oxygen and the greater the carbonic acid, until in extreme cases of pollution the oxygen becomes entirely exhausted and the carbonic acid increased to a high figure. In shallow ponds which have an excess of vegetation or which have at the bottom a mass of decomposing mud the oxygen is usually low and the carbonic acid high. In deep ponds with muddy bottoms the lower strata may contain no oxygen but a large amount of carbonic acid, while above the thermocline the opposite conditions may prevail. The gaseous contents of ground waters depend upon the character of the soil through which the water has passed. As a rule ground waters are high in carbonic acid. The amount of oxygen varies considerably from complete absence of the gas to complete saturation. Generally low oxygen is accompanied by high carbonic acid and vice versa.

These facts serve to explain certain occurrences of the microscopic organisms. It has been known for some time that if ground waters were stored in open reservoirs exposed to the light, troublesome growths of diatoms and other organisms were likely to appear. The explanation usually advanced to account for this fact was based chiefly upon the nitrogen in the form of nitrate, an important constituent of plant food and usually abundant in ground waters. In the light of present knowledge, it would seem as though the controlling influence was exercised by the dissolved carbonic acid instead of the nitrates, though naturally the latter is also of importance.

Again, it has been noticed that in deep ponds with muddy bottoms, the heavy growths of diatoms usually occur after the so-called "overturnings" in the spring and autumn, when the water at the bottom is carried upward and mixed with the general body of water, taking with it the nitrogenous products of decomposition at the bottom, which near the surface become oxidized to nitrates, a condition in which they are available as plant food. The diatoms being also carried upward by the vertical currents find at the surface light, oxygen and nitrates, three factors necessary to their development. This has been the common explanation and, so far as it goes, it is doubtless correct; but the part played by the carbonic acid has been ignored, although it was referred to by one of the writers in 1894. During the periods of stagnation, decomposition of the organic matter at the bottom results in the exhaustion of oxygen, after which putrefaction takes place under anaerobic conditions, both of these processes, especially the second, resulting in the liberation of carbonic acid which goes into solution in the lower strata. When this is carried upward at the time of overturning it is probably the exciting cause of the great development of diatoms at that time. After a time the carbonic acid becomes dissipated into the atmosphere, and it is reasonable to suppose that this may put a limit upon the duration of the growth. In this connection, it should be observed that there is reason for believing that, in some cases at least, the microscopic organisms have the power of taking carbonic acid from the bicarbonates of the alkaline earths dissolved in the water.

The microscopic organisms are usually most numerous near the surface of a pond, but this is not always the case. If the amount of oxygen and carbonic acid were the same at all depths the greater intensity of light near the surface naturally accounts for their preference for the upper strata, but if the carbonic acid is deficient at the surface the organisms may be more numerous at some point lower down. Two illustrations of this may be cited. On one occasion the writers found that in a reservoir 20 feet deep, but which was thermally stratified, diatoms were entirely absent above the thermocline, but were quite numerous near the bottom. The water of the reservoir was light colored, and no doubt the solar rays penetrated to the bottom. Analyses of the water at various depths showed that oxygen was abundant at all points in the reservoir, but that at the surface and down to the level of the thermocline there was no carbonic acid, while below it the carbonic acid increased gradually toward the bottom. The increase in the amount of carbonic acid corresponded with the increase in the number of diatoms. The other instance was still more striking. In a lake 60 feet deep, thermally stratified and containing water light in color, a heavy growth of Mallomonas was found just below the thermocline, while at the surface and at the bottom these organisms were entirely absent. As these organisms contain chlorophyll they naturally require both oxygen and carbonic acid for their development. A study of the gaseous contents of the water at different depths showed that at the surface of the lake there was no carbonic acid, while at the bottom there was no oxygen, while just below the thermocline, where the Mallomonas were concentrated, both gases were present.

If further studies prove the correctness of the theory that the dissolved carbonic acid in the water is the controlling factor in the occurrence of the microscopic organisms, there is reason to believe that it may be turned to practical account, inasmuch as it is possible to remove the carbonic acid from water under certain conditions. In some places this has been unwittingly done. By the so-called process of aeration whereby water is allowed to become saturated with oxygen by allowing it to fall in drops or thin sheets through the air, a large part of the free carbonic acid is removed, and consequently the water after this treatment is less suited to the growth of organisms. This method is well adapted to removing the carbonic acid from ground waters, and it may be that in certain instances this simple process will serve as a protection against growths of organisms even when the water is stored in the light. It should be remembered, however, that stagnation may occur even in comparatively small shallow reservoirs, and the carbonic acid that may be generated at the bottom of the reservoir should also be guarded against. How long an exposure of water to the air is necessary in order to remove the carbonic acid or how this may be best accomplished, are matters which demand further experiments upon a large scale. In past years there has been much discussion of the merits of aeration in preventing growths of organisms, but the question has been generally argued from the standpoint of oxygen rather than from that of carbonic acid. Apparently little is to be gained by blowing air into a body of water, as is sometimes done; it is not so much a question of putting oxygen in as getting carbonic acid out.

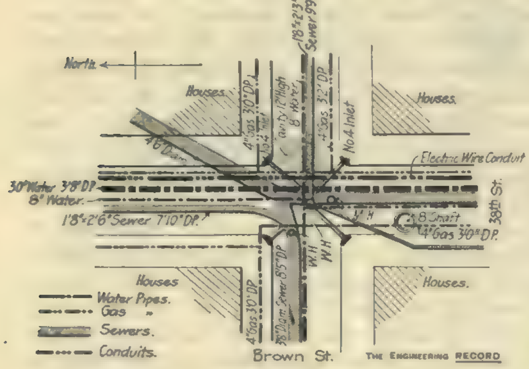
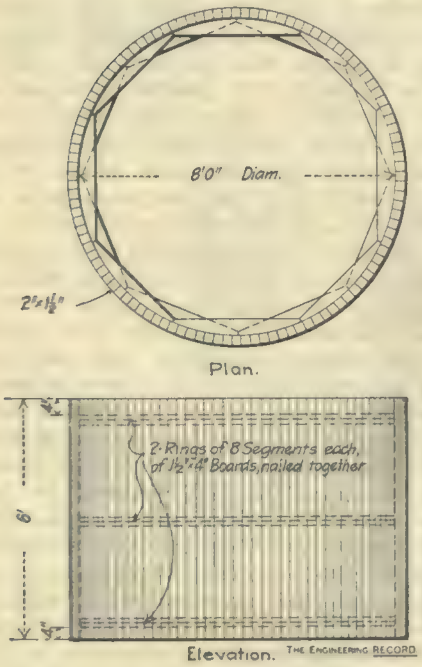


Diagram of Pipes and Sewers.


8'0" Diam.
2"x1½"
Plan.
2-Rings of 8 Segments each, of 1½"x4" Boards, nailed together
6'
4"
4"
Elevation.
The Engineering Record

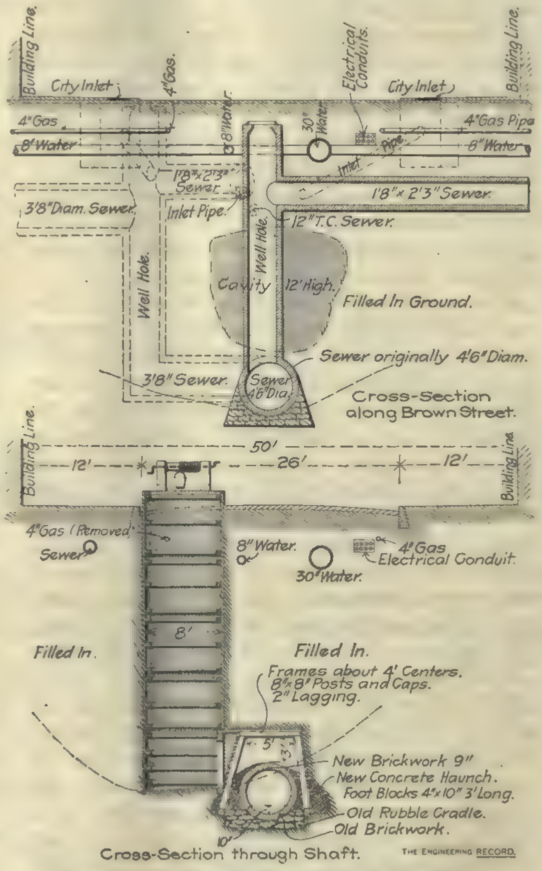
Casing of Shaft.

Some authorities have claimed that growths of organisms have at times been prevented by adding lime to the water. If this be true it no doubt results from the union of the lime with the dissolved carbonic acid. Whether this method could be successfully used in practice is another matter which is worthy of an experimental test upon a large scale.

Difficult Sewer Reconstruction.

By Harrison Souder, Civil and Mining Engineer.

The city of Philadelphia has lately finished a difficult piece of sewer work at 38th and Brown Streets. The original sewer at this place was circular in section and 4 feet 6 inches in diameter, but it was crushed into an oval shape 5 feet 8 inches wide by 4 feet 3 inches high for some 90 feet. A portion had formerly been rebuilt and at the junction of the old sewer and the rebuilt portion a large opening had gradually formed, allowing the filling above to escape. The movement of the made ground toward the sewer was liable to cause large cracks in adjoining houses, for the displacement of the material in the neighborhood was serious, as shown by the fact that a cavity 12 feet high was discovered above the sewer during the last reconstruction.



Vertical Sectional Diagrams of Streets.

The repair operations at the street intersections were rendered more difficult by the presence of many gas, water and drainage pipes. By the breaking of the upper sewer another smaller cavity was formed under the street and a heavy wagon falling through broke a 6-inch water main which so increased the size of the hole that the wagon almost disappeared.

In order to repair the large sewer a circular shaft 8 feet in diameter was sunk at one side of the street and an opening cut through on the side toward the sewer. A heading was driven along the line of the sewer giving room for the removal of the old and the building of the new and larger sewer. On account of the mobility of the filling great care had to be exercised to prevent caving.

The shaft was designed by the contractors, Messrs. M. & J. B. McHugh, and was composed of five sections 8 feet in diameter and 6 feet long, constructed of 1½-inch stuff as shown in the drawings. These sections were built and sunk consecutively, the bottom edge being cut under and weight applied above to force them down. It proved very efficacious. A ladder way was built for the men and the material was hoisted by whim.

In driving the heading a timber set would be placed, the 2-inch lagging driven ahead with mauls and supported temporarily while a footing was being excavated for the 4 x 10-inch footblocks 3 feet long. When these were in place the permanent set would be put in.

The old sewer was removed to within 10 inches of the bottom, which was left to form a waterway, and the new sewer was carried up as rapidly as possible, the new diameter being 5 feet 8 inches. Haunches were constructed of concrete, extending 18 inches beyond the footblocks. At the spring line the haunch was made 18 inches thick. The posts were removed where possible in advance of the concrete. The fill above the sewer was thoroughly compacted by ramming.

The whole of the work was successfully accomplished without any mishaps, under the direction of Mr. Wm. A. Brooks, Chief of the Bureau of Highways. The method of sinking the shaft is especially noteworthy.

The Development of Bituminous Pavements.

Extracts from a paper read before the League of American Municipalities by Fred J. Warren, Boston.

All forms of bituminous pavements, whether manufactured from natural or artificial asphalt, are in fact artificial stone pavements. The industry started with the use of the natural rock asphalt from the mines in the Val de Travers, Canton Neufchatel, Switzerland. The mines were discovered in 1721, but it was in 1849 that its utility as a road covering was first noticed. The rock was then being mined for the purpose of extracting the bitumen contained in it for its use in medicine and the arts. It is a limestone found impregnated with bitumen, of which it yields on analysis from 8 to 14 per cent.

It was observed that pieces of rock which fell from a wagon were crushed by the wheels, and under the combined influence of the traffic and heat of the sun a good road surface was produced. A macadam road of asphalt rock was then made which gave very good results, and finally, in 1854, a portion of the Rue Bergere in Paris was laid with compressed asphalt on a concrete foundation. In 1858 a still larger sample was laid, and from that time it has been laid year by year in Paris. From Paris it extended to London, being laid on Threadneedle Street in 1869, and Cheapside in 1870, and in successive years on other streets. It has also been extensively used in Berlin and other cities on the Continent.

The early success of the asphalt pavement in European cities led American contractors to seek the manufacture of an artificial asphalt which would have similar qualities, and the first idea was to utilize the tar produced at the gas works, which was then almost without value. The result was about twelve to fifteen compounds, varying only in detail, being all essentially composed of tar, or coal tar pitch and sand, forming an artificial sandstone. Large quantities of these pavements were laid in Washington and other cities between 1870 and 1874, the stone pavements on Fifth Avenue, New York City, being surfaced in this manner. A large number of cities, especially in New England, use this artificial mixture successfully on sidewalks, and the coal-tar sidewalk continues to be in greater use in Massachusetts than all other forms combined.

The result on street work was a general failure, and the impression has since generally prevailed that coal tar or its products are entirely unsuitable for roadway construction. The work was done at ridiculously low prices by contractors who had no previous familiarity with the construction of bituminous pavements or incentive to improve, and, in fact, at the time the pavements were laid, no one in this country or Europe had any accurate knowledge of the requirements necessary to produce good work. A few of these pavements, however, are in use to-day even on roadways, and have been in use longer than any asphalt pavements in existence in this country or in Europe. I think all failures can be traced to the use of inferior grades of coal tar, improper methods of preparing the cement, and the use of improper sand in the wrong proportions.

The early failure of the artificial asphalt pavements put them almost entirely out of use in roadway construction. A German chemist, Prof. de Smedt, had secured a patent on a formula for making a bituminous surface, using natural asphalt as a cementing material. Experiments were made with Mexican, Cuban and Trinidad asphalt; the so-called Albertite, Gilsonite and other bitumens found in this country were also tried, but generally without success. Small samples of the Trinidad Lake asphalt pavements were laid in Newark, N. J., and in New York City, in 1870 and 1871, respectively, but it was not until 1876 that a pavement was laid on a large scale.

Chemists generally knew that there were physical properties in asphalt which made it impossible for them, by any chemical test, to determine the durability or utility of any given asphalt, and no city could be induced to adopt this form of pavement until, from actual test, it had stood in Fifth Avenue in New York, with an average daily traffic of 13,000 vehicles, for several years.

In 1876 Pennsylvania Avenue, in Washington, was in an almost impassable condition, being covered with a rotten wooden pavement. Congress directed its repaving, and appointed a commission consisting of Gen. H. C. Wright and Gen. Q. A. Gillmore, of the Corps of Engineers, and Edward Clark, architect, to have supervision of the work. The terms of the law directed them to lay the best known pavements. They advertised for proposals, making no restriction as to materials. They received forty-one proposals, for every variety of stone, wood, macadam and bituminous pavements. Out of them all the commission selected two, and laid these respectively on two-fifths and three-fifths of the avenue. These were the natural rock asphalt from Neufchatel, and the Trinidad Lake asphalt mixture. Both pavements were completed in the spring of 1877. The Neufchatel pavement lasted about ten years, while the Trinidad Lake mixture was not resurfaced until 1890.

After 1876, under the present permanent form of government, the asphalt pavement has become the recognized pavement of Washington. It has spread from Washington to many other American cities, Buffalo taking the lead, with something over 300 linear miles, Philadelphia and New York City also laying large quantities each year.

Many other forms of asphalt have from time to time come on the market, and have been laid with more or less success. The physical differences which existed in the new varieties of asphalt have made it necessary for their promoters to develop new formulæ, and to endure many poor pavements laid during experimental stages and under close competition.

It seems to be a fact that the early asphalt pavements caused as much annoyance to the promoters as did the early coal-tar pavements, but they were generally laid at a good margin of profit, under a guarantee system which justified and encouraged the most careful methods and immediate repair of defects; and considering the complications presented in the manufacture of the bituminous surface, it is to the credit of the established paving companies that they have succeeded in laying asphalt pavements so satisfactorily.

As late as 1885 some of the pavements laid by the most experienced companies were complete failures when first laid, and the cost of repairs during the first five years sometimes amounted to twice the original cost of construction of the wearing surface, while the average cost of the most experienced companies for the maintenance of pavements laid since 1890 will hardly average 5 per cent. of first cost of surface during the first five years, and the pavements are frequently in perfect condition without repair at the end of that period. When it is considered that a slight variation from the proper proportions of ingredients brings about disastrous consequence, the improvements are quite remarkable.

Probably the greatest failures were due to improper selection of the sand or mineral grain. Sands which careful analysis show to be very different are frequently so closely alike in appearance that the most expert eye could not detect the difference. There was no record kept of the nature of the sand until recent years, almost any sand being considered suitable.

The bitumen is used to surround the grains of mineral matter for the purpose of cementing them together. In the Richardson patent formula, used in the Trinidad Lake pavement, the mineral grain is so fine that the aggregate surfaces of the grains to be coated approximate 1,000 square inches to each cubic inch of the wearing surface, and the coating of bitumen around each grain is about one four-thousandth of an inch in thickness.

If the sand is not of such graded sizes that the voids are approximately filled by the bitumen used, then on exposure in such minute particles early failure is quite certain, on account of evaporation and decomposition. A slight variation in the size of the grains makes a great difference in the area of grains to be coated with bitumen, and in turn, in the thickness of the coating when a given proportion of bitumen is used, and consequently upon the length of time which it would take to change its physical condition on exposure. So great is the difference that a given bulk of sand, of an even size, passing a No. 200 screen, contains about 30 times as much surface to be coated as does the same bulk standing between a No. 10 and No. 20 screen; and about 1,000 times as much surface to be coated as does the same size of grain passing a 2-inch screen and standing on a 1-inch screen. In the effort to duplicate the Neufchatel pavement, the entire development and practice has been to exclude from the bituminous mixture all mineral grains coarser than about 1/20 inch in diameter.

A form of bituminous roadway known as tar macadam has been used in England with very variable results for more than thirty years, and also in a few American cities. The process employed is defective in principle and does not accomplish uniformity. I feel that there is little permanent merit in the use of crude tar, or in coating stones of even sizes laid in courses, with an effort to roll the several courses together, as the very life of the bitumen depends upon its proper selection, preparation and use, in proper proportions, with a dense mineral mixture.

Considerable investigation has convinced me that both practices are wrong, and that the future development of bituminous pavements will be along the line of using a coarser mineral aggregate than is used in the asphalt pavement, and more modern methods than employed in tar macadam.

The advantages of a coarse grain are: First, the coarse grain gives rigidity in itself not acquired by fine grains, and also gives a surface that will not wear slippery. Second, it is, therefore, possible to use a softer cement, which will have longer life. Third, a heavier coating will be secured around each grain, which will tend to increase the life of the bitumen if exposed. Fourth, the voids can be greatly reduced, thereby avoiding exposure of bitumen in minute particles. Fifth, lower temperatures can be used in mixing, and consequent saving in fuel and labor. Sixth, less danger of injuring the bitumen by overheating in the process of making cement or mastic.

The mixture to be used in any particular piece of work should always be determined by experts who will recognize the conditions present, and the special treatment necessary, as the complications are many. Under proper instruction failures should be reduced to a minimum.

A pavement constructed on above principles would be a bituminous-concrete pavement, as distinguished from the bituminous-mortar surface of the asphalt pavement.

Owing to the nature of the mixture, I think the best forms of coal tar, properly treated, will furnish the best form of bituminous cement for such a pavement. The coarse stone used should be the hardest procurable, and I can see no reason why, under proper development, the bituminous cement will not bind the mineral matter together until the stone itself wears out, under moderate traffic. I should not advise placing such a pavement on the heaviest-traveled streets of large cities at the start. It would be best to develop perfection under more moderate usage.

I think the term bituminous macadam is a suitable name for such a pavement, as it contains all of the good points of a first-class macadam road with durability and cleanliness added; and owing to the coarse grain, it is not as slippery as other forms of bituminous pavements.

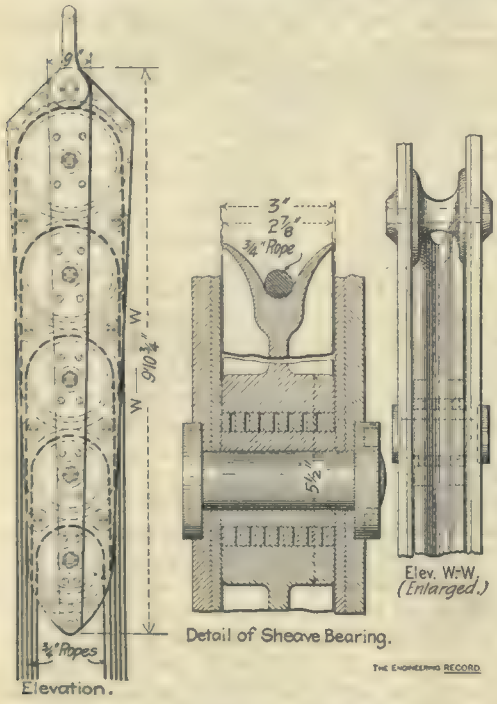
An equipment of $3,000 to $4,000 in machinery would be sufficient to lay 300 to 1,000 square yards per day of bituminous macadam, and municipalities, under proper supervision, could do the work themselves much cheaper than by contract. The largest sample of pavement laid on this plan is in the city of New Bedford, Mass. Lowell, Mass., has also borrowed a plant to construct 5,000 yards or more, and Holyoke, Mass., has tried a block and seems well pleased.

The city of Pawtucket, R. I., was the first Eastern city in recent years to try the use of tar on its streets, doing the work itself under an old formula, but has recently had a sample of bituminous macadam laid on the above plan. Mr. Carpenter, the city engineer, was not satisfied with the lack of life of his first work, but he accomplished better results than others who have experimented on their own account.

An Erratum should be made in the article on the Lincoln power station of the Boston Elevated Railway Company, in this journal's issue of August 17. The number of poles in the two types of generators was inverted; actually the Westinghouse machine has 24 and the General Electric machine 36.

A Large Block.

A tandem block for large tackles has recently been made, as shown in the accompanying cut, by the John A. Roebling's Sons Company for the Pennsylvania Railroad Company for use in hauling derailed 50-ton cars out of the way of traffic and for other purposes requiring an unusually powerful tackle. The finished steel sheaves are set between two ¼-inch steel side plates about 10 feet long with rounded ends tapering from a width of 14 inches at one end to 26½ inches at the other end. The five sheaves have their axes in the center line of the case and are set with a very slight clearance between their rims. The hub is ⅛ inch thicker than the rim and is bushed with a self-lubricating bearing which revolves on a sleeve, the axle of which is a 1½-inch pin with 3-inch heads countersunk half way into ½-inch reinforcement strips riveted to the sheave case. One of the heads on the pin is welded and the other is screwed on and locked to the case with two small round keys. The sheaves have deep grooves with the sides turned to circular curves. The smallest one has a diameter of 14 inches at the bottom of the groove and each successive sheave is 2 inches larger than the preceding one, so that the ropes will clear each other in the same plane. The side plates are separated by two spools riveted between each pair of sheaves, and a 2½-inch steel loop is connected at one end by a 3-inch pin with square heads countersunk flush. All the rivets have very thin, flat, smooth heads and there are no projections likely to catch when the block is dragged along on the ground. One complete block weighs about 1,100 pounds and when rove with ¾-inch plough steel rope with a breaking strength of 25 tons has a large safe working capacity. Its ultimate strength is about 250 tons.



A Large Wrecking Block.

The Steel-Work is Set on Section No. 3 of the New York Rapid Transit Railway by a 2-ton stiff-leg hand derrick with a 20-foot boom, which slides on the top of the trench timbering. The rear leg of the derrick is in a plane at right angles to that of the other two legs and its sill is hinged to theirs, so that when in operation the derrick has a T-shape base, which, for removal, can be folded up and the legs all brought into the same place, and revolved down horizontally together. This has been found to be a great advantage.

Interim Report of the Royal Commission on Sewage Disposal.

We, the Commissioners appointed to inquire and report:

I. (1) What method or methods of treating and disposing of sewage (including any liquid from any factory or manufacturing process) may properly be adopted, consistently with due regard for the requirements of the existing law, for the protection of public health, and for the economical and efficient discharge of the duties of local authorities; and

(2) If more than one method may be so adopted, by what rules, in relation to the nature or volume of sewage, or the population to be served, or other varying circumstances or requirements, should the particular method of treatment and disposal to be adopted be determined; and

II. To make any recommendations which may be deemed desirable with reference to the treatment and disposal of sewage.

Humbly report, as follows:

We have examined a large number of witnesses, and visited many sewage works of various kinds. We have also instituted through our own officers a number of necessary scientific investigations. Many of these investigations are still in progress, and considerable time must necessarily be taken by the work which still remains to be done, and especially by such work as is needed before the second part of the Terms of Reference can be adequately dealt with. We have, however, arrived at conclusions on three questions which appear, for reasons hereafter given, to be of urgent importance, and we have therefore deemed it desirable to make a preliminary report and to publish the evidence already taken.

The three questions are:

(1) Are some sorts of land unsuitable for the purification of sewage?

(2) Is it practicable uniformly to produce by artificial processes alone an effluent which shall not putrefy, and so create a nuisance in the stream into which it is discharged?

(3) What means should be adopted for securing the better protection of our rivers.

Mr. Alfred Douglas Adrian, C. B., who, as Assistant Secretary of the Local Government Board, had charge for some years of the department concerned with questions of sewerage and sewage disposal, was the first witness whom we examined. His evidence contains a most valuable historical statement of the subject of sewage disposal, of the law on the subject, and of the practice of the Local Government Board in regard to this matter. The first Sewage Commission was appointed in the year 1857. In 1865, as a result of labors extending over eight years, they reported that: "The right way to dispose of town sewage is to apply it continuously to land, and it is only by such application that the pollution of rivers can be avoided."

In 1868, a further Commission was appointed to inquire into the best means of preventing the pollution of rivers. They made several reports, the fifth and last being made in 1874. The opinion of this Commission on the comparative merits of the three classes of processes for the treatment of sewage, viz.: chemical precipitation, intermittent filtration and broad irrigation, may be stated thus: (1) All these processes are to a great extent successful in removing polluting organic matter in suspension. But intermittent filtration is best, broad irrigation ranks next and the chemical precipitation processes are less efficient. (2) But for removing organic matters in solution the processes of downward intermittent filtration and broad irrigation are greatly superior to upward filtration and chemical processes.

The last Commission was appointed in 1882. They were directed to inquire into and report upon the system under which sewage was discharged into the Thames by the Metropolitan Board of Works, whether any evil effects resulted therefrom, and, if so, what measures could be applied for remedying or preventing the same. In November, 1884, they issued their final report. They found that evils did exist "imperatively demanding a prompt remedy," and that by chemical precipitation a certain part of the organic matter of the sewage would be removed. They reported, however, "that the liquid so separated would not be sufficiently free from noxious matters to allow of its being discharged at the present outfalls as a permanent measure. It would require further purification, and this, according to the present state of knowledge, can only be done effectually by its application to land."

Since the publication of the last-mentioned report it has been the practice of the Local Government Board to require, save in exceptional cases, that "any scheme of sewage disposal, for which money is to be borrowed with their sanction, should provide for the application of the sewage or effluent to an adequate area of suitable land before its discharge into a stream." There can be no doubt, in our opinion, that the Local Government Board were bound, under the circumstances, to insist upon such a rule.

It is now contended that in many cases, especially in the great centers of manufacturing industry, the land available is either of unsuitable quality, is available in quite inadequate area for effective filtration through the soil, or is obtainable only at prohibitive cost, and it is suggested that sewage purification may, in such cases, be carried out on comparatively small areas artificially prepared. During recent years a variety of artificial processes, differing from those which were considered by the earlier Commissioners, have been elaborated for treating sewage, and it is urged that satisfactory effluents can be obtained by such artificial processes.

Having regard to the definite findings of previous Commissions, to the consequent practice of the Local Government Board in insisting on the provisions of land for the purification of sewage, and to the fact that the artificial processes are still only in the experimental stage and, as might be expected therefore, the evidence in regard to them is inconclusive on many points, it has appeared to us essential to subject the artificial processes to sustained examination, and also carefully to test the contention that in certain cases it is not practicable to purify sewage by land treatment.

At the time of the investigations of the earlier Commissions, the science of bacteriology was in its infancy, and those Commissions confined themselves almost entirely to a chemical examination of sewage effluents. Since the dates of those Commissions a large amount of exact knowledge has been gained concerning the part played by bacteria in various processes of nature and operations of man, and it became our duty to study the various questions connected with sewage disposal not only from a chemical, but from a bacteriological point of view as well. This has largely increased our labors, but we trust will also largely increase their usefulness. We have had to initiate and carry out various bacteriological investigations, and, in particular, finding that the work done by earlier Commissions in regard to land treatment was not complete enough for our purposes, we have thought it necessary to include in our work a systematic investigation, bacteriological as well as chemical, of the treatment of sewage on land of various kinds. This investigation is on the point of completion. For the purpose of our own work we appointed the following officers: Professor Boyce, bacteriologist; Dr. Houston, bacteriologist; Dr. McGowan, chemist; Mr. Colin Frye, chemist; Mr. G. B. Kershaw, engineer.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXI, PRAGUE, CARLS BRIDGE.
One of the most picturesque of mediaeval bridges, built between 1350 and 1500, and one where sculpture and architectural features enhance its beauty. This view is taken across the Moldau toward the section of the city called Kleinseite, where the Bohemiah capitol is situated.

Question I.—As regards the allegations that certain sorts of land are so unsuitable as to render them practically useless for the purification of sewage, we have received evidence from a number of witnesses who have had much experience of sewage treatment. Almost without exception their testimony is to the effect that peat and stiff clay lands are unsuitable for the purification of sewage. Our own officers have made a large number of analyses of effluents from well-managed farms with different classes of soil, and their results support this general opinion.

We doubt if any land is entirely useless, but in the case of stiff clay and peat lands the power to purify sewage seems to depend on the depth of the top soil. There are, of course, numerous gradations in the depths of top soil which are met with in nature, and it is not easy to draw the line between lands which contain a sufficient depth to justify their use, and lands which do not. We are, however, forced to conclude that peat and stiff clay lands are generally unsuitable for the purification of sewage, that their use for this purpose is always attended with difficulty, and that where the depth of top soil is very small, say six inches or less, the area of such lands which would be required for efficient purification would in certain cases be so great as to render land treatment impracticable. Further information with regard to this point will be available when our investigation of land treatment is completed.

Question II.—The following general classification will serve to show the nature of the artificial processes to which we refer: Closed septic tank and contact beds; open septic tank and contact beds; chemical treatment, subsidence tanks, and contact beds; subsidence tanks and contact beds; contact beds alone; closed septic tank followed by continuous filtration; open septic tank followed by continuous filtration; chemical treatment, subsidence tanks and continuous filtration; subsidence tanks followed by continuous filtration; continuous filtration alone.

Many valuable experiments on artificial treatment have been made by a number of local authorities, and in particular the Corporations of Leeds and Manchester have subjected certain processes to sustained observation. In this way much reliable information has been obtained. We are not, however, in a position to express an opinion upon the relative merits of the several artificial processes, nor can we at present make a complete comparison between land treatment and artificial treatment of sewage, or state how far purification of sewage can be uniformly effected by one or another artificial process, and at what cost as compared with land treatment. The character of the sewage of different towns varies to a considerable extent, especially in respect to the amount and nature of the trade refuse mixed with the domestic sewage, but also in respect to domestic sewage itself; and a method applicable to one sewage might not be applicable to another. The problems involved in the matter are so many and so varied that only investigation, and, we may add, experience of a prolonged and varied character, will suffice to solve them.

After carefully considering, however, the whole of the evidence, together with the results of our own work, we are satisfied that it is practicable to produce by artificial processes alone, either from sewage or from certain mixtures of sewage and trade refuse, such, for example, as are met with at Leeds and Manchester, effluents which will not putrefy, which would be classed as good according to ordinary chemical standards, and which might be discharged into a stream without fear of creating a nuisance. We think, therefore, that there are cases in which the Local Government Board would be justified in modifying, under proper safeguards, the present rule as regards the application of sewage to land. No general rule as to what these safeguards should be can be laid down at present, and indeed it will, probably, always be necessary that each case should be considered on its own merits.

As we have already said, sewage effluents must, in accordance with present knowledge, be judged not only from a chemical, but also from a bacteriological point of view. In order to safeguard public health, it is, in certain cases at any rate, not enough to know the chemical features of an effluent and to ascertain that it will not putrefy of itself; we must know the bacteriological features as well. Several witnesses have referred to the danger of allowing pathogenic organisms to enter streams which are used for drinking purposes, and our own officers are carrying out careful prolonged investigations on this matter. We are impressed with the great importance of the bacteriological questions which have arisen in the course of our inquiry, but we do not, at present, feel justified in putting forward any conclusions concerning them.

We may, however, even at this stage point out that as a result of a large number of examinations of effluents from sewage farms and from artificial processes we find that while in the case of effluents from land of a kind suitable for the purification of sewage there are fewer microorganisms than in the effluents from most artificial processes, yet both classes of effluents usually contain large numbers of organisms, many of which appear to be of intestinal derivation, and some of which are of a kind liable, under certain circumstances at least, to give rise to disease. We are of opinion, therefore, that such effluents must be regarded as potentially dangerous, and we are considering whether means are available and practicable for eliminating or destroying such organisms, or, at least, those giving rise to infectious diseases.

Question III.—From the evidence which we have received, from our own observation and from information collected for us by the Local Government Board for Scotland, we are satisfied that the Rivers Pollution Prevention Act, 1876, has not resulted in the general purification of our rivers. This is due largely to the reluctance of the authorities to put the act in force, but partly also to the difficulty which a sanitary authority experiences in proving that the pollution within its district comes from the district against which, or the person against whom, action is taken. An authority wishing uniformly to enforce the act in its own district has no security that the authorities above and below it on the stream will do the same, and it is therefore naturally disinclined to take action.

The Local Government Act, 1888, Section 14 (1) and the Local Government (Scotland) Act, 1889, Section 55 (1), give to County Councils of England and Wales and Scotland "power in addition to any other authority to enforce the provisions of the Rivers Pollution Prevention Act, 1876, in relation to so much of any stream as is situate within or passes through or by any part of their county." This concurrent power of the County Council does away with the difficulty of proving pollution within a district from a source within the area of the county, though outside the district, and it should insure equal and fair treatment for all authorities and persons within the county. Several county councils are putting the act into operation and are making good progress.

Section 14 (3) of the Act of 1888 provides that "The Local Government Board by Provisional Order made on the application of the council of any of the counties concerned may constitute a joint committee or other body representing all the administrative counties through or by which a river, or any specified portion of a river, or any tributary thereof passes, and may confer on such committee or body all the powers of a sanitary authority under the Rivers Pollution Prevention Act, 1876, or such of them as may be specified in the Order," and similar powers are conferred on the Secretary for Scotland by Section 55 (3) of the Local Government (Scotland) Act, 1889. Under the Local Government Act, 1888, the Mersey and Irwell Joint Committee, the Ribble Joint Committee and the West Riding Rivers Board have been constituted. The evidence shows that these bodies have done much useful work in enforcing the treatment of sewage and trade refuse, and that it is of considerable importance to have for each watershed a single authority.

The advantages a county has in enforcing the Rivers Pollution Prevention Act, 1876, are also possessed by a joint committee of more than one county, and are increased in proportion to the wider area. But those councils or committees of more than one county who are enforcing the act feel the injustice of compelling their authorities and manufacturers to purify their effluents, whilst in other parts of the country and over wide areas little or nothing is being done. Previous Commissions have referred to the necessity of setting up watershed boards and otherwise strengthening the machinery for the protection of our rivers, as the following extracts will show:

Extracts from Second Report of the Commission appointed in 1857 to inquire into the best mode of distributing the sewage of towns: "We have now to urge, as the first and all-important step towards securing this object and the permanent improvement and protection of the rivers of the country, that a general local jurisdiction and conservancy be created throughout the kingdom, with adequate powers and proper guarantees for their due administration. . . . The abuses and nuisances which have now grown up with the growth of towns and manufactures 'urgently demand some available law for the conservancy of rivers, from their sources to their outfalls.' . . . Having now fully stated our conclusions as to the means of disposing of the sewage of towns, and shown that the remedies for the evils which are experienced, although various, are both practicable and economical, we beg to repeat our conviction that the only security for a general and continued employment of such means will be the establishment of responsible conservancies throughout the country, armed with adequate powers."

Extracts from First Report of the Commissioners appointed in 1865 to inquire into the best means of preventing the pollution of rivers: "We also humbly submit the following recommendations to Your Majesty: That the whole river be placed under the superintendence of one governing body. That it be made incumbent upon the conservators to see to the enforcement of the above prohibitions against pollution of the river."

Extracts from Third Report of the Commissioners appointed in 1865 to inquire into the best means of preventing the pollution of rivers: "Where manufactures have been established and a large resident population has grown up as before stated, the greatest amount of pollution takes place, the area of country over which such form of nuisance is spread having no defined boundary other than the dividing ridges of such watershed and the shores of the sea. In order to prevent the pollution and legally control the management of rivers, their basins or watersheds must be placed under supervision, irrespective of any arbitrary division of county, parish, township, parliamentary, municipal or Local Government Act boundaries; or, indeed, of any artificially established division. Running waters flow on from their source to the sea, and if the upland waters are polluted by town sewage and by refuse discharged from manufactures, as in the West Riding of Yorkshire, the entire length of a river is necessarily polluted, and will require to be conserved or protected. One conclusion, therefore, forces itself upon anyone who honestly deliberates upon the existing state of things in regard to the rivers we have visited with a view to its permanent improvement. A stronger power than has hitherto been available must be brought to bear if the present abuse and pollution of streams is to be arrested, and Government supervision and inspection must enforce and strengthen the action of local authorities."

Extract from First Report of the Commissioners appointed in 1868 to inquire into the best means of preventing the pollution of rivers; separate conclusions and recommendations by Maj.-Gen. Sir William Denison, chairman.: "The evidence we have had of the total disregard of mere legal enactments which tend to fetter the actions of masses of people, of the constant evasions of obligations imposed by law, of the inefficiency of the law, even when means have been found to bring it into action, to enforce the adoption of any special remedy for the evils complained of, has satisfied me that it will be necessary to call into action an authority superior to all those local municipalities, embracing in its scope the whole area of the watershed subdivided among these bodies, and to confer upon such authority powers differing both in kind and degree from that exercised by ordinary municipalities or conservancies."

Extract from Third Report of the Commissioners appointed in 1868 to inquire into the best means of preventing the pollution of rivers: "Recommendations, That all rivers and streams in England be placed under the superintendence of a central authority or board, to be composed of not more than three persons, who shall be duly qualified to deal with all questions connected with the pollution of water and with water supply. That it be the duty of this board to see that all enactments relating to the use or abuse of running water be duly enforced; and that for this purpose power be given to it to inspect manufactories, reservoirs, sewerage and other similar works; and to cause to be constructed, at the expense of the owners of the same, whether corporate or private, any necessary purifying apparatus, in case the said owners neglect or refuse to provide such apparatus for themselves."

We consider it of the utmost importance that the simplest possible means should be provided for adequately protecting all our rivers, and we are further of opinion that it will be desirable, probably for some time to come, that scientific experiments should be carried on in order to ascertain all the real dangers of pollution, against which they should be protected. In the present state of knowledge, and especially of bacteriology, it is difficult to estimate these dangers with any accuracy, and it seems quite possible that they should be either exaggerated or undervalued according to the predisposition of those who have to deal with them. An authority, guided by medical considerations, might not unnaturally be inclined to insist on a degree of purity which may ultimately prove in certain cases to be uncalled for, while another authority, with its mind fixed upon economy, might shrink from taking essential precautions.

It is, perhaps, scarcely for us to say what arrangements should be made, but we are of opinion that the general protection of our rivers is a matter of such grave concern as to demand the creation of a separate commission, or a new department of the Local Government Board, which shall be a Supreme Rivers Authority, dealing with matters relating to rivers and their purification, and which, when appeal is made to them, shall have power to take action in cases where the local authorities have failed to do so.

Movable Steel Centers have been employed in lining about 922 feet of the Gothard and Sonnenburg double-track tunnels near Velden, Bavaria, on the Nuremberg & Schnabelward Railway. The tunnels have a horseshoe cross-section with masonry walls, concrete haunches and brick arches, one brick thick in dry places and one and a half brick thick in wet places. The two centers or travelers on which the arch lining was built, each consisted of three transverse riveted bents resembling the bents of the ordinary bridge-erecting traveler used in the United States, except that the top and sides have a curved outline corresponding to the intrados of the arch and support the lagging on which it is built. The bents are 40 inches apart and are each trussed in triangular panels with single-riveted diagonal angles from 2 to 3 inches wide. The top chord and main verticals are T-shaped, made of pairs of 3 x 3-inch angles, back to back, and the bents are longitudinally X-braced together, and seated on two longitudinal sills, each made of a pair of channels mounted on two double-flanged wheels which run on special track rails outside the rails of the single track, which was temporarily put in the middle of the tunnel to maintain traffic during construction. The traveler had a clearance for trains through it of about 14 feet width and 16 feet height. There was a working platform on each side of the traveler at the height of the haunches and another in the center at the crown, all accessible by stairways. When in use the traveler was raised from its wheel base by sixteen jack screws, which enabled the centering to be lowered easily after the completion of the arch. Generally both travelers were used together to make one continuous platform, and an average length of 31 inches of lining was finished daily at a total cost, including drainage pipes, etc., of $25.45 per lineal foot for one-brick crowns. The details of the lining and traveler are illustrated in the "Nouvelles Annales de la Construction." Centers of much the same type were illustrated in The Engineering Record of April 20, 1901.

Recent Accidents on the East Side Intake, Cleveland Water-Works.

On August 14, at 2.30 A.M., a fire broke out on crib No. 2 of the East Side tunnel, Cleveland, Ohio, which completely burned the superstructure to the floor line, 13 feet above water level, leaving only the outer walls standing. The exact cause of the fire is not known, although the testimony of the workmen all tended to show that it was due to an overheated smokestack, which set fire to the roof, the flames spreading with such rapidity that five of the men were burned to death where they slept; the others, to the number of 26, were compelled to jump into the lake, some clinging to ropes caught over spikes in the side of the crib, and the most of them supporting themselves on plank which were thrown off the crib. Four men lost their hold and were drowned, and 22 were saved. Six of these were picked up by a boat from a steam barge which was coming down the lake with a barge in tow. On seeing the fire she dropped the barge and came on full steam, dropping her boat near the crib and picked up six men who were hanging to the side of the crib. About the same time a tug arrived and picked up all the others, 16 in number.

This fire occurred just at a time when the stationary engineer on duty, who was in charge of the crib, was down at the bottom of the shaft. He and the elevator operator came up on the elevator to within about 20 feet of the top, but were then driven back to the bottom of the shaft by the flames and went into the west drift of the tunnel, where nine men were engaged in cleaning out the drift, preparatory to building a new air-lock at the face of the work, or about 3,400 feet from the shaft. After its completion they were to resume the work of building the tunnel in this heading to the intake crib, the distance between this heading and the inlet shaft being about 3,600 feet.

After the fire had been put out by a fire tug the contractor's foreman went down the shaft and called out for the men in the tunnel to come to the shaft. He found the air badly vitiated at the bottom, and came up quite exhausted.

The men in the tunnel had been working at about 2,800 feet west of the shaft, having cleaned up and removed all dirt and waste material to this distance from the shaft. They were soon joined by the engineer and elevator operator, who, as before stated, were forced to recede to the bottom of the shaft by the flames and smoke descending into it, and after telling them what had occurred on the crib, they all then started for the shaft. When within a short distance of the place where the air-lock had formerly been located, they encountered afterdamp which had forced its way down the shaft and into the tunnel. This soon overcame one of the men and he was placed on a work-car and pushed along by the other men until their strength threatened to give out, when he was left behind on the car and the rest made their way to the shaft. Men were then lowered down the shaft with ropes, and the men at the bottom were soon conveyed to the surface by the same appliance used in the lowering of the rescuing party. All of the men were conscious except one man, and he was soon revived and taken ashore. The number of men brought up was eight, and they reported that there were three more men in the tunnel.

Air was then pumped into the tunnel by the fire-tug, which turned off the sea-cocks connected with the pumps, and, after pumping out the water in the bilge, pumped air through a 4½-inch hose which was lowered down the shaft and dragged in the tunnel to about 150 feet west of the shaft by the rescuing party, consisting of the contractor's men, who were assisted by the captain and crew of the United States Life Saving Station at Cleveland.

Attempts were made throughout the day to bring out the men remaining in the tunnel, and one of the rescuing party lost his life during one of these endeavors. In the afternoon the man who had been left on the car was rescued, brought up to the surface, and, although apparently dead, he soon revived under the efforts of the life-saving crew to bring him back to life. The next trip brought up the body of the man who lost his life in heroically trying to rescue his fellow-workmen.

In making these trips from the shaft to where the man had been left on the car, the men making them found no sign of anyone else in the tunnel, and the contractor's superintendent, as well as others on the crib, after questioning the men who had been rescued from the tunnel, came to the conclusion that there were no more men in the tunnel, and that the men must have made a mistake as to the number of men working in the tunnel at the time the fire occurred on the crib. Nothing was said by anyone that would lead one to believe that two of the men were left behind or had become separated from the rest of the party. All the information received indicated that the man left on the car was the farthest in the tunnel from the shaft, and if others had been overcome, it would be between him and the shaft; and as no one was found in this part of the tunnel, it was concluded that all the men were out of the tunnel.

As all the machinery and boilers on the crib were destroyed or injured, the contractor then procured another boiler, which, owing to the unfavorable weather, could not be placed on the crib until August 18. His intention was to fit up this boiler and overhaul one of the air-compressors which seemed to be in pretty fair condition, and as soon as possible pump fresh air into the tunnel through the pipe leading to the face of the work, and as soon as it became safe, to send men into the tunnel and bring out the bodies of two mules which were known to be in there.

On the following day one of the men on the crib heard a faint rapping on the air-pipe extending from the top of the shaft to the face of the work, and on telling the foreman, the latter gave the regular signal on the pipe for calling men out of the tunnel, and got an immediate response—indicating that one or more persons had remained in the tunnel and were still alive. As soon as additional help could be procured a party of men were lowered down the shaft and only went a short distance into the tunnel, when they met two men who were coming toward them. These men had become separated from the others at the time of the fire without their knowledge and had gone back toward the face of the work.

Work on the headings from this crib was shut down in December, 1900, and permission had been asked this spring by the contractor to resume operations and continue driving tunnel toward the inlet shaft. This was granted by the city, and the contractor then proceeded, as stated, to clean up the tunnel and to move the air-lock. This not being construction work there was no city inspector maintained on the crib.

When work was shut down last winter the fire pump, which had been placed on the floor of the crib for fire protection, was in its proper place. It seems, however, that when the contractor began the work of pumping the water out of the tunnel and cleaning out the drift, he moved this pump and set it up at the bottom of the shaft, without the knowledge of the city officials, leaving the crib entirely without fire protection. The total number of lives lost in this fire is ten; five burned to death, four drowned and one lost his life in attempting to rescue his fellow-workmen.

According to the terms of the contract, the contractor is obliged to take all reasonable precaution to protect the tunnel, shafts and cribs from any possible danger of damage of any description from floods, storms, tidal waves, fire or any other cause, and must immediately repair any damages that may occur to the tunnel, shafts, cribs and lights, or any other structures or appliances required or used in connection with the building of the tunnel and shafts. He must assume all risk of every nature in doing the work, and shall be held liable for the safety of the cribs, shafts and tunnel to the amount paid for them by the city. In accordance with another provision of the contract, the contractor was notified to immediately repair all damage resulting from the accident, and upon his refusal to do so the city has begun rebuilding the crib at the contractor's expense.

The second accident occurred at 7.30 P.M. August 20, at the intake crib of the East Side tunnel, known as Crib No. 3. The intake shaft on this crib had just been completed and the work of driving the tunnel from this shaft toward crib No. 2 begun. The invert of the first section of tunnel was built up, and the men were just engaged in setting the ribs for the purpose of building the arch.

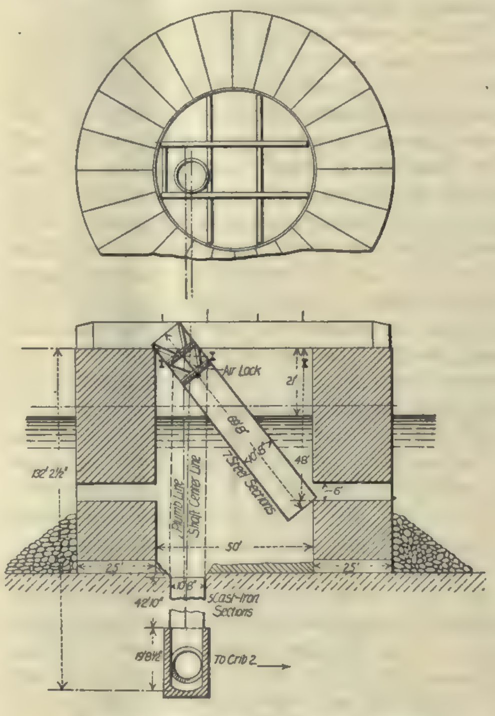
This shaft had been completed under air-pressure, the air-lock being situated in the second cylinder from the top, or about 17 feet below the floor line of the crib. One man was in this air-lock and two men were on a platform immediately below the air-lock guiding a rib through the lower door, which was being lowered to be placed in position by four men working at the bottom of the shaft. Without any warning whatever the upper portion of the shaft, about 69 feet in length, broke away from the lower sections and, according to the account of the foreman on the crib, shot up about 10 feet above the floor of the crib, then settled back and went up again, this time going up to the roof of the building on the crib, about 24 feet above the floor line.

The shaft was sunk on the north side of the well, 50 feet in diameter. In settling back the bottom of this broken section of shaft swung out across the well of the crib and lodged in one of the lower inlet tubes on the south side of the well opposite from the shaft, the top of the shaft resting on the bolster on the north side of the well near the floor line, as shown in the diagram.

Immediately after the shaft had settled back the foreman went down to the air-lock and opened the valve on the blow-off pipe, and, according to his account, exhausted the air in the shaft in about two minutes. In his opinion there was about 10 pounds pressure on when he opened the valve. As soon as the air-pressure was exhausted the door was opened and they were able to rescue the men who had been in the air-lock and one of the men who had been on the platform immediately beneath the air-lock. The other man who had been on the platform could not be found, although search for him was made down to the water's edge. He was hurled down the shaft and drowned. The two men rescued were not injured in any way. The four men who had been at work in the bottom of the shaft also lost their lives. The services of a diver were procured and an examination made, which disclosed the fact that the break had occurred at the roof of the lower flange of the ninth cylinder from above, or at a point about 4.1 feet below the bottom of the well.

This shaft was built of seven cylinders made with steel plates and cast iron flanges, of a total length of 52½ feet, and below that seven cast-iron cylinders 60 feet long, resting on a brick underpinning consisting of four rings of brickwork, and extending 19½ feet from the last iron cylinder to the bottom of the shaft, the total length of the shaft being 132 feet, 2½ inches. The shaft is made with internal flanges, the clear diameter being 10 feet and the outside diameter 11 feet. During the building of the shaft from 25 to 30 pounds air pressure were maintained, and at the time of the accident the gauge only indicated 24 pounds pressure.

The total weight of the iron cylinders and the brickwork which was secured to the cylinders by heavy iron rods, was about 342,000 pounds. The total lifting power of the air at 24 pounds pressure was about 328,000 pounds. The shaft was also secured by four pine timbers, each 12 inches wide and 14 inches deep, extending across the top of the shaft and wedged up tight against the under side of the upper flange of the two heavy plate girders spanning the well and riveted to the inner shell of the crib. Some of the ironwork of the superstructure was bent and twisted, and will have to be replaced; but this damage is not serious. Up to date no satisfactory conclusion as to the cause of this break has been reached. The contractor was given immediate notice to repair all damage done, and he has expressed his willingness to proceed with this work at once.



Position of Broken Shaft, Crib 3.

The Association of Railway Superintendents of Bridges and Buildings will hold its eleventh annual convention at the Kimball House, Atlanta, on October 15-17 inclusive. Among the topics for discussion are the tools for the equipment of a gang of bridge men, the use of concrete for bridge piers and culverts, and hand and air riveting. Of the various committees to report, three may be expected to give papers interesting to the Record's readers; the chairman and the subject assigned to his committee in each case are: Methods of sinking foundations for bridge piers in depths of water of 20 feet or under; G. W. Andrews, B. & O. R. R., Baltimore. The relative advantages of the erection of steel structures by railway companies and by manufacturers; O. J. Travis, Ill. Cent. R. R., Chicago. The best outfit cars for bridge gangs, and number of men constituting a bridge gang; A. W. Merrick, C. & N. W. Ry., Huron, S. D. Mr. S. F. Patterson, Concord, N. H., is secretary of the Association.

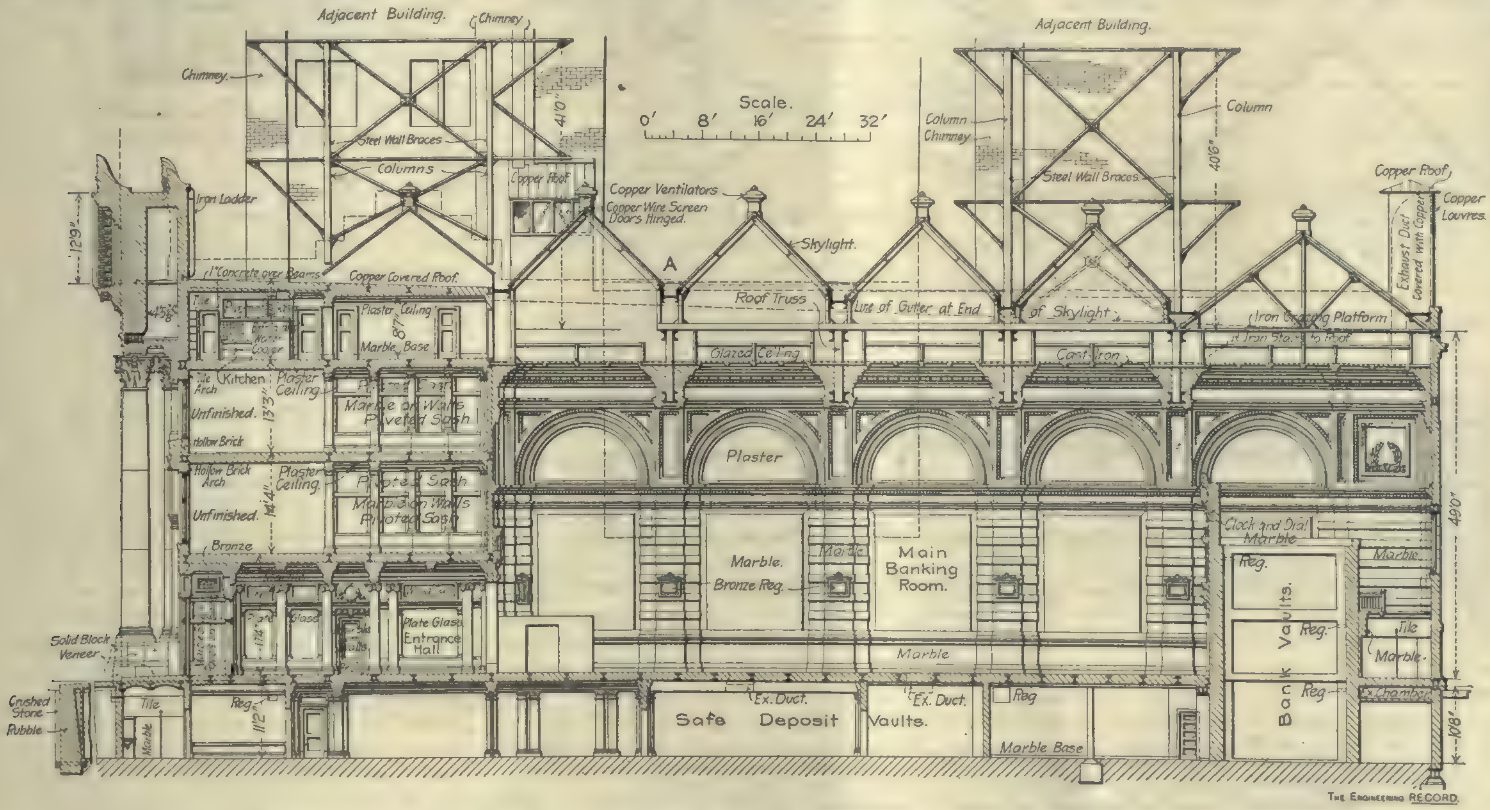
The Chicago National Bank Building.

The Chicago National Bank Building is a 90½ x 181½-foot four-story steel and brick structure fronting on Monroe Street, designed especially for banking purposes and now occupied exclusively by the Chicago National Bank, the Equitable Trust Company, the Chicago Safe Deposit Company and the attorneys for these institutions. It forms part of a solid block and, except a rear alley, has only the street front exposed; this has a colonnade of six 4-foot fluted columns about 45 feet high, which support a carved and moulded frieze extending entirely across the front. In the center of it rises a pediment of large stones elaborately carved and carried by deep I-beam girders built into the masonry. Behind the pediment the ashlar face wall rises to a height of about 75 feet and terminates in a horizontal cornice surmounted with carved ornaments above the summit of the roof. An arched entrance about 11 feet wide and 30 feet high is in the center of the front, and the panels between the columns on both sides of it have corresponding large windows extending through two stories. There are double bronze doors in the lower part of the entrance and ornamental bronze-work and windows in the arch above. For about 44 feet back of the face wall, the building is about 56 feet high, with four stories and a flat roof; the remainder is nearly as high but has only one story above the basement and forms a main banking room, 133 feet long, 87 feet wide and 44 feet high, in the rear portion of which the three-story vaults rise 20 feet above the floor and extend down through the basement. The front wall of the vaults rises 10 feet above their flat top and is finished like a parapet with a center pediment containing a large clock dial. Behind the vault are toilet rooms with a liberal number of fixtures for employees and officials; these rooms have ceiling lights and a balcony above them gives access to the upper story of the vault.

The banking room is unobstructed by columns and its roof is supported on the end walls by four transverse steel Pratt trusses 10 feet deep. The lower parts of these trusses are enclosed in moldings about 6 feet deep, which divide the ceiling into five rectangular transverse panels with central horizontal cast-iron ceiling frames, glazed with 4-foot squares of crystal glass, slightly ornamented. The roof consists of five transverse double-pitched skylights, one over each ceiling panel, with steel channel rafters supported from longitudinal I-beams across the top chords of the roof trusses by short columns of slightly varying lengths. This construction leaves considerable space between the ceiling and the skylights, and in it platforms of corrugated iron with hand rails are carried on the roof trusses for the use of the janitors when cleaning the glass.

Except for the mechanical plant the basement is occupied entirely by the safe deposit company and is reached by the elevator and stairs from the entrance hall in the four-story portion of the building. At the foot of the stairs there is a large T-shaped lobby from which there are entrances to the manager's office and three large meeting rooms, to the ladies' reception room and to the men's retiring room. The ladies' reception room communicates at one end with a toilet room and at the other end with a retiring room, and both this and the men's retiring room are divided into numerous private enclosures for the use of persons having boxes in the safe deposit vault, which occupies a 48 x 64-foot space, with the storage and engine rooms between it and the bank vault. Adjacent to the engine room is the heating and ventilating plant, and behind the bank vault is a 66 x 10-foot room with steel lockers for the employees, accessible from a rear stairway, which also leads to the janitor's room and a room for the women servants. Under the street entrance there is a coal bin, general storage room and four toilet rooms.

The first-story entrance vestibule opens into a hall 17 feet wide and 40 feet long, which is practically a continuation of the main banking room, and gives access on one side to the stairs and elevator serving the three upper stories of the front part, and to the directors' room, president's office and private toilet room, which occupy one side of its first story. The whole opposite corner of this part of the building is occupied by the savings bank, with entrances from the main hall and from the national bank, which occupies the remainder of the building. The great banking room has a 42 x 84-foot open central space for the public, which is surrounded on three sides by low partitions and counters enclosing the clerks' rooms. In the second and third stories of the front part of the building there is a large finished hall, a wide unfinished front room, and two light wells above the glazed ceilings of the savings bank and the president's room, which have pitched skylights above the flat roof. All of the fourth story is finished and is occupied by a large dining-room to seat 40 employees, a smaller one for the officials, a kitchen, toilet-rooms and the janitor's closet.



LONGITUDINAL SECTION ON CENTER LINE, CHICAGO NATIONAL BANK BUILDING.

JENNEY & MUNDIE, CHICAGO, ARCHITECTS.

The great banking room has a floor of Vermont marble tile with dots and borders of Georgia green marble, except in the working offices. The walls are covered with marble to a height of 28 feet, and above that with plaster relief ornaments and color decorations. There are five semicircular panels on each side, corresponding with the ceiling panels, as seen in the longitudinal section, and three similar panels in each end of the room. They and the false beams which form the ceiling panels are ornamented in relief and decorated in color. Each arched panel will contain a painting by Mr. Lawrence C. Earle, Montclair, N. J., illustrative of the history of Chicago from the landing of Pere Marquette to the present time. Each picture will be illuminated from below by 28 16-candle-power concealed electric lamps.

The wainscot in the working space is of white Italian marble; elsewhere it, as well as all the piers and panel stiles, is of second statuary Italian marble. Between the piers there are large rectangular panels of Paranozzo marble, each formed of four slabs 7 feet wide and 8 feet high, with matched veining. Some of the slabs were set in one piece, but others, although shipped with liners on the back, broke at the veins and had to be set in small sections, great care being taken in matching. The vault fronts are entirely covered with second statuary marble and the counters are of Georgia green marble with statuary-bronze grillwork above. The gates of the entrance hall, the main doors, all register fronts and electric cabinet fronts are of statuary bronze. The marble work in the trust company's rooms corresponds with that in the main banking room and all public floors are tiled with marble. The wood finish throughout the fourth floor is of quartered oak; in the directors' room it is English oak; in the ladies' reception rooms it is white enamel, and everywhere else in the building it is selected Tobasco mahogany.

The safe deposit vault has a steel and concrete grillage foundation and is 38½ feet wide, 42½ feet long and 8 feet high, with double paving-brick walls and a roof supported on steel girders to obviate the necessity for interior columns. The 17-inch outer wall and the 13-inch inner wall are separated by a 3-inch air space and there is a 1-inch lining of two thicknesses of laminated chrome steel and a 1-inch thickness of bessemer steel. The ceiling is divided into ornamented panels by bronze beams and there are polished bronze plates in the fronts of the 13,800 boxes. The 15 x 25½-foot bank vault is of similar construction. There is a cash vault containing ten large manganese steel safes in the second story, at the level of the floor in the main banking room. The first and third stories are divided by transverse steel partitions into five compartments with separate doors. They are used for books and storage and are fitted with steel shelves and filing cases. The third story is accessible by a balcony supported on cantilever steel beams built into the masonry walls.

The front wall of the building is self-supporting and built of common red brick faced with stone from the Hoosier quarries of the Bedford Quarries Company. The shafts of the columns are each in three pieces, and some of the cornice stones have a volume of 180 cubic feet. On the east side the steel columns are sunk into the old party wall and the new brick wall, only 4 inches thick, is carried on steel beams and is stiffened with steel T-bars 4 feet apart to carry the interior marble facings. The other walls are 13 inches thick, built of hollow brick, supported on steel beams riveted to the columns. On these walls the marble facing is anchored directly to the brickwork, except where it is supported by the angle-iron furring built out around the columns to form pilasters and enclose vertical galvanized iron rectangular air ducts. The marble is bedded in plaster on expanded metal furred out 2 inches from the brickwork. On the east wall the plaster above the marble facing is made on metal lath carried out several inches from the face of the brickwork on steel furrings. The other walls are plastered directly on the brickwork.

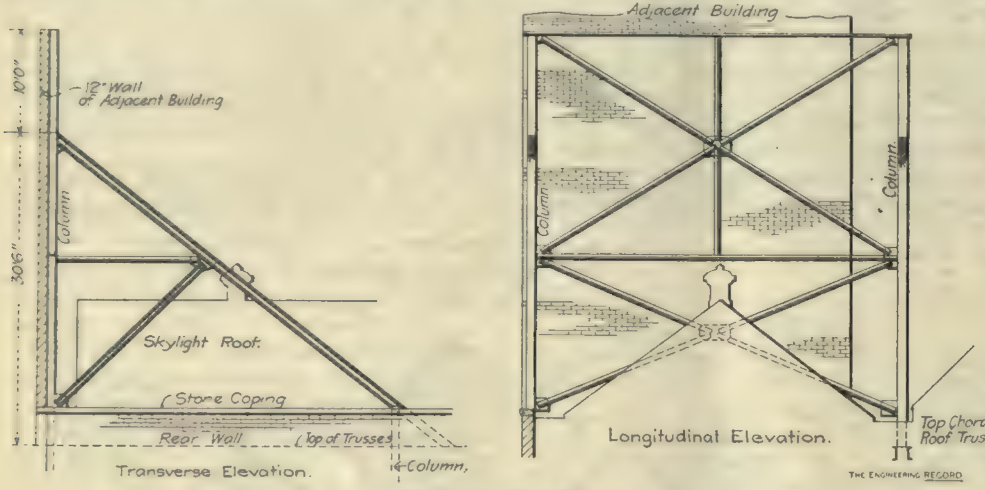
The floors and roof are carried entirely by steel columns which are supported on separate cylindrical concrete piers 4 feet in diameter, and the front wall and entrance columns are supported on similar 5-foot piers. The soil is of soft clay for 50 feet below the street, beyond which it is mixed with gravel to an average depth of 72 feet, where hard-pan is encountered 15 feet above the solid rock. This soft clay usually compresses several inches under customary foundation loads, and as it was desirable to avoid even a small settlement of the building, and as the site was surrounded by small old buildings which may be replaced with tall ones having deep foundations, it was determined to carry the foundation piers down to the hard-pan. This was done by excavating inside of wooden lagging like successive sections of barrels, which were set as the pit was dug. The lagging was 2 inches thick, 4 inches wide and 5 feet long, each section being held by two interior steel hoops. Small pockets of quicksand were passed without difficulty and when the hard-pan was reached, the bottom of the pit was belled out to a diameter of 6½ feet. The shaft was then filled with Atlas cement concrete, made 1:3:4 for the lower 40 feet and

3:6:8 above. Under the entrance columns there are separate piers, in pairs, with their enlarged footings united as shown in the detail. Horizontal steel rails set in concrete were laid across the tops of the pier and overhang it to carry a grillage of transverse 60-pound rails in the concrete footing of the 10½-foot brick pier.

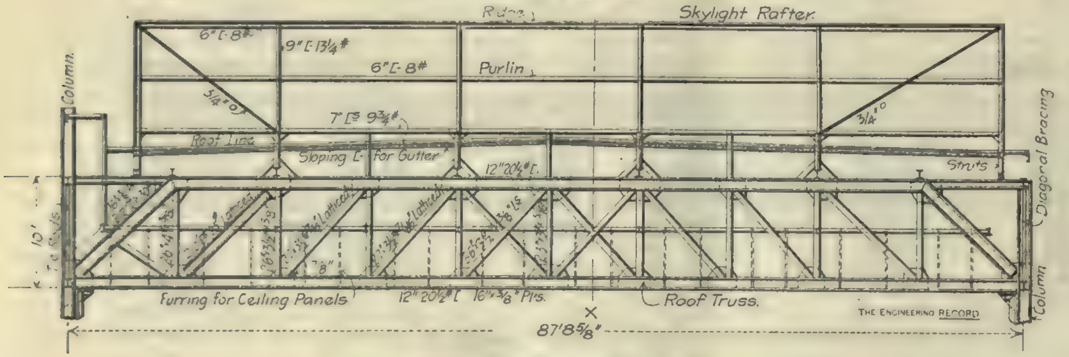
There are twenty main columns in the walls of the building and eight more in two transverse rows in the four-story front part, besides some small ones which support the first floor only. They are made with Z-bars or with pairs of channels and cover plates, and are seated on cast pedestals, bedded in the pier concrete except at the two rear corners, where three are supported indirectly from a pair of piers by a double set of cantilever girders arranged as shown in the detail plan and elevation.

The first floor marble tiles are laid in concrete filling over brick arches 10 and 12 inches thick and of 5-foot span, supported by the lower flanges of I-beam joists which, in the four-story portion, are from 9 to 15 inches deep and of various lengths. In the main banking room they are transverse 12-inch I-beams of about 22-foot span and are supported by pairs of 15-inch longitudinal I-beam girders of 24 feet span except over the safe deposit vault, where there are 8-inch longitudinal I-beams carried on its walls and on two 64-foot transverse box girders 3 feet deep and 15 inches wide.

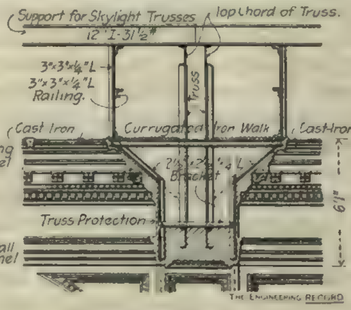
The column and girder construction is of the usual type, except that in the east wall four of the columns are extended nearly 40 feet above the wall coping and are braced by batter posts in transverse planes, and connected by horizontal longitudinal channels so as to make two stiff vertical frameworks, as shown in the diagram. These are really skeleton fire walls and are intended to act as guards for the bank in case of fire in the adjacent building, which is about 30 feet higher than the bank and contains combustibles which would burn fiercely and probably cause the wall to fall outward aganst the bank.



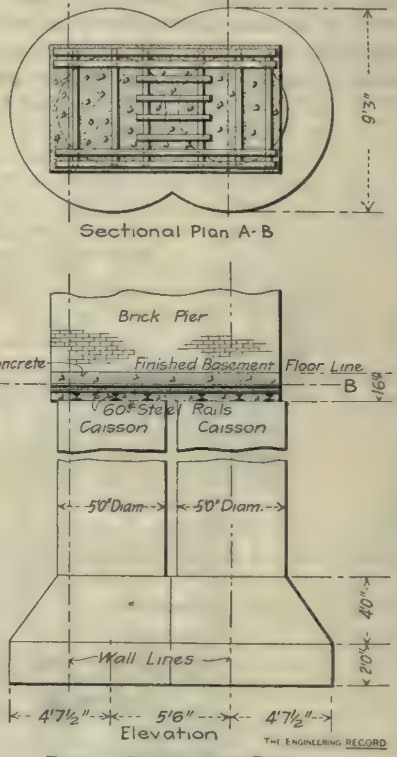
SKELETON FIRE SHIELD.



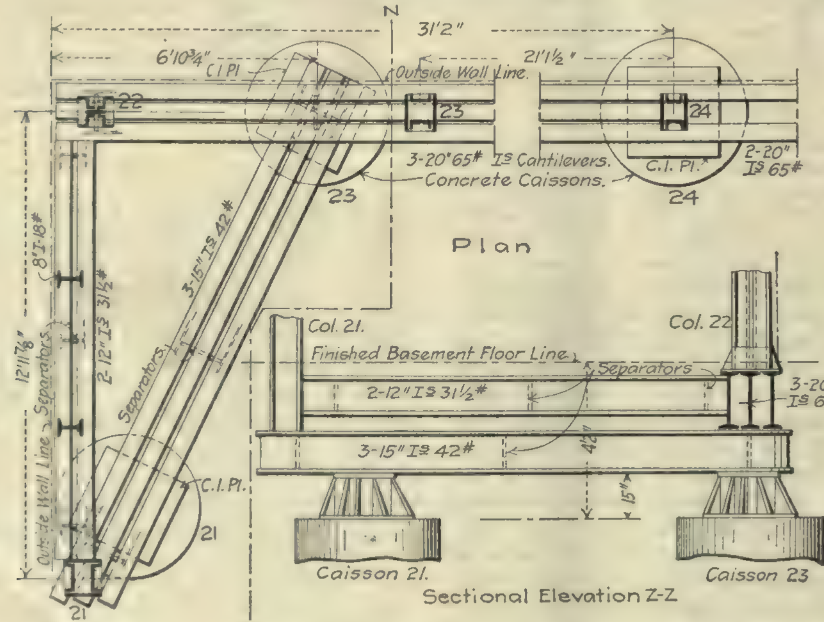
ROOF TRUSS AND SKYLIGHT FRAME.



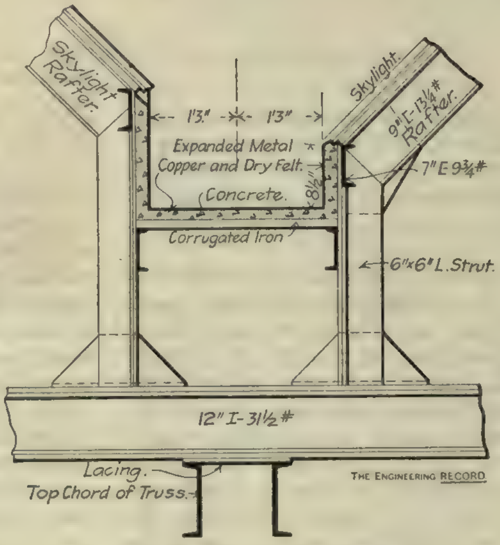
WALK FOR CLEANERS.



DOUBLE FOUNDATION PIER.



DOUBLE CANTILEVERS UNDER COLUMNS.



GUTTER BETWEEN SKYLIGHTS

Over the four-story part of the building the roof construction is similar to the floor construction and is supported on the interior columns, but over the banking room the whole surface, except close to the side walls, is covered with wire glass on copper frames in the double-pitched skylights. The skylight frames span the panels between the roof trusses and have between them, over each truss, a transverse gutter pitched both ways from the center to longitudinal side gutters which pitch from the front wall to leaders at the rear. The gutters are made as shown in the detail, with No. 18 corrugated galvanized iron bottoms and expanded metal sides. They are lined with 2 inches of concrete, covered with two thicknesses of dry felt and sheathed with 16-ounce copper.

The roof trusses are connected together by wall channels at the top and bottom chord levels and by four intermediate lines of 12-inch longitudinal I-beams on the top chords. Alternate panels are X-braced with five sets of ¾-inch and ⅞-inch rods.

Messrs. Jenney & Mundie, Chicago, were the architects and Mr. E. C. Jensen was in charge of the plans in their office. The general contractor was Mr. Joseph Haigh, Chicago. The foundations were put in by Mr. J. H. Sutter, of Chicago, the steelwork was furnished by the Carnegie Company, and the vaults were built by the Remington & Sherman Company, of Philadelphia, and the Herring-Hall-Marvin Safe Company, of Hamilton, Ohio.

The Regulation of Architectural Practice in California.

A few months ago, a law was enacted in California to regulate the practice of architecture, and under its provisions a State Board of Architecture has been formed and rules adopted for the guidance of the members of the profession in taking out licenses. There are ten members of the Board, all appointed by the Governor of the State. Five of them are residents of the northern part of the State and the other five of the southern part, and all must be members of a "chapter of the American Institute of Architects or some similar institution or association of architects." The term of office is four years, except in the case of four members of the original board, who have been appointed for two years. The members serve without compensation from the State, and the expenses are raised by fees collected from applicants for certificates to practice. The officers of the present Board are as follows: President, Octavius Morgan, Los Angeles; vice-president, Seth Babson, San Francisco; secretary and treasurer, Merritt J. Reid, San Francisco; assistant secretary and treasurer, Fred H. Roehrig, Los Angeles.

For administrative purposes, the State is divided into Northern and Southern Districts, with offices at San Francisco and Los Angeles, respectively. The members from the two sections, five from each, are grouped into District Boards, each having a seal distinct from that of the whole Board. The latter meets once a year regularly, and on other occasions at the written request of four members and after 20 days' notice. The District Boards meet at their offices on the last Tuesday of January, April, July and October of each year for the examination of the applicants for certificates to practice, and at such other times and places as they may elect.

Any person is entitled to such an examination on payment to the District Board of a fee of $15. If the examination is passed, a further fee of $5 must be paid to the secretary for an official note of the fact, addressed to the Secretary of State. On the presentation of this note to the latter officer and the payment to him of another $5 fee, the candidate will receive a certificate or license to practice, containing a statement of his full name, birthplace, age and the District Board before which he appeared.

Any architect in good standing, who can prove to the satisfaction of the board of the district in which he resides that he was practicing his profession on the date of the passage of the act, will be granted a note of this fact without any examination on payment to the board of $5, provided the application is made within six months of the passage of the act. On receipt of this note and another fee of $5, the Secretary of State will issue a certificate stating that the person named is authorized to practice.

Every licensed architect must have his certificate recorded in the office of the recorder of every county in which he practices, the fee being the same as for recording deeds. A failure to have a certificate so recorded is sufficient cause for revoking it.

The penalty section of the act establishing this system of licenses is, of course, the most interesting feature of the whole scheme; it reads as follows: "After the expiration of six months from the passage of this act, it shall be unlawful, and it shall be a misdemeanor, punishable by a fine of not less than $50 nor more $500, for any person to practice architecture without a certificate in this State, or to advertise, or put out any sign or card or other device which might indicate to the public that he was an architect; provided, that nothing in this act shall prevent any person from making plans for his own buildings, nor furnishing plans or other data for buildings for other persons, provided the person so furnishing such plans or data shall fully inform the person for whom such plans or data are furnished, that he, the person furnishing such plans, is not a certificated architect; provided, that nothing in this act shall prevent the employment of an architect residing out of the State of California, to prepare plans and specifications for buildings or other structures within the State, conditioned, he shall present satisfactory evidence to the Board of the District in which the structure is to be erected, that he is a competent architect, when such Board shall issue to such architect a temporary certificate for such employment, upon the payment of a fee of $5. Architects' certificates issued in accordance with the provisions of this act shall remain in full force until revoked for cause, as hereinafter provided for in this act. A certificate may be revoked for dishonest practices, or for gross incompetency in the practice of the profession, which question shall be determined by the District Board of the district in which the person whose certificate is called in question shall reside, or shall be doing business; and upon a full investigation of the charges by the District Board, an opportunity having been given the accused to be heard in his own defense or by counsel; and upon the verdict of at least four members of the District Board, the Board may issue its certificate to the Secretary of State revoking the certificate of the person accused; and the Secretary of State shall thereupon cancel such certificate. And on the cancellation of such certificate, it shall be the duty of the Secretary of the District Board to give notice of such cancellation to the County Recorder of each county in the State, whereupon the Recorder shall mark the certificate recorded in his office 'cancelled.' After the expiration of six months, the person whose certificate was revoked may have a new certificate issued to him by the Secretary of State upon the certificate of the District Board by which the certificate was revoked."

All plans issued from the office of a certificated architect must be impressed with a seal having his name and place of business, and the words "certificated architect." A rubber stamp is not sufficient.

Each member of a firm practicing in the State must have a certificate.

The rules concerning examinations recently adopted by the Board read as follows:

The regular class examinations shall occupy not less than two days. One day at least shall be devoted to written examinations, and one day shall be devoted to ascertaining the ability of the candidate to make practical application of his knowledge in the ordinary professional work of an architect, which will include an effort toward ascertaining the qualifications of the applicant in draughtsmanship and also in design, in construction and in the art of planning and rendering.

A diploma of graduation from the full course in architecture or architectural engineering in any university or technical school, approved by the Board, may be accepted as satisfactory evidence of a competent knowledge of architectural design and construction required for a certificate to practice as an architect in California according to law; provided that in such case the applicant for examination shall present evidence, satisfactory to the Board, to show that he has acquired the ability to successfully apply his knowledge to the design and construction of buildings, and to supervise the execution of work.

The subjects upon which the applicants for a certificate of competency to practice architecture, shall be examined are as follows:

Demonstration of ability to make practical application of knowledge in the ordinary professional work of an architect, as follows: 1, merit as investment; 2, planning; 3, construction; 4, design; 5, rendering.

Materials and construction of buildings, eleven subjects, as follows; foundations, concrete work, stone masonry, mortar, brick masonry, structural iron and steel work, carpentry, joinery, sheet metal work, plastering, painting.

Strength of materials, eight subjects, as follows: tension, compression, shearing, transverse strain, structural columns, floor beams, girders, trusses.

Sanitation, three subjects, as follows: plumbing, heating, ventilation.

Electrical construction as applied to buildings.

Supervision, of all the foregoing subjects as applied to buildings.

Each subject of each subdivision shall be graded by the committee on examinations, and the applicant whose grading shall be 75 per cent. or over, shall be entitled to a certificate of competency.

The Blasting of a Very Large Rock on a steep slope just above the tracks of the railroad from Brantome to Champagnac, France, is described in the "Genie Civil." The rock was about 56 feet high, 53 feet long and 20 feet wide, and projected from the face of a cliff, the upper part of which was about 150 feet from the track and about the same distance above it. It was seated on the narrow neck of a base about 10 feet high and was separated from the main cliff by a vertical fissure about 16 inches wide, in which it was thought possible that ice might form and overturn the rock so as to roll it down to the track below. Seventy 2½-inch holes were drilled to a depth of from 1½ to 23 feet, in three rows in the side of the rock and one row in the top, and half a dozen were drilled obliquely in the base. Three-story scaffolds were erected on 60-foot poles and the holes were drilled obliquely from them in vertical planes parallel to the face of the rock. They were charged with 533 pounds of dynamite in ½-pound cartridges, which were loaded in strings, gently rammed with wooden bars, and finally tamped with copper bars. While the holes were being drilled, the slope between the rock and the track was cut in four terraces, concave toward the rock, so as to arrest any fragments rolling toward the track. The charges of dynamite were simultaneously exploded by electricity and shattered the whole mass, of an estimated volume of 1,962 cubic yards, two-thirds of which was retained on the first terrace, and one-quarter on the second terrace. The track was only slightly obstructed, and only four rails were bent. The work cost about $600. A much larger blast made in 1899 by the Pikes Peak Power Company was described in The Engineering Record of January 27, 1900.

LETTERS TO THE EDITOR.

Low Water in the Potomac.

Sir: Various engineers have been employed at different times to report upon the development of the water-power of the Great Falls of the Potomac. To some of these, who had seen the river only in ordinary stages, the results of a low-water gauging made by myself in 1856 seemed so improbable that they have expressed doubts of the accuracy of the measurement. The discharge of the river at that time was 1,063 cubic feet per second.

One report says: "The irregular character of the river bed, however, would render reliable results from a single observation practically unattainable, and the observed discharge (1,063 c. f. s.) can only be considered approximate." Another engineer writes: "Knowing something of the difficulty attending a measurement of the water in that locality, and something of the means available for water measuring at that date, the result appears to be attended with considerable uncertainty."

For the information of others who may have occasion to refer to this gauging, I beg space to say that at the point selected for the measurement, the bottom, although of rock, was quite regular, and the two sections measured were similar. At this low stage the water flowing slowly in a fairly regular bed was quiet, and eminently suitable for the purpose. The sections were marked by two parallel cords across the river, with tags at every 5 feet, and the profiles of the bottom were measured with graduated rods. "Krayenhoff" floats, bars of light pine loaded to float upright, were used to obtain velocities. These reached within a foot of the bottom of the river, and numerous observations were made of the time occupied by them in passing from one section to the other. The time at which each float passed each line and the point of passage were carefully observed, and the velocities deduced therefrom were used without correction.

In the same year Mr. Francis used the same method for gauging the flumes at Lawrence, and made careful experiments to determine the accuracy of the method. He concludes that with rods reaching to within one foot of the bottom the error was under 3 per cent., except in one of fifteen experiments, without correction. When corrected they did not exceed 1½ per cent. These experiments were made on wooden flumes.

The observations in the above measurement were not "single." Nor were there any difficulties from "turbulence" or from insufficient means.

A gauging at another point below the Falls had been made two years before (September, 1854) by means of surface floats. The river was low, though not so low as it had been a month previous, and the method being only approximate, no great weight was given to the result. This indicated a flow of about 2,300 cubic feet per second.

Very truly, Wm. R. Hutton.

New York, August 27.

Engine Specifications.

Sir: The Engine Builders' Association of the United States, at its recent Indianapolis meeting, took up the question of engine specifications, and as a result makes some suggestions for the consideration of engineers and others who draw specifications. These suggestions refer to the general provisions covering engine installations, and as many engineers—including myself—have been guilty of the practices which it is suggested be remedied, it would seem that some remarks from the standpoint of the engineer are in order.

The recommendations referred to are:

(1) That contracts which provide a penalty for failure to deliver in time, or for failure to meet guarantees, ought also to provide equal premiums for earlier delivery, or better results than specified.

There are two distinct features in this clause, one time, and the other efficiency. It would seem that the suggestion is, in the abstract, meritorious. It often happens, however, that while the purchaser may suffer serious loss if he does not get his engine at the time agreed, circumstances may prevent his realizing any benefit by earlier delivery. This would happen, for instance, where the purchaser has a contract for a large amount of electric lighting, either public or private, which goes into effect on a fixed date. In other cases, where an income might be earned at an earlier date if the entire plant were ready, the earlier delivery of the engine alone would be of no benefit unless the dynamos, boilers, piping, distribution lines, etc., were also completed at the earlier date. These are nearly always in separate contracts. It is often necessary, therefore, to impose a penalty when no bonus can be offered. Where the entire installation is in the hands of a single contractor, and where the work which the purchaser is preparing to do is of such a character that it can be entered upon profitably at an earlier date, it would be proper to give a bonus, as well as exact a penalty.

It may be well to point out here the fallacy of the statement, often made, that no penalty can be collected where no bonus has been offered. It is perfectly legal for two parties to enter into an agreement covering the purchase and sale of a machine at a definite value if delivered on a certain date, and a lower value if delivered later. The courts will not uphold a penalty, however, which can be shown to be in excess of the actual damage which the purchaser has suffered. Where the damage, however, is difficult or impossible of exact determination, the courts will uphold the value which has been placed upon it by the contracting parties themselves.

I see no objection to the suggestion that where a penalty is stipulated for loss of efficiency, there should also be a premium for better efficiency. This might, however, be coupled with the limitation that such increased efficiency is not to be secured by the addition of devices or mechanism which would unduly complicate the engine, or increase its liability to derangement.

(2) That bonds should not be required on installation contracts unless corresponding bonds for similar amounts are given to secure payment, an exception always being made in the case of Government, State or municipal contracts.

This bond question is often a troublesome one to the engineer. My own practice is not to require them from manufacturers of known experience and financial standing, who are working within well-established lines. It sometimes happens, however, that the most attractive proposal comes from a new concern, but whose apparatus appears to be of such merit as to entitle it to serious consideration. It may even happen that builders of established standing may enter new fields, and may build engines of new and special types, on which they may make stiff guarantees. In such cases it would not seem unreasonable for the purchaser to ask for a bond of reasonable amount and duration. It has been claimed that the fact that the builder puts a great deal of money into the machine itself, before he gets anything out of it, should constitute a sufficient bond, but that fact would not reimburse the purchaser if the machine should prove a failure. It goes without saying that the seller has the right to satisfy himself fully as to the integrity and financial standing of the purchaser, even to the extent of demanding a bond.

(3) That settlements, or any part of them, ought not to extend beyond three months from completion of contract, and that delay on the part of the owner ought not to delay payment beyond a reasonable time.

No objection can be offered to this, as a general proposition. It often happens that the engine builder exerts himself to the utmost, and goes to increased expense, to make delivery by the date agreed upon, only to find that the purchaser is not ready, and that the machine lies idle for months. This is sometimes due to the purchaser naming a very early date simply to make sure that the engine will be on hand when needed, and this course is not altogether without justification, in view of the length of time which some builders have heretofore taken to get out work. The average purchaser, however, tries to figure his dates as accurately as possible, but he is often delayed by matters unforeseen and wholly beyond his control. In such cases he or his engineer should notify the engine contractor and give him as much additional time as possible. Where the final payment is not due until the engine has been started, the engine builder may lose the interest on the balance for a considerable period, but it should be remembered that the purchaser also loses the interest on the earlier payments. It would seem that where such terms of payment are mentioned in the original specifications, the engine builder could protect himself by adding a small margin to his bid.

(4) That a guaranty against defective material or workmanship should not be made to cover a period of more than one year from date of shipment.

This would seem to be a reasonable provision, and is in line with my own practice. Special circumstances might warrant a departure from the rule, such as where the engine is of a comparatively new and untried type, or where local conditions might prevent a complete test with full load within the first year.

(5) That purchasers of engines ought not to be furnished with complete working drawings, but simply with general drawings showing the assembled engine in outline, with such principal dimensions as will answer for building foundations, the erection of engines, or their care.

My own practice is to ask for detail drawings only in those cases where the engine is very large or of unusual or special type. Also where it is to be located at a considerable distance from the shops of the builders, or where the builders are of limited experience, and liable to go out of the engine business. In such cases detail drawings will perform a very useful purpose in the making of repairs, and in assisting the working engineer in their care and adjustment. They would even permit of the rebuilding of any part, or the entire engine, if for any reason satisfactory arrangements could not be made with the original builder. I see no injustice in these requirements provided they are mentioned in the original specifications, so that the bidder can add to his price whatever he thinks the drawings are worth. Aside from this question of cost, the objections of the builders to giving out detail drawings appear to be about as follows: A, they fear that they may pass into the hands of competing builders; B, if the engine is to be duplicated, they do not think other shops should have the benefit of their design.

As to A, no honorable purchaser would turn the plans over to a competitor, and the builder might very properly insist on this in his bid. As to B, these drawings should only be used for repairs, or where it is impossible to make arrangements with the original builders. If the purchaser really wanted to duplicate his engine he could not be prevented from doing so by not having detail drawings, as the measurements could be taken from the original engine itself.

This question of the ownership and use of drawings is one which has worried professional men for a long time. The architect's code provides that the drawings belong to the architect and not to the owner, but the courts, I believe, have refused to sustain this view, so that it sometimes happens that buildings are duplicated from the original plans without further payment to the architect. Engineers not infrequently have experiences of the same kind.

From the above it would appear that no hard and fast rules can be drawn which will properly cover all the cases that may arise. It is undoubtedly true that engine builders often have cause for grievance along the lines indicated above, but it is equally true that there is another side to it. Undoubtedly there is sometimes warrant for each of the five objectionable practices referred to. It is evident, however, that thoughtful consideration of these difficulties, and a mutual effort in good faith to avoid friction, must result in a better understanding all around.

Yours truly, William H. Bryan,
St. Louis, July 10. Consulting Engineer.

Personal and Obituary Notes.

Mr. C. J. Fiske, city engineer of Gloversville, N. Y., has resigned that office and Mr. Morris Vrooman has been appointed his successor.

Mr. Wm. Brown, for many years superintendent of the steel plant of the Phoenix Iron Co., has resigned to accept a similar position with the Lukens Iron & Steel Co., Coatesville, Pa.

Mr. J. Winslow Meade, of Rochester, for the last six years chief clerk of the New York State Department of Public Works, has been appointed deputy superintendent of public works, succeeding Dr. Elon Huntington Hooker.

Dr. James C. Bayles, a writer for the New York "Times," and former president of the New York Board of Health, has been retained by Comptroller Coler to report on the value of the garbage disposal plant at Barren Island.

Mr. Oscar J. West, formerly in charge of the Boston offices of the Phoenix Bridge Co., is now its resident engineer at 455 The Rookery, Chicago, taking the place of Mr. A. C. Stiles, who has retired after a long service with the company.

As a result of a preliminary architectural competition for the Newark, N. J., city hall, the following five firms have been selected for the final competition: O'Rourke & Duboys, New York; John H. & Wilson C. Ely, Newark, with Mowbray & Uffinger, New York, as associates; W. B. Tubley & Bro., New York; Jeremiah O'Rourke & Sons, Newark; Ackerman & Ross, New York.

Mr. J. F. Cassell has resigned the position of division engineer at Baltimore of the Baltimore & Ohio R. R. to become chief engineer of the Elgin, Joliet & Eastern and Chicago, Lake Shore & Eastern roads, with headquarters at Chicago. He will be succeeded at Baltimore by Mr. E. P. Mobley, now division engineer at Cumberland, whose office will be taken over by Mr. A. W. Thompson, promoted from the position of assistant engineer at Pittsburg.

John Rochester Thomas, the well-known New York architect, died suddenly at the Thousand Islands on August 27. He was born in Rochester in 1848, and studied his profession there and in Europe. In 1882 he opened an office in New York and soon built up a large practice. The Elmira Reformatory, the Eighth Regiment Armory and the double-story drill halls of the Seventy-first Regiment Armory in New York, and the Rahway Reformatory, are a few of his leading works. In 1896 his designs for a new city hall in New York were given first prize among the 133 submitted in competition, but the legislature stopped their execution. Of late he was the architect of the new Hall of Records in New York, now under construction.

Mr. Charles M. Jarvis, M. Am. Soc. C. E., formerly president of the Berlin Iron Bridge Co., has returned from Europe and will shortly take up the duties of vice-president of the P. & F. Corbin Mfg. Co., New Britain, Conn., one of the leading New England industrial establishments. Mr. Jarvis is so well known in the engineering and business worlds that his statement of his new responsibilities is of general interest: "Both Philip and Andrew Corbin, the men who founded and nurtured this great industry, from the day when its sole power was furnished by an old white horse in the cellar of a little shop, until now, when it stands the greatest manufacturer of hardware in the world, feel that they are entitled to more relaxation than their energy has permitted them to take in many years past. So they have decided that I can in great part relieve them of some of their care and responsibility. I will get into harness in a few weeks. Now don't convey the impression that Messrs. Corbin are to separate themselves in any way from the business which they have created and guided these many years. That would be quite impossible. They are to be there, but I am to step in and act as a sort of buffer between them and a good deal of the great volume of business which comes to them as the heads of the concern."

A New Pipe Joint for high-pressure steam piping is shown at the Pan-American Exposition by the Walworth Manufacturing Company of Boston, which will be of interest to designers of steam plants. It consists of a saddle flange, made by flanging the end of extra-heavy steel pipe of various diameters, so that it can be riveted directly to steam mains for the nozzles of branch connections. Usually such branches have been made by inserting ties in the main, by casting nozzles on the main itself when it is of cast iron, and, in a few instances, by employing pipe made of boiler steel, bent and riveted at the laps, the end of the branch pipe being heated, flanged, and then riveted to the main. A 42-inch gate valve for steam, said to be the largest ever made for such use, is also shown.

The American Society of Municipal Improvements will hold its annual convention in the auditorium of the Pure Food Company at Niagara Falls on October 1-4 inclusive. The secretary, Mr. D. L. Fulton, states that the papers listed up to this time are: Report of Committee on Taxation, August Herrmann, Cincinnati; report of the Committee on Disposition of Garbage, John Jones, Toronto; report of the Committee on Review, Nelson P. Lewis, Brooklyn; report of the Committee on Municipal Data, C. C. Brown, Indianapolis; "The New Sewage Purification Plant at Madison, Wis.," F. E. Turneaure; "State Legislation and Municipal Sanitation," Olin H. Landreth, Schenectady; "The Water Meter as a Sanitary Agent," Moses N. Baker, New York; "Engineering Phases of Work of Municipal Boards of Health," Marshall O. Leighton, Montclair, N. J.; "Recent Experiences with Wood Pavements," B. T. Wheeler, Boston, Mass.; "Pavement Guarantees," George W. Tillson, Brooklyn; "Utilization of Garbage in Production of Steam," Dr. E. B. Ellicott, Chicago; "Wooden Pavements at Home and Abroad," F. A. Kummer, New York.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Laurel, Neb.—Bids are wanted Sept. 6 for a system of water-works, as advertised in The Engineering Record.

Fremont, O.—Bids are wanted Sept. 13 for furnishing material and labor necessary for the drilling of 2 or more artesian wells. Geo. O. Harlan, Pres. Bd. of Water-Works Trustees.

Cleveland, O.—Bids are wanted Sept. 17 for constructing a conduit to divert Giddings Brook through Baldwin Ave. into Doan Brook. Chas. P. Salen, Dir. Pub. Wks.

Geneva, O.—Bids are wanted Sept. 4 for the construction of foundation walls and stone bulkhead for pumping station. A. H. Reed, Village Clk.

Voorheesville, N. Y.—Bids are wanted Sept. 3 for $17,000 water-works bonds. S. J. Daring, Village Clk.

Greenwood, B. C.—D. D. Hardy (present address, 619 Moblee Ave., Chicago, Ill.), foreman of construction, writes that water-works are to be built at an estimated cost of $50,000; pipe will not be laid until the spring of 1902. Engr. in Charge, S. Johnston.

Carthage, N. Y.—Engr. in Charge Jas. P. Brownell writes that preliminary surveys for a new water supply have been completed; they show the length of line to be 15 miles, and springs 126 ft. higher than the stand-pipe.

Brockton, Mass.—City Engr. Chas. R. Felton writes that a report has been made recommending Silver Lake as a source of water supply for this city, but no action has been taken by the city government. Desmond Fitz Gerald, of Boston, Consulting Engr.

Duluth, Minn.—L. N. Case, Mgr. of the Water-Works, writes that the extension of water mains to Hunter's Park and Glen Avon has been petitioned for, to be put in next season; work will be done by the department, but bids for materials will be received.

Longmont, Colo.—The City Council has approved an ordinance providing for the issue of $110,000 bonds for the purpose of rebuilding, enlarging and improving the water system.

Caldwell, Idaho.—City Clk. C. J. Shorb writes that on Aug. 21 a vote was taken in favor of issuing $20.000 worth of water-works bonds.

Morton, Minn.—The contact for constructing a system of water-works (without reservoir) has been awarded to Fairbanks, Morse & Co., of St. Paul, Minn., for $2,994; the contract for the reservoir was awarded to John Anderson, of Morton, Minn., for $1,200.

Edison, Ill.—Village Clk. D. A. Pfitzinger writes that the proposition to construct water-works and a sewer system at an estimated cost of about $26,000 is still in the hands of the Board of Local Improvements. R. C. Huston & Co., of Chicago, Ill., Engineers.

Ft. Collins, Colo.—The Beaver Creek Reservoir Co. has been incorporated with a capital of $5,000. Incorporators: Philip Wilson, E. J. Gregory and Chas. A. Button.

Sardis, Miss.—A vote is said to have been taken at the recent election in favor of the construction of water-works, at an estimated cost of $15,000.

Cripple Creek, Colo.—The City Council has under consideration a proposition by E. E. Wade to sell a portion of the Seven Lakes on Pike's Peak for a reservoir site.

Westerville, O.—Bonds to the amount of $25,000 have been voted for water-works.

Newport News, Va.—The Virginia Artesian Water Co. has secured franchises in this city. Address, Thomas B. Henley, Newport News, for further information.

Barberton, O.—Press reports state that the proposition of O. C. Barber, to build, under certain conditions, a $75,000 water-works and electric light plant for this village, has been accepted.

Washington, Pa.—The Citizens Water Co. has closed the negotiations for the purchase of 125 acres of land at the site of the new dam it proposes to erect on a branch of Chartiers Creek, some three miles south of Washington.

San Diego, Cal.—City Engr. G. A. D'Hemecourt writes that the Common Council has directed that a report, with recommendations for improvements, be made upon the condition of the two water plants recently purchased by the city.

Sheridan, Ore.—The question of water-works construction is said to be under consideration.

Thief River Falls, Minn.—Press reports state that the estimated cost of a water-works system is $11,000.

Sherburne, Minn.—Press reports state that there is talk of extending the water mains.

Columbus, O.—Press reports state that Capt. Palmer, Constructing Quartermaster, is preparing plans for the independent water-works system, at the barracks, ordered by the War Department. The plans call for a 10,000-gal. tank and a water tower.

Redwood Falls, Minn.—The Chicago Bridge & Iron Co. was, according to press reports, the lowest bidder for a steel water tank, at $5,880. Loweth & Wolf, of St. Paul, Engrs.

Valley Springs, S. D.—The Council is said to be considering a compressed air system of water-works.

Waterloo, Ia.—W. J. Zitterell, of Webster City, Ia., is reported to have received the contract for constructing a pumping station for the Waterloo Water Co., at $14,960.

Dallas, Tex.—At a recent mass meeting the citizens passed resolutions in favor of the issue of $100,000 additional bonds for a pipe line to convey water from the new reservoir to the city.

Yardley, Pa.—C. Taylor Leland, of Philadelphia, is said to be negotiating for franchises to construct water-works in Yardley and New Hope, Pa.

East Liverpool, O.—Local press reports state that a site has been purchased for the installation of a sand filtration plant, estimated to cost $5,000.

Fort Worth, Tex.—The contract between the city of Fort Worth and Daniel W. Mead, of Chicago, for the 3,000,000 gal. artesian water supply daily, has been signed.

Chattanooga, Tenn.—The city has entered into a new 20-year contract with the City Water Co.

Oswego, N. Y.—Press reports state that the question of issuing $550,000 bonds for the purchase of water-works is under consideration.

California, O.—W. W. Ramsey, Receiver, Neave Bldg., Cincinnati, will sell Sept. 3, at California the entire contractors' plant purchased by R. M. Quigley & Co. for the construction of reservoirs and other work of building the new water-works, at a cost of $100,000. R. M. Quigley & Co., California.

Mantua, O.—The State Board of Health has approved plans for a new water supply for Mantua.

Ft. Plain, N. Y.—Engineer Baxter, of Utica, has been engaged to investigate the village water-works, with a view to improving same.

Kirkwood, Mo.—A committee has been appointed, with Geo. W. Taussig as chairman, to secure estimates, etc., for the proposed system of water-works.

Laurinburg, N. C.—Press reports state that an engineer will be engaged to survey the town for the proposed water-works and electric light plant.

Pass Christian, Miss.—The Council has passed an ordinance providing for the issue of $12,000 bonds for a water-works system.

Appleton, Wis.—Consulting Engrs. Sturtevant & Todd write that the date has not been set for the letting of water-works contract.

Keene, N. H.—A site has been purchased on Beech hill for a new 3,000,000-gal. distributing reservoir.

Wellsville, O.—The State Board of Health has approved plans for a new water supply for this city.

Denver, Pa.—E. B. Kay, of Ithaca, N. Y., has been employed by the Borough Council to prepare plans and specifications for the proposed water plant.

Deer River, Minn.—A vote has been taken in favor of the construction of water-works at a cost of $5,000.

Troy, N. Y.—Maps and plans for the Tomhannock extension of the water-works system have been confirmed by Commissioner of Public Works Phelan. Estimated cost, $680,000 for reservoir and $260,000 for conduit.

Fond du Lac, Wis.—Press reports state that the water company has been ordered to repair and improve the water mains to the manufacturing district.

Lafayette, Ind.—Plans and specifications are being prepared by J. F. Alexander & Son, Lafayette, for a $10,000 auxiliary pumping station in Columbian Park.

Keswick Cal.—Vallejo capitalists are stated to have organized a company with a capital of $75,000 for the construction of water-works for Keswick.

Pierce, Neb.—The proposition to issue $10,000 water-works bonds is stated to have carried.

Shellman, Ga.—At the election held Aug. 21 it was voted to construct water-works.

Laurel, Md.—Kenneth Allen, of Baltimore, in a recent report recommends the plan of securing water from Cull's Lake and the erection of a pumping station near the power house of the electric light company; estimated cost $12,209; the estimated cost of the distributing system is $19,500, making the total within the appropriation of $35,000.

Asotin, Wash.—Articles of incorporation have been filed by the Asotin Land & Irrigation Co. Capital stock, $40,000.

Lynn, Mass.—A majority report from the committee on water supply recommends that $400,000 be borrowed for the development of the water system.

Ft. Leavenworth, Kan.—Plans are now being prepared for the new water supply for Ft. Leavenworth.

Newman, Ill.—Press reports state that steps are being taken toward establishing a water system.

Baraboo, Wis.—The Council has unanimously adopted a resolution for the mayor and city attorney to take steps to annul the charter of the Baraboo Water-works Co., and authorized the finance committee to take the initiatory steps toward issuing municipal bonds for the construction of a new water plant.

Trenton, N. Y.—The question of establishing water-works and sewerage system is being agitated.

Marshall, Mo.—This city has decided to build a municipal water-works plant and on Aug. 24 Richard H. Phillips, of St. Louis, was appointed as consulting engineer in charge of surveys and the preparation of plans and specifications. A test well is to be bored at once.

Sarnia, Ont.—Town Clk. J. D. Stewart writes that it is proposed to secure a water supply from Point Edward at an estimated cost of about $65,000, but the necessary by-law has not yet been submitted to property owners.

Madison, Neb.—City Clk. Clyde G. Rynearson writes that on Sept. 24 a vote will be taken on the proposition to issue $5,500 bonds for the construction of a stand-pipe and the extension of water mains.

Abbott, Tex.—A charter has been filed by the Abbott Artesian Water Co., of Abbott, Hill County. Capital stock is $10,000. The incorporators are F. D. Wilkes, W. R. Tinsley and Milton Bowman.

Joliet, Ill.—Bids are wanted Sept. 2 for the furnishing of an air compressor for the water-works plant, to be run by steam or electricity and capable of lifting 4,000,000 gals. of water per 24 hours from a depth of not less than 200 ft. below the surface. The said compressor to be completely installed, with foundations, steam and air connections, at the city water-works plant. Richard J. Barr, Mayor.

Centralia, Ill.—It is stated that bids are wanted Sept. 9 for an earthen dam for a reservoir to contain 19,000 cu. yds. Wm. Hahn, Chmn. Water Com.

SEWERAGE AND SEWAGE DISPOSAL.

Boston, Mass.—Bids are wanted Sept. 27 for building 9 sections of the high-level sewer in Quincy and Milton, as advertised in The Engineering Record.

Kings Park, N. Y.—Bids are wanted Sept. 18 for constructing a sewage disposal plant at the L. I. State Hospital, as advertised in The Engineering Record.

Edison, Ill.—See "Water."

Evansville, Ind.—Bids are wanted Sept. 14 for the construction of a sewer in block 13. W. E. Clarke, Clk. Dept. of Pub. Wks.

Rome, N. Y.—Bids are wanted Sept. 3 for the construction of a storm sewer system on South James St. Jay Capron, City Engr.

Ligonier, Ind.—Bids are wanted Sept. 5 for the construction of a tile sewer. R. E. Jeanneret, City Clk.

Milton, Pa.—Town Clk. Wm. C. Miller writes that bids will be opened Sept. 3 for 2,300 ft. of sewer construction on 3 streets. Estimated cost, $3,000.

Toledo, O.—Bids are wanted Sept. 9 for constructing pipe sewers in 2 streets. John E. Connell, City Clk.

Oshkosh, Wis.—Bids are wanted Sept. 16 for the construction of a part of the Murdock St. sewer system. Frank Monahan, Chmn. Bd. of Pub. Wks.

Susquehanna, Pa.—Chas. F. Curtis, Chmn. of the Sewerage Committee, writes that the proposition to construct a general system of sewerage for the borough is under consideration, but no definite action has as yet been taken.

Madison, N. J.—Plans for a system of sewage disposal are now before the State Sewerage Commission.

Jersey City, N. J.—Bids are wanted Sept. 3 for the construction of sewers in Van Wagenen and Milton Aves. Geo. T. Bouton, Clk. Bd. of Street & Water Commrs.

Webster City, Ia.—City Clk. P. M. Banks writes that the contract, for 2,510 ft. of 18-in. pipe sewer, with 17 manholes and 20 catch basins, has been awarded to Dunnegan & Sullivan, of Shenandoah, Ia., for $5,327. Average depth of excavation, 11½ ft., mostly in sand and gravel.

Westerville, O.—Bonds to the amount of $20,000 have been voted for the construction of sewers.

Mapleton, Minn.—County Surveyor Brooks has commenced work on laying out the sewer system.

Niagara Falls, N. Y.—City Engr. Very has submitted estimates on sewers necessary to be built, amounting in all to $243,100.

Highland Park, Ia.—Resolutions of necessity have been passed by the Council for the construction of a sewer system for Highland, Oak and Lake Parks.

Vandalia, Ill.—J. W. Dappert, C. E., of Taylorville, Ill., writes that in a few weeks contracts will be let for about 6 miles of dredge-works, about 107,000 cu. yds. of earth work and some 6 miles of large tile drains. A. B. Alexander, County Surveyor.

Hartland, Me.—The question of constructing a system of sewers is under consideration, but plans have not yet been made.

Clinton, Ia.—The question of constructing a sewerage system at a probable cost of $200,000 is under consideration.

Logansport, Ind.—The Common Council has instructed the City Engineer to prepare plans for the extension of the sewerage system, embracing about 1 mile of 8 to 12-in. pipe sewer with manholes, etc.

Ashland, O.—Plans prepared by Engineer Chapin, for a sewer system, including a disposal plant, have been approved by the State Board of Health.

Armstrong, Ia.—Press reports state that a contract is about to be let for the construction of a sewerage system.

Woodstock, Ont.—Press reports state that the septic tank system of sewage disposal may be installed.

Trenton, N. Y.—See "Water."

Bluefield, W. Va.—Steps are being taken to issue bonds for an entire sewerage system. Estimated cost, $30,000.

Lancaster, Pa.—The Finance Committee has approved the ordinance appropriating $10,000 for new sewers.

Salem, Ore.—The State Board of Capitol Building Commissioners has accepted the bid of Chas. A. Gray at $13,990 for the construction of a sewer 20 x 30 in., the State to do the back filling.

Indianapolis, Ind.—Bids are wanted Sept. 6 for a local sewer in Dearborn St.; also in first alley north of New York St. Albert Sahm, Chmn. Bd. Pub. Wks.

Wilkinsburg, Pa.—Bids are wanted Sept. 5 for sewers in portions of Montier and Bessica Sts. Frease & Sperling, Boro. Engrs.

Wilmerding, Pa.—Bids are wanted Sept. 3 for sewers in portions of several streets. C. C. Cowell, Boro. Clk.

Binghamton, N. Y.—Bids are wanted Sept. 3 for a sewer in Jarvis St. I. C. Hull, City Clk.

Scranton, Pa.—Bids are wanted Sept. 3 for constructing and repairing sewers in numerous streets. John E. Roche, Dir. Dept. Pub. Wks.

McKeesport, Pa.—Bids are wanted Sept, 7 for a sewer in Monongahela Ave. H. C. Griffin, Chmn. Sewer Com.

Cincinnati, O.—The State Board of Health has approved plans for storm water sewers in Districts 13 and 14.

Fowler, Ind.—Bids are wanted Sept. 9 for a sewer system consisting of 6,868 ft. of sewer with branches and 1,395 ft. extension, average cut 10½ ft., with 20 catch basins, 19 manholes, etc. Frank Carter, Town Clk.

Conneaut, O.—Plans for a sewer system have been approved by the State Board of Health, with the understanding that a purification plant be added to the system.

Los Angeles, Cal.—City Engineer Safford is said to be working on plans for new outfall sewer to the ocean. It is proposed to built 6-ft. masonry sewer on gravity system, which it is stated will cost $750,000.

Delhi, N. Y.—The Village Clerk writes that on Aug. 28 it was voted to construct a sewerage system.

Hazleton, Pa.—According to local press reports, contracts will soon be let by City Engineer Celiax for the extension of the stone arch sewer on Locust St. Appropriation, $5,000.

Homestead, Pa.—The Borough Engineer of W. Homestead has been directed to prepare an estimate of the cost of sewering, paving and grading the streets of the entire town, preparatory to voting upon the question of issuing bonds for the same at the general election in November.

Harrison, N. J.—It is stated that bids are wanted Sept. 3 for pipe sewers in 2 streets. B. P. Walsh, Town Clk.

Albany, N. Y.—Clerk Wachman of the Board of Contract & Supply will receive bids for sewers in 3 streets.

Joliette, Que.—Bids are wanted Sept. 4 for constructing a sewer plant and a water intake. A. L. Marsolais, Secy.-Treas.; J. O. A. Laforest, Engr., 99 St. James St., Montreal.

Coldwater, Mich.—Bids are wanted Sept. 2 for constructing 1,575 ft. of 42-in. brick or cement block and 375 ft. of 10, 600 ft. of 12 and 900 ft. of 15-in. vitrified pipe storm water sewers, with manholes, catchbasins, etc. P. H. Sweeney, City Clk.

Dayton, O.—Bids are wanted Sept. 10 for 600 lin. ft. of 36-in. brick and 1,450 lin. ft. of 12, 18, 24 and 30-in. pipe sewers, 7 manholes and 16 catchbasins. G. F. Kuhns, Pres. Bd. City Affairs.

Newark, N. J.—Bids are wanted by the Bd. of Street & Water Commrs. until Sept. 5 for a main pipe sewer in Frelinghuysen Ave. J. Crowell Mundy, Gen. Supt. of Wks.

Victoria, B. C.—A petition will soon be presented to the City Council asking that a bylaw be placed before the ratepayers to authorize the borrowing of $100,000 for the purpose of providing septic tank system of sewerage for certain portions of the city.

Sault Ste. Marie, Mich.—Local press reports state that the following bids were opened Aug. 22 for constructing trunk and intercepting sewers in a portion of the city: J. E. Whalen, of Sault Ste. Marie, $49,284; C. S. Beadle, Sault Ste. Marie, $56,592; John F. Arnott, Sault Ste. Marie, $65,049; J. H. Green & Sons, Appleton, Wis., $59,213.

Owosso, Mich.—Local press reports state that the following bids were opened recently for the construction of Allendale and Texarkana annex sewers: Guild & Co., of Chattanooga, $97,200; T. J. Shea, of St. Louis, $98,950; C. M. Burkalter & Co., of Birmingham, $105,723.60.

Wabash, Ind.—City Engr. Robert P. Woods writes that bids received Aug. 26 for sanitary sewer outlet, 9,057 ft. of 12-in. vitrified pipe, except 420 ft. of C. I. pipe, average cut 9 ft., of which 3½ ft. is rock, were as follows: Th. Bridges' Son, $1.98 per lin. ft., total $17,932.86; W. S. Stitt, $1.91 per lin. ft., total $17,298.87; P. Hipskind & Sons, $1.88 per lin. ft., total $17,027.16. All bids were rejected.

Mayville, N. D.—City Auditor W. J. Cooper writes that the following bids were opened Aug. 19 for constructing a sewerage system, work to include 7,166 ft. of 10 to 24-in. pipe sewers, average depth of excavation to be 15 ft.: Michael Fitzgerald, Duluth, Minn., $17,934; E. T. Webster, Alexandria, Minn., $20,204; Allan Block Co., St. Paul, Minn., $15,888; Jas. Kennedy, Fargo, N. D., $13,595 (awarded). Engineer in Charge, Geo. Brambel.

BRIDGES.

Dayton, O.—Bids are wanted Sept. 4 for the construction of stone abutments and pier for the bridge across Hydraulic Race at Linwood St. G. F. Kuhns, Pres. Bd. of City Affairs.

Cleveland, O.—Bids are wanted Sept. 4 for repairing with concrete and masonry the substructure of bridge over the Cleveland Terminal & Valley R. R., connecting Stone's levee and Canal St. Chas. P. Salen, Dir. of Pub. Wks.

Hamilton, O.—Bids are wanted Sept. 13 for the construction of 2 iron or steel highway bridges; also for masonry, abutments, etc., for several other bridges. H. C. Gray, Auditor Butler Co.

Miles City, Mont.—County Surveyor Geo. Scheetz writes that the Board of County Commissioners will soon receive bids, with plans and specifications, for the construction of a bridge over Yellowstone River.

Dallas, Ore.—Bids are wanted Sept. 4 for the construction of 72-ft. span bridge across Yamhill River, about 2 miles above Grande Ronde Agency. U. S. Loughary, County Clk.

Paulding, O.—Bids are wanted Sept. 12 for constructing 2 bridges across Auglaize River at Oakwood, O. M. P. Jacobs, County Commr.

Weiser, Idaho.—Bids are wanted Sept. 9 for either a wood or steel bridge to be built across Main Weiser River. Estimated cost, $2,500, if wood, or $4,000 if steel. I. F. Smith, Clk. Bd. of County Commrs. D. A. Utter, of Weiser, Engr. in Charge.

Mahwah, N. J.—Bids are wanted until Sept. 4 by a committee of the Board of Chosen Freeholders of Bergen County, at Petry's Hotel, Mahwah, for building a bridge with stone abutments, steel beams and brick arches in the township of Hohokus. Jas. Devine, Jr., Chmn. of Com.

Vicksburg, Miss.—Bids for the construction of an iron bridge over Big Black River will be opened Sept. 4, not Sept. 2, as previously stated. Wm. Curphy, Pres. Bd. of Supervisors.

Jacksonville, Fla.—A resolution has been adopted by the City Council requesting the Board of Public Works to have the Atlantic, Valdosta & Western Ry. Co. rebuild the Duval St. viaduct and keep the same in repair.

Kenosha, Wis.—It is stated that the Street Railway Co. contemplates building a $20,000 bridge here.

Stony Brook, Minn.—Press reports state that the Great Northern R. R. will this winter construct a steel bridge across St. Louis River, near Stony Brook, to replace present temporary structure. J. F. Stevens, Ch. Engr., St. Paul.

Richmond, Que.—The construction of a $35,000 bridge, between Richmond and Melbourne, is said to be under consideration.

Long Island City, N. Y.—Plans are being prepared, according to press reports, for 3 stone arch and steel bridges, also 5 steel viaducts, to be constructed on the Port Jefferson branch of the L. I. R. R.

Connellsville, Pa.—A charter has been granted to the Greenwood Bridge Co. for the purpose of constructing a bridge across Youghiogheny River between Connellsville and New Haven.

Havre, Mont.—O. E. Peppard, of Missoula, is stated to have secured the contract for constructing a bridge across Mill River, at $6,200 and $5 per lin. ft. for 120 ft. of approaches.

Milwaukee, Wis.—B. E. Sivyer is reported to have secured the contract for building a bridge at 2d Ave., for $5,750.

President Cornelius Corcoran of the Common Council has appointed a committee to confer with the officials of the Milwaukee R. R. in regard to building a bascule railroad bridge near West Water St.

New York, N. Y.—The Dept. of Bridges is preparing plans for a bascule bridge over Newtown Creek, to cost about $750,000.

Glendale, R. I.—The citizens contemplate constructing a stone arch bridge near Glendale.

New London, Conn.—The Central Vermont R. R. Co. is said to be contemplating the construction of a bridge to replace present structure across Winthrop Cove; also the elimination of the crossings at 6th and 16th Sts., in East New London.

St. Paul, Minn.—The Board of Aldermen has approved plans for a combination iron bridge to be constructed at White Bear Road. It will be 820 ft. long, including approaches, have a 20-ft. roadway and 5-ft. walks. Probable cost, $16,000.

Erie, Pa.—City Engineer Briggs will communicate with iron bridge companies in regard to specifications and the estimated cost of proposed bridge over the railroad tracks at 18th St, and the Buffalo road. The city engineer recommends a 2-span bridge, while the P. & E. Co. wants a single-span bridge erected.

Newburyport, Mass.—The Essex County Commissioners have completed plans for the Salisbury bridge at Newburyport, and will soon submit them to the Harbor and Land Commissioners.

Dedham, Mass.—The Norfolk County Commissioners are to be given a hearing Sept. 18 by the Harbor and Land Commissioners on their petition for approval of plans for the Quincy Point bridge over Weymouth Fore River.

Annapolis, Md.—Lauer & Harper, of Baltimore, are reported to have secured the contract for placing a steel draw in South River bridge, at $8,925.

Houston, Tex.—A movement is on foot to have the County Commissioners build a bridge over the bayou at some point between the present San Jacinto St. bridge and the Santa Fe Railway bridge.

Cincinnati, O.—Press reports state that the offer of the Pennsylvania Co. to elevate its tracks through the city limits has been accepted and steps for carrying out the improvement will begin at once. It is said that the Baltimore & Ohio Southwestern will in the near future elevate its tracks. It is the intention of the B. & O. Southwestern to abolish all grade crossings in Cincinnati, involving an expenditure of $1,000,000. The surveys and estimates of this work have already been made.

Tipton, Ind.—Bids are wanted Sept. 13 for 9 small steel county bridges, ranging from 16 to 50 ft. long. E. Perry, Co. Aud.

Charlotte, N. C.—This township will build a steel bridge at an early date. Address M. C. Mayer, Charlotte.

Pittsburg, Pa.—Plans for reconstructing the Panhandle bridge across Monongahela River have been approved by the Secretary of War.

Kenosha, Wis.—The cost of removing and completing the Main St. bridge has been estimated at $6,800.

Greenwich, N. Y.—See "Railroads."

Seattle, Wash.—The Northwestern Bridge Co. is said to have received the contract for constructing a bridge across Duwamish River at Spokane Ave.; also for building 5,000 ft. of approaches, at $5,900 and $2.20 per ft. respectively.

St. Joseph, Mich.—It is stated that the Pere Marquette R. R. Co. has decided to construct a $200,000 steel swing bridge over St. Joseph River here. It will be 750 ft. long, including approaches, and will be operated by steam power.

Boston, Mass.—Bridge Commissioners Wheeler, of Boston, and Marvin, of Cambridge, have awarded a contract to the United States Wood Preserving Co., for stripping Harvard bridge, over Charles River, and laying a new deck of 3-in. long leaf yellow pine treated by the creoresinate process, and on that to lay a surface of wood block paving, also creo-resinated. Area, about 11,425 sq. ft.; estimated cost, $50,000. The mayor of each city has approved the contract. This bridge is supported equally by Boston and Cambridge.

Atlantic County, N. J.—Bids are wanted Sept. 11 for the construction of the Absecon bridge, as advertised in The Engineering Record.

Willows, Cal.—It is stated that bids are wanted Sept. 17 for constructing a steel bridge at Needham Crossing. W. H. Sale, Clk.

New York, N. Y.—John G. Tait, Pelham Parkway, has secured the contract for constructing a bridge over Bronx River at Westchester Ave. (bids opened Aug. 28), for $77,851.

Ogden, Utah.—A. F. Parker, City Engr., writes that bids will be received Sept. 23 for a steel Pratt truss highway bridge, having 100 ft. span and an 18-ft. roadway.

Sherbrooke, Que.—Bids are wanted Sept. 3 for constructing the superstructure of a riveted steel highway bridge, 295 ft. long. F. J. Griffith, City Secy.-Treas.

Batavia, N. Y.—The Town Board and Village Council have granted permission for the construction of a new bridge at Walnut St. to replace present structure, which has been condemned by Engineer F. W. Stowell.

Binghamton, N. Y.—The following bids for constructing the substructure and superstructure of a bridge at Exchange St. were opened Aug. 27: Owego Bridge Co., Owego, N. Y., $49,915 (awarded); American Bridge Co., N. Y. City, $57,275; Berlin Bridge Co., New York City, $58,805; Cambria Bridge Co., Ellery Colby, Owego, N. Y., $59,445; Canton Bridge Co., Canton, O., $62,125; Penn Bridge Co., Bever Falls, Pa., $60,566; King Bridge Co., Cleveland, O., $60,012; Syracuse Bridge Co., Syracuse, N. Y., $61,161. The detail bid of the Owego Bridge Co. was as follows: Superstructure (gross amount), $27,000; substructure; embankment, 50 cts. per cu. yd.; loose stone and brush, $2 per cu. yd.; concrete, $6 per cu. yd.; masonry in abutments, including coping, iron in clamps, etc., and removal of present wall, $8.50 per cu. yd.; masonry in pier, including coping, cutwater steel angles, iron in clamps, etc., $[illegible]0; piles, 30 cts. per lin. ft.; hemlock timber, $30 per 1,000 ft. B. M.; wrought iron in drift bolts and spikes, 3 cts. per lb.

PAVING AND ROADMAKING.

Shelby, O.—Bids are wanted Sept. 14 for the construction of about 1½ miles of pike road, as advertised in The Engineering Record.

Woonsocket, R. I.—Bids are wanted Sept. 4 for building a section of the Manville road, as advertised in The Engineering Record.

Marion, O.—Bids are wanted Sept. 14 for the improvement of East Center St., work to include 7,250 cu. yds. of grading, 4,470 lin. ft. straight curb, 2,650 ft. 8-in. and 1,770 ft. 9-in. tile, 2,750 cu. yds. of macadam for paving, and 15 catch basins. D. M. Odaffer, City Clk.

La Porte, Ind.—Bids are wanted by the City Council until Sept. 9 for furnishing materials and constructing cement walks on numerous streets.

Pittsburg, Pa.—Bids are wanted Sept. 11 for the permanent improvement of the Saltsburg road and Peoples Plank road. F. W. Patterson, County Road Engr., Rm. 29, Court House. W. E. Thompson, Co. Comptroller.

New Brunswick, N. J.—Bids are wanted Sept. 4 for macadamizing 1¼ miles of road at Tanner's Corner. Asbury Fountain, Dir. Bd. of Chosen Freeholders, Middlesex County.

Mingo Junction, O.—Bids are wanted Sept. 10 for the improvement of 3 streets. Geo. H. Turner, Village Clk.

Marinette, Wis.—Bids are wanted Sept. 17 for the construction of a shale brick pavement on Main St. W. H. George, Chmn. Bd. of Pub. Wks.

Jersey City, N. J.—Bids are wanted Sept. 3 for paving Newark Ave., 2,870 sq. yds., with asphalt; also Palisade Ave., 3,620 sq. yds. of asphalt paving. Geo. T. Bouton, Clk. Bd. of Street & Water Commrs.

Glenville, O.—Bids are wanted Sept. 18 for grading, constructing storm water sewers, catch basins, manholes and paving the roadways of several streets to a width of 27 ft. with 9 ins. of broken limestone and 3 ins. of trap rock dressing. Ira C. Farley, Village Clk.

Cincinnati, O.—Bids are wanted Sept. 16 for improving several streets. Robert Allison, Pres. Bd. of Public Wks.

Conneaut, O.—Bids are wanted Sept. 21 for paving with brick on four streets. Geo. B. Pike, City Engr.

Westerville, O.—A vote was recently taken in favor of the issue of $30,000 bonds for macadamizing the streets.

Sheraden, Pa.—Boro. Engrs. Trimble & Miller, of Pittsburg, write that W. H. Coates, of New Brighton, has received three street improvement contracts at 26 cts. and 27 cts., for grading, $1.40 and $1.47 for paving and 52 cts. and 53 cts. for curbing; the contract for paving one street was awarded to Greenough & Baumgarden, of Bellevue, at 27 cts. for grading, $1.42 for paving and 53 cts. for curbing.

Oberlin, O.—Bids are wanted Sept. 17 for paving with brick and curbing West College St. Chas. H. Snyder, City Clk.

Union, N. J.—Bids are wanted Sept. 9 for improving a portion of Hudson Ave. by paving the roadway with Belgian blocks, curbing with blue stone, etc. Chas. Singer, Jr., Town Clk.

Erie, Pa.—Bids are wanted Sept. 9 for the purchase of $70,000 repaving bonds. John Depinet, Mayor.

Contracts will soon be let for repaving State St., about 12,250 sq. yds. Bids will be received on both brick and sheet asphalt with 3-ft. brick gutter.

Albany, N. Y.—Clerk Wachman of the Board of Contract & Supply will receive bids for paving portions of 2 streets with brick.

Yonkers, N. Y.—It is stated that bids are wanted Sept. 5 for asphalting and macadamizing paths, walks and drives and constructing stone steps. S. L. Cooper, Supt. of Parks.

Cincinnati, O.—A resolution has been adopted by the Board of Public Service directing the City Engineer to prepare a resolution and specifications for paving a portion of 9th St. with brick. The improvement will cost $9 per lin. ft.

Buffalo, N. Y.—Bids are wanted Sept. 11 for repaving East and Hamilton Sts. and paving Ryan St. R. G. Parsons, Sec'y Bd. Pub. Wks.

Weehawken, N. J.—The Uvalde Asphalt Paving Co. is reported to have submitted the lowest bid for 2,200 sq. yds. of asphalt pavement on Jane St., at $1.68 per sq. yd.

Stillwater, Minn.—City Engr. Myron Shepard writes that about 2,200 ft. of artificial stone curbing has been ordered by the Council for So. 3d St.

Chicopee, Mass.—City Engr. Frank P. Cobb writes that the city will lay about 2,500 ft. of macadam on Broadway at Chicopee Falls.

Scranton, Pa.—Bids are wanted Sept. 3 for curbing and paving with stone-block on a sand base a portion of W. Market St., and for furnishing and laying 5 ft. flagstone sidewalks on both sides of Myrtle St. and Adams Ave., and on one side of Jefferson Ave. John Roche, Dir. Dept. Pub. Wks.

Wilkinsburg, Pa.—Bids are wanted Sept. 5 for grading, curbing and paving with brick on a portion of Oak St. Frease & Sperling, Boro. Engrs.

Springfield, O.—Local press reports state that the Springfield Ry. Co. contemplates constructing an 8-mile bicycle track at Spring Grove Park.

Bids are wanted Sept. 17 for $19,183 street improvement bonds. R. N. Lantz, City Clk.

Moline, Ill.—The J. J. Duffy Asphalt Co., of Chicago, has secured the contract, according to reports, for paving 20th St. with California asphalt, for $8,160. The contract for paving 22d St. is reported awarded to the Barber Asphalt Co. for $7,884.

Albany, N. Y.—According to press reports, State Engineer Bond has awarded 2 contracts for the construction of State roads in Westchester County, as follows: Armonk-Mount Kisco Road, 4½ miles long, to Eldert & Johanknecht, of Jamaica, L. I., for $34,200. Mt. Kisco-Bedford, 5 miles, to Bellow & Merritt Co., of Tuckahoe, for $40,314.

Tarentum, Pa.—The Council has, according to reports, awarded the contract for grading, curbing and paving Negley Ave. to Daniel Burns, of New Kensington, at $27,837.

Marion, Ia.—City Engr. Samuel N. Parsons writes that the following bids were opened Aug. 15 for paving a portion of 8th Ave. with asphalt on 5-in. concrete, binder 1 in., surface 1½ in.:

Bidders. *Contract awarded.	Paving per sq. yd.	Extra grading.	Per 100 ft. overhaul.	Extra concrete.	Extra gravel.	Extra br. stone.	Extra sand.	Old curb reset.	Drain tile.	Comb. curb and gutter.	Gutter.
Barber Asphalt Paving Co., Chicago	$1.90	$.25	$.01½	$5.00	$1.25	$1.50	$1.10	$.12	$.14	$.43	$.24
*Western Paving & Supply Co., Chicago	1.59	.15	.03	4.50	1.50	1.65	1.25	.10	.10	.37	.17
R. F. Conway Co., Chicago	1.71	.30	.01	4.25	.80	1.25	1.00	.10	.10	.45	.20

Kansas City, Mo.—The City Engineer has been instructed to prepare plans for paving the approaches to the Kansas Ave. bridge.

Chicago, Ill.—It is stated that the R. F. Conway Co. has received the contract for paving Archer Ave. with asphalt at $113,918.

Bristol, Tenn.—The citizens of Bristol and Sullivan County are considering the question of issuing bonds to constructing a double-track pike from Bristol to Blountville.

Troy, N. Y.—The City Engineer has been directed to prepare specifications for paving 2d Ave.

Galion, O.—Baldwin & Graham have secured the contract for paving a portion of W. Columbus St. with Athens brick or block on an 8-in. gravel foundation. Contract price said to be $14,424.

Chester, N. Y.—At an election held recently the proposition to issue $17,000 bonds for paving the principal streets with Telford pavement carried.

Denver, Colo.—John F. Speicher, of Denver, is reported to have secured the contract for 1,776 sq. yds. of brick pavement on Main St., for $4,455.

Glens Falls, N. Y.—The Board of Trustees has instructed the Clerk to obtain figures on paving blocks to be used on Main St.

Elyria, O.—The Ayers Paving Co., of Zanesville, is reported to have received a $25,000 contract for paving West Ave. with sheet asphalt.

Superior, Wis.—The Board of Public Works has decided to repave Tower Ave. with block pavement.

Boston, Mass.—See "Bridges."

St. Paul, Minn.—The lowest bid received for macadam pavement on East 7th St. is reported to have been submitted by James Forrestal & Co., who offered to do the work for $29,745 for the city's portion and $16,000 for the city railway company's portion, using granite. All bids received were in excess of the City Engineer's estimate and will probably be rejected.

The Assembly has passed a resolution to pave S. Wabash St. with asphalt.

Kewanee, Ill.—Bids are wanted by the Board of Local Improvements Sept. 3 for 11,112 sq. yds. brick pavement, 8,006 lin. ft. concrete combined curb and gutter and 6,101 cu. yds. grading on Chestnut and Prospect Sts.; also for 4,384 sq. yds. brick pavement, 3,026 lin. ft. concrete combined curb and gutter and 3,185 cu. yds. of grading on S. Tremont St. John Eaton Shepardson, City Engr.

Iowa City, Ia.—Wm. Harrabin is stated to have secured the contract for brick paving College and Summit Sts., in all 18,809 sq. yds., and 12,291 sq. yds. on Market St., at $34,251 and $23,764 respectively.

Lima, O.—Bids are wanted Sept. 23 for $23,496 E. McKibben St. paving bonds. C. E. Lynch, City Clk.

Salem, N. J.—Bids are wanted by the Board of Chosen Freeholders until Sept. 18 for building about 7 miles of oyster shell or macadam roads. Josiah Miller, Engr., 51 Market St.

Chester, N. Y.—Bids are wanted Sept. 9 for furnishing material and constructing a telford road. A. H. Olmsted, Engr., Bloomfield.

Wilmington, Del.—Bids will be received by the Street & Sewer Dept. until Sept. 5 for furnishing material and paving with Belgian block and brick on numerous streets. Harvey J. Wiley, Secy.

Denver, Colo.—An ordinance has been passed to grade and curb Broadway. Estimated cost, $65,000.

Houston, Tex.—County Judge E. H. Vasmer writes that contracts for furnishing material and constructing 25 miles of paved roads, including necessary grading, embankment and ditching, have been awarded as follows: To Hipp & Key, Houston, Tex., 5 miles rock shell sand road at $5,622.50 per mile; 10 miles shell and gravel, $5,08'690 per mile; 2 miles shell and gravel, $5,565 per mile; 5 miles rock shell and sand, $5,269.70 per mile; total, $116,184. To Suderman, Dolson & Co., 2.6 miles shell and gravel, $6,674.70 per mile; total, $17,354. Grand total, $133,538. These roads will be paid for out of $600,000 cash on hand and the balance of $466,461 will be hereafter spent for good roads.

Newark, N. J.—Local press reports state that the following bids were opened Aug. 22 for asphalt and granite pavement on Verona Ave. and Chapel St., in all 14,700 sq. yds. of granite and 4,300 sq. yds. brick. For brick pavement the bids were: J. Roosevelt Shanley, $2.37 and $2.42; Thomas A. O'Connor, $2.35 and $2.40, and the Newark Paving Co., 4 bids, from $2.07 to $2.30. For granite pavement the bids were, respectively: J. Roosevelt Shanley, $1.85 and $1.98; David Harper, $1.87 and $2.10, and Thomas A. O'Connor, $2.09, $2.10.

Lincoln, Neb.—Local press reports state that contracts for asphalt pavement, with 10-year guarantee, on P Street and South 11th St. districts, in all 20,000 sq. yds., have been awarded as follows: To the Barber Asphalt Paving Co., P St. district with 1½-in. binder and 2-in. wearing surface, at $1.58 per sq. yd.; to R. F. Conway & Co., of Chicago, Ill., South 11th St., 30 ft. roadway, 15 ft. brick gutters, 2-in. wearing surface and 1½-in. binder, at $1.69 per sq. yd.

POWER PLANTS, GAS AND ELECTRICITY.

Mascoutah, Ill.—Bids are wanted Sept. 16 for furnishing for a period of 10 years, on the moonlight schedule, 85 incandescent lights of both 30 and 50 c. p. Geo. W. Lischer, Mayor.

Colwyn, Pa.—This borough is about to install a new lighting system and prospective bidders will be furnished with all information on application to James H. Cutler, Colwyn.

Canandaigua, N. Y.—The Village Board of Trustees has granted a franchise to D. L. Brown, of Jackson, Mich., to lay gas pipes in the streets of the village for the purpose of supplying natural gas for all purposes.

Barberton, O.—See "Water."

Utica, N. Y.—Bids are wanted Sept. 6 for supplying electric light to the streets and municipal buildings for the term of 1, 3 and 5 years, from Jan. 1, 1902. J. A. Cantwell, City Clk.

London, England.—Bids are wanted until Oct. 8 for the supply and delivery of two 2,500 I. H.-P. vertical steam engines, each coupled direct to a continuous-current 1,500-Kw. dynamo working at from 550 to 625 volts, and the erection of these sets in the generating station of the South London Electric Supply Corporation, near Loughborough Junction. Also for three auxiliary 250-I. H.-P. vertical high-speed enclosed steam engines, each coupled direct to a continuous-current dynamo working at from 200 to 225 volts, and for the erection of these sets in the Council's Generating Station at Greenwich. Drawings, forms of contract, specifications and other particulars may be obtained at the Engineer's Department, County Hall, Spring Gardens, S. W., upon payment of the sum of £3. Address G. L. Gomme, Clk. of the London County Council Tramways, Spring Gardens, S. W.

Holly, N. Y.—Village Trustee J. M. Brown writes that on Aug. 26 it was voted to construct an electric light plant.

Laurinburg, N. C.—See "Water."

Muscatine, Ia.—City Clk. B. C. Benham writes that specifications are now being prepared for city street lighting; 150 2,000-c. p. inclosed arc lamps will be required.

Altamont, Ill.—Bids are wanted Sept. 4 for an electric light plant. Byron Pippers, City Clk.

Los Angeles, Cal.—Abbot Kinney, president of the Equitable Gas and Electric Co., formally applied to the Fire Board for permission to erect a complete modern gas works on 16th St.

Jamaica, Vt.—It is stated that this town contemplates putting in an electric light plant.

Mt. Forest, Ont.—The rate-payers have voted in favor of the town purchasing the works and property of the Mt. Forest Electric Light Co.

Chicago, Ill.—Plans have been completed by Samuel A. Treat, 279 Dearborn St., for an addition (fireproof construction) to the Clinton St. plant of the Western Electric Co., to cost $223,000.

Bloomington, Ind.—The Council has passed an ordinance granting to the Peoples Gas, Electric & Heating Co. the right to lay, operate and maintain a system of pipes in the streets for the purpose of conveying hot water or steam to public and private consumers.

Clay Center, Kan.—The electric light plant, owned and operated by Williamson, Wickstrom & Co., is stated to have been destroyed by fire. The plant was valued at about $10,000.

Baltimore, Md.—The Welch Light, Heat & Equipment Co., of Baltimore, Md., is stated to have been incorporated Aug. 27 under the laws of West Virginia, at Charleston, W. Va., for the purpose of manufacturing and selling all kinds of light, heat and equipment for the same. The authorized capital stock is $5,000,000. Incorporators: W. A. Morgan, John Sherman, W. D. Blanks and others, all of Baltimore.

Indianapolis, Ind.—The Board of Works Aug. 23 rescinded all action in regard to letting the new electric lighting contract (bids for which were to have been received Aug. 26), and decided to postpone action for the present.

St. Anthony, Idaho.—J. T. Sidley and Levi Carter are stated to have been granted a franchise to construct an electric light plant.

Carroll, Ia.—Press reports state that the Electric Light & Power Co. will increase its facilities for lighting. New machinery will soon be installed.

Port Edwards, Wis.—Press reports state that the Electric & Water Co., of Grand Rapids, Wis., will in the near future extend the lighting service to Port Edwards.

Harrisburg, Ill.—The Harrisburg Water, Light & Power Co. has been incorporated with a capital of $60,000. Incorporators: John Fraser, Fred D. Monell, Howard C. Bates.

Algonquin, Ill.—An ordinance has been passed by the Board of Village Trustees to permit Henry Keyes to construct, establish, maintain and operate an electric light plant and electrical works, and to erect poles, etc., in this village.

West Superior, Wis.—Mayor Parker has signed the ordinance passed by the Council granting a franchise to the Black River Falls Co. to bring power into the city from the falls, situated 16 miles from the city.

St. Bernard, O.—The Suburban Electric Co. has been incorporated with a capital of $10,000. The company will supply electric power, heat and light for streets, public and private buildings. Incorporators: Byron M. Clendenning, Jas. H. Woodard, John C. Wessels, and others.

Burlington, N. J.—It is stated that the Dollar Gas Co., of Burlington, N. J., has been incorporated with a capital stock of $40,000, to supply and distribute illuminating gas; principal office, Burlington.

San Bernardino, Cal.—Press reports state that Judge J. L. Campbell is securing estimates on the cost of machinery for the operation of a power plant.

Renovo, Pa.—The Council has adopted an ordinance granting permission to the Renovo Edison Light, Heat & Power Co. to construct and maintain a steam heating system in the streets and alleys of the borough.

Salt Lake City, Utah.—Attorney H. C. Edwards, as trustee for the Merchants' Lighting Co., has made application to the City Council for a 50-year franchise for the construction of an electric light and power system.

Cincinnati, O.—The contract for the public electric lighting of the city for 10 years has been signed by General A. Hickenlooper as Pres. of the Cincinnati Gas & Electric Co., and Robert Allison as Pres. of the Board of Public Service. The contract will not go into effect until June 1, 1902. The time until then is given to the lighting company for the purpose of putting in the underground conduits. The contract is said to amount to $4,000,000.

Lancaster, Pa.—Press reports state that the Lancaster County Ry. & Light Co. will erect at Engleside, just south of this city, an electric power house. Cost complete, $300,000.

Lykens, Pa.—The Borough Council has granted the right of way to the Home Light, Heat & Power Co., of Lykens, Williamstown and Wiconisco Township. Incorporators: G. M. Stiles, M. D., and J. C. Reigle, of Williamstown, and F. S. Reiff, of Lykens.

Live Oak, Fla.—The electric light franchise for the town has been granted to the Live Oak Manufacturing Co. Geo. E. Potter, proprietor of the company.

Beaver Falls, Pa.—The Council of College Hill, a borough adjoining this place, has awarded the contract for an electric light plant to cost $10,000 to James R. Ridinger, representing the Iron City Engineering Co., of Pittsburg.

Norway, Mich.—Bids are wanted Sept. 19 for furnishing material and machinery and constructing an electric light plant. Wm. R. Bolicho, Clk. Bd. Pub. Wks.; Pierce, Richardson & Neiler, Electrical Engrs., 315 Dearborn St., Chicago, Ill.

Goshen, Ind.—The City Council has passed an ordinance granting a franchise to Wilbur L. Stonex to establish a hot water heating plant, to be owned and operated by the city.

Denver, Colo.—The Denver Gas & Electric Co. is said to contemplate making improvements to its plant at Sixth and Lawrence Sts., amounting to $150,000.

Geneva, O.—The Council has granted a 25-year franchise to Fred. Storm, which provides for the building of an electric power plant.

Abbeville, La.—Press reports state that Albert G. Nauch, of New Iberia, will erect an electric light plant at this place.

Eveleth, Wis.—The Village Council has granted an electric light franchise to Alexander Hughes, of Minneapolis.

ELECTRIC RAILWAYS.

Portland, Ore.—An ordinance authorizing the West Side & Suburban Ry. Co. to construct and operate a street railway between Portland and Forest Grove has been given second reading in Common Council.

Carlisle, Pa.—The Harrisburg & Lewisburg Trolley Road has been chartered at the State Department by citizens of Carlisle. The road will be constructed from New Cumberland, through Cumberland County, to Lewisburg. Capital, $40,000.

Bluffton, Ind.—The City Council has granted a franchise to the Muncie, Hartford City & Ft. Wayne Electric R. R. Co.

Toledo, O.—The Toledo & Lima Traction Co. of Toledo, has been incorporated with $50,000 capital stock by J. D. S. Neely, D. J. Cable, A. K. Detwiler, H. A. Tobey and G. G. Metzgar. They propose to build and acquire and operate an electric railway in the streets of Toledo and Lima, and through Lucas, Wood, Henry, Putnam and Allen counties.

Laurel, Md.—Vice-President George H. Harries, of the Washington Traction Co., has applied for a right of way through Laurel to Berwyn, a distance of about 9 miles.

Winthrop Harbor, Ill.—Surveys are now being made for the proposed electric railway, 12 miles in length, from Winthrop Harbor to Antioch, Ill.

Colorado Springs, Colo.—Local press reports state that W. S. Stratton is having plans prepared for a new power plant for the Stratton electric railways in Colorado Springs.

Pottstown, Pa.—The Ringing Rocks Traction Co. has been incorporated to build an electric road about 9 miles long. Capital stock, $54,000. Cyrus Q. Guldin, Pres., Reading, Pa. A. E. Shauer, of Pottstown, is said to be interested.

Wilmington, N. C.—According to press reports, the Wilmington Sea Coast R. R. Co. proposes to extend its electric road into this city.

Bryan, O.—The right of way has been secured and the final survey is now being made for an electric railway between Bryan and St. Marys. The road will be 95 miles in length, and known as the Bryan-St. Mary's line, and will pass through all leading towns in Williams, Defiance, Paulding, Mercer, Van Wert and Anglaize counties.

Tampa, Fla.—A trolley franchise has been granted to a company of which John P. Martin is the head.

Marion, O.—The Columbus, Marion, Tiffin & Toledo Ry. Co. has been incorporated, with a capital of $20,000, to build an electric line from Marion to Tiffin. S. E. Barlow, G. W. Kemp, C. E. Sawyer, H. B. Hane and Senator W. G. Harding are the incorporators.

Belair, Md.—The directors of the Belair & Havre de Grace Ry. & Power Co. have decided to begin work upon the construction of the line, which will be 16 miles long.

Canandaigua, N. Y.—The Ontario & Wayne County Traction Co. has been incorporated, with a capital stock of $500,000, to operate an electric road from Canandaigua to Pultneyville. The directors are Senator John Raines, State Commissioner in Lunacy William L. Parkhurst and J. H. Pardee, and others.

Delta, O.—The Council has granted a franchise to the Toledo-Bryan Air Line Ry.

Northport, N. Y.—The Northport Traction Co. has filed a certificate of incorporation. It is organized with a capital of $50,000 to operate an electric road between the East Northport station on the L. I. R. R. and Northport Harbor. The directors are Wm. H. Baldwin, Jr., Wm. F. Brown and Wm. J. Kelly, of Brooklyn; F. F. Haff, of Long Island City, and others.

Cohoes, N. Y.—The Hudson Valley Electric Co., which has been incorporated with a capital stock of $2,600,000, is the consolidation of the various electric roads between Troy and Glens Falls and Glens Falls and Warrensburg. The officers of the new company are: Addison B. Colvin, Pres.; Geo. Greene, Vice-Pres., and Thomas O'Connor, Secy.

Milwaukee, Wis.—The Common Council on Aug. 26 passed an ordinance granting a franchise to the Milwaukee, Burlington & Lake Geneva Ry. Co. for an elevated electric road.

Barrington, N. Y.—James Hallock, Town Commissioner of Highways, has granted a franchise to the Dundee, Tyrone & Bradford R. R. Co. to construct an electric railroad through this town.

Laporte, Ind.—The franchise granted to the Chicago, Valparaiso & Michigan City Ry. Co. by the Laporte County Commissioners provides that the road must be completed before Aug. 15, 1902.

Little Falls, N. Y.—The Mohawk Valley Traction Co. will apply for a franchise from the City Council.

Long Beach, Cal.—W. H. Holabird has applied for a franchise, and bids for same are being received by the City Trustees.

Natchez, Miss.—The Natchez Electric Street Ry. Co. has awarded a contract to the Safety Electric Co., of New Orleans, to prepare the specifications and estimates for the construction of its line.

New Oxford, Pa.—The Town Council has granted permission to the Baltimore, Westminster & Gettysburg Ry. Co. to operate a trolley line in the borough.

Mineola, (L. I.), N. Y.—The application of the Port Washington Heat, Light & Power Co. for a franchise over the county roads in the town of North Hempstead has been granted by the Board of Supervisors of Nassau County. Charles F. Lewis, Pres.; Lorenzo B. Smull, Secy.

Baltimore, Md.—The Liberty Turnpike Electric R. R. Co. has been incorporated with a capital of $150,000. Directors: Frank H. Callaway, James E. Ingram, Jr., Milton W. Offutt, Fielder C. Slingluff and John W. Styne.

Martins Ferry, O.—The City Council has granted the Ohio Rapid Transit Co. a franchise over certain streets upon condition that the Steubenville, Mingo & Ohio Valley Traction Co. have the right to use the tracks of the first-named company in the northern part of the city. J. B. Wilson, of Wheeling, W. Va., Attorney.

Kalamazoo, Mich.—J. J. Patterson, of Philadelphia, is said to be interested in the proposed construction of 100 miles of electric road connecting Grand Rapids and Kalamazoo.

RAILROADS

Pittsburg, Pa.—Bids are wanted Sept. 12 for the graduation and masonry of the Pittsburg, Carnegie & Western and Cross Creek R. Rs., as advertised in The Engineering Record.

Vicksburg, Miss.—Surveys are now being made by R. H. Engle for the Vicksburg & Southeastern R. R. extension from Vicksburg to Hattiesburg, Miss. P. M. Harding, Vicksburg, Pres. of the road.

Kansas City, Mo.—It is stated that work is about to be started on the construction of the proposed Arkansas & Choctaw Ry., which is to run from Arkinda, I. T., to Wichita Falls, Tex. The work will cost about $5,000,000, and 300 miles of track must be completed by January, 1903. R. H. Keith, Pres., Kansas City.

Bangor, Me.—The Bangor & Aroostook R. R. proposes to build a 50-mile extension from Ashland to Fort Kent, on the St. John's River.

Guthrie, Okla.—The Santa Fe R. R. has secured a charter to build 14 separate lines of railroad, with a total length of 815 miles. These are to be operated as the Eastern Oklahoma line, and are to traverse Oklahoma, Indian Territory and Kansas.

San Francisco, Cal.—Press reports state that preliminary surveys are now being made for a tunnel 27,000 ft. in length which the Southern Pacific Ry. proposes building through the Sierra Nevada Mountains of California. Probable cost, $3,000,000 to $5,000,000.

Muscatine, Ia.—Press reports state that the Chicago, Milwaukee & St. Paul Ry. Co. has awarded contracts for the construction of 79 miles of road between Muscatine and Ottumwa as follows: To Flick & Johnson Construction Co., of Davenport, sections 2 and 3, 44½ miles, and to McIntosh Bros., of Milwaukee, sections 1 and 4, 34½ miles. Total cost of construction, exclusive of rails and ties, $1,030,000.

Los Angeles, Cal.—Press reports state that bids will be received by the officials of the San Pedro, Los Angeles & Salt Lake R. R. until Sept. 9 for 30 miles of grading from Los Angeles to Pomona. Estimated cost of road, $8,500 per mile.

Greenwich, N. Y.—Ch. Engr. Clarence B. Vorce, of Hartford, Conn., writes that the contract for grading and masonry on the 7-mile extension of the Greenwich & Johnsonville R. R. has been let to I. M. Luddington, of Rochester, N. Y. Contracts for 7 steel bridges on the extension of the Greenwich & Johnsonville R. R. to Schuylerville, N. Y., including bridge across the Hudson River, have been let to the Berlin Construction Co., of Berlin, Conn. E. D. Graves, of Hartford, Conn., is Consulting Bridge Engr.

Central City, Colo.—Articles of incorporation have been filed by the Boulder & Intermountain R. R. Co., which proposes to construct, equip, acquire and operate railroad lines in the State of Colorado. Capital, $60,000. Directors: Walter S. Lee, John R. Wolff, Millard F. Leech and others, of Boulder.

Hampton, Ia.—The Chicago Great Western Ry. Co. proposes to build extensions from Hampton, Ia., to Sioux City, Ia., and from Ft. Dodge to Council Bluffs. A. B. Stickney, Pres., St. Paul, Minn.

Cleveland, O.—Engineer Ritchie has submitted plans to the Grade Crossing Commission for the abolition of railroad crossings on the Pennsylvania, Lake Shore, Nickel Plate, Big Four and Erie Railroads, in all 109 crossings.

Duluth, Minn.—The Minnesota Land & Construction Co. has filed articles of incorporation. It is empowered to build railways, depots, wharves, docks, shops, etc. The headquarters of the company are in Duluth, and the capital stock is $100,000. The incorporators are: J. L. Washburn, Pres., Duluth; Henry L. Levy, Vice-Pres., Eau Claire, Wis.; James F. Walsh, Secy., Duluth; W. K. Coffin, Treas., Eau Claire.

Belmore, O.—The Town Council of Belmore has granted a franchise to the Toledo, Columbus, Cincinnati & Springfield Ry. Co.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Muscatine, Ia.—Wm. Kincaide has received the contract for the erection of a $60,000 hospital.

Moorestown, N. J.—Richard C. Loos, 1017 Chestnut St., Philadelphia, has completed plans for alterations and additions to M. E. Church. Cost, $15,000.

Carthage, Ill.—The Board of Supervisors of Hancock County have reported in favor of building a court house to cost $150,000 and to issue 30-year bonds to cover expense. Jas. Westfall, Co. Clk.

Warrensville, O.—Bids are wanted Sept. 6 for building a town hall. W. W. Cowle, Clk. of the Township Bd. of Trustees.

Harrisburg, Pa.—The architects of Pennsylvania have been invited to submit, on or before Nov. 30, plans and specifications for the construction and completion of the State Capitol, including a power, light and heat plant. Total cost of building, etc., not to exceed $4,000,000. Edgar C. Gerwig, Sec'y Capitol Bldg. Com.

Forest City, Pa.—Bids are wanted Sept. 10 for the erection of a borough building. D. G. Allen, Sec'y.

Oklahoma, Okla. Ter.—Bids are wanted Sept. 10 for the erection of the First Christian Church of Oklahoma City. Architect, D. Turbyfill, 208½ Main St. Pres of Building Com., O. D. Halsell.

Jacksonville, Ill.—Bids are wanted Sept. 10 for the erection of the proposed public library; bids will be received separately on the stone work, heating, etc., as well as on the entire building. W. E. Veitch, Chmn. Bldg. Com.

Huntington, W. Va.—It is stated that bids will be received until Oct. 2 for erecting a building for epileptics, to cost $50,000; also one for feeble-minded and idiots, to cost $30,000, at the West Virginia Asylum for Incurables at Huntington. Harrison Albright, Archt., Charleston, W. Va.

Meridian, Miss.—It is stated that bids are wanted Nov. 4 for erecting a jail to cost $35,000. Krouse & Hutchison, Archts.

St. Cloud, Minn.—Bids are wanted Sept. 3 for erecting a public library. Patton & Miller, Archts., Chicago, Ill. E. C. Erwin, Sec'y.

Verona, N. J.—Bids are wanted by the Bd. of Trustees of the Newark City Home at Newark until Sept. 3, for erecting a boys' cottage and boiler house; also an extension to present boiler house and girls' cottage in the township of Verona. C. M. Harrison, Sec'y.

Colorado Springs, Colo.—City hall bonds amounting to $118,000 were sold recently.

Oakland, Cal.—Albert Sutton, of San Francisco., has prepared plans for a group of new county infirmary buildings. Two estimates were submitted, one for brick buildings the other for frame buildings, the total cost of construction being $227,000 and $197,000 respectively. An allowance of $28,000 was made for a hot water heating system and $17,500 for plumbing. A heating and ventilation fan system was also estimated at $24,000.

Schenectady, N. Y.—The contract for building the almshouse has been awarded to Austin Simkins, for $110,937.

Shreveport, La.—Press reports state that a vote has been taken in favor of building a $70,000 jail.

Washington, D. C.—Arthur E. Randle has donated a site for the Congress Heights engine house. Appropriation for building, $25,000.

Nashua, N. H.—Local press reports state that the County Commissioners will let contracts at once for constructing the foundation for the new county court house and registry of deeds building.

Montclair, N. J.—Van Vleck & Goldsmith, of New York, have prepared plans for a $75,000 edifice for the First Methodist Church of Montclair. Chas. I. Reeves, Chmn. Bldg. Com.

Lenox, Mass.—Plans prepared by Geo. C. Harding, of Pittsfield, are stated to have been accepted for a $40,000 town hall.

Petoskey, Mich.—Press reports state that the Baptist Society will build a $15,000 church.

Billings, Mont.—At the recent election a vote was taken in favor of issuing $32,000 bonds for a new city hall.

Canandaigua, N. Y.—The building committee of the Methodist Church has decided upon plans for the erection of a church to cost about $30,000. Architects, Joseph Blaby, of Palmyra, and Crapsy & Lamm, of Cincinnati.

Pittsfield, Mass.—The County Commissioners have voted to engage H. Neill Wilson, Saving Bank Bldg., to prepare plans for the proposed addition to the court-house. Estimated cost, $25,000.

Fort Worth, Tex.—The directors of the Benevolent home have decided to erect a new building on the 35-acre tract donated by the county commissioners. The building will cost about $25,000.

Carthage, O.—Harry J. Rill, Detroit, is said to be preparing plans for a 4-story and basement dormitory building for the House of the Good Shepherd, the building to be heated by steam and lighted by electricity. Cost, $33,000.

New York, N. Y.—The Park Board on Aug. 22 formally awarded the contract for the construction of the public library at 42d St. and 5th Ave. to Norcross Bros., for $2,865,706.

Cedar Rapids, Ia.—According to press reports Mrs. T. M. Sinclair has donated $30,000 to the Third Presbyterian Church for a new edifice.

Manistee, Mich.—The proposition to issue $35,000 jail bonds is stated to have carried.

St. Louis, Mo.—Local press reports state that the Board of Trustees propose to expend $400,000 in improvements to be made at St. Luke's Hospital.

The Evangelical Luthern Society will erect a $35,000 church at Jefferson Ave. and Armad St.

Chicago, Ill.—J. T. Long, 185 Dearborn St., has prepared plans for a $40,000 church to be erected by the Central Park Congregational Church at Warren and Sacramento Aves.

Des Moines, Ia.—The Westminster Presbyterian Church has decided to build a $20,000 edifice.

Bedford, N. Y.—Bids are wanted Sept. 12 for additions to steam heating apparatus in the reception house of the N. Y. State Reformatory for Women. Address Jas. Wood, Pres. Bd. Mgrs.

Brookings, S. D.—Plans are being prepared for a $30,000 auditorium building. H. H. Natwick, of Sioux Falls, is said to be interested.

Mansfield, O.—Bids are wanted Sept. 24 for furnishing materials required in the construction of the superstructure of workshop "C" and for the floor of the east cell wing at the Ohio State Reformatory, including Portland cement, lake sand, lime, crushed granite and crushed limestone. F. F. Thomas, Chmn. Bd. Mgrs.

Detroit, Mich.—Local press reports state that the following are the lowest bids received by Park Commissioner Bolger for work in connection with the erection of an aquarium and horticultural building on Belle Isle: Mason work, Henry Carew & Co., $13,100; structural steel and iron work, H. B. Lewis, $14,940; fire-proofing and concreting, Schillinger Bros., $2,950; plastering, John Hanley, $1,350; carpenter work, Vinton & Co., $23,345; plumbing, Jacob Zerga, $1,950; sheet metal and roofing, Breil & Co., $5,705; tile and marble work, P. Christa & Son, $6,485.95; painting and glazing, W. Diedrich, $11,300; electric work, Seidler-Miner Electric Co., $393; heating and power plant, Webster, Harrigan & Reid, $23,777; stokers, Underfeed Stoker Co., $2,614: combination bids for horticultural building, including structural steel, carpenter work, paint, glass, sheet metal and roofing, Lord & Burnham Co., $40,000; Hitchings & Co., $56,000.

BUSINESS BUILDINGS.

Woonsocket, R. I.—The Guerin Spinning Co. is about to erect a 135 x 70-ft. 3-story brick building, "heavy mill construction." Power to be supplied from present plant.

Nashville, Tenn.—The American Biscuit Co. is about to build a $22,000 warehouse at Belleville & Harrison Sts. Architects, Thompson, Gibel & Asmus, of Nashville

Marion, Ind.—The Cincinnati, Richmond & Muncie R. R. is about to build a $10,000 brick depot at Marion. Architect, W. S. Kaufman, of Richmond, Ind.

Yonkers, N. Y.—The American Real Estate Co. has had plans prepared by Bruce Price, 1133 B'way, New York City, for a hotel to be built at Park Hill, near Yonkers.

Chase City, Va.—It is reported that G. J. Hunt, of Richmond, has received the contract for the Chase City Sanitarium, to cost about $150,000. T. F. Jeffress, Richmond, is largely interested.

Youngstown, O.—The Heller Bros. Co., of Youngstown, has received a $100,000 contract for the carpenter, brick and stone work of the Dollar Savings & Trust Co.'s block.

Philadelphia, Pa.—Carl P. Berger is said to be preparing plans for laboratory and office building to be erected on Roberts Ave., south of Wayne Ave., Wayne Junction, for Max Levy.

Boston, Mass.—Plans have been filed by Architect Charles E. Park, 110 Tremont St., for a 6-story brick and granite building, 100 x 90 ft., to be used for light manufacturing, at 257 Atlantic Ave. Owner, Wallace C. Sprague, Pemberton Sq.; builder, A. E. Long, 7 Water St. Estimated cost, $150,000.

Wichita, Kan.—The contract for the erection of a 40 x 70-ft. 4-story addition to the Hamilton Hotel is stated to have been let to Moore Bros., of Kansas City, Mo. The total expenditures will aggregate about $24,000.

Easthampton (L. I.), N. Y.—The Maidstone Club has had plans prepared for a new clubhouse, to cost $50,000.

Peach Lake, Westchester Co., N. Y.—The Peach Lake Co. has been incorporated to build hotels and places of amusement at Peach Lake; capital, $100,000. Directors—J. Herbert Shield, William R. Finch, Frederick W. Siebert and others.

Connellsville, Pa.—Plans have been completed and bids are being solicited for a $35,000 business block, to be erected by Rockwell Marietta.

New York, N. Y.—The Knights of Columbus have purchased a site at Columbus Ave. and 67th St. for an 8-story building, estimated to cost $200,000. Architects, L. & J. Brandt, of New York. Francis Sullivan, Managing Dir. of the Knights of Columbus Building Co.

Utica, N. Y.—Press reports state that the N. Y. Central R. R. Co. proposes to build a new union passenger station and a freight house in Utica.

Massillon, O.—The C. L. & W. R. R. proposes to build a new depot in Massillon.

Cleveland, O.—Plans are stated to have been completed by Warren Whitman & Morgan, of New York, for a department store to be erected by John H. Brown, upon property adjacent to the streets between Erie and Chestnut Sts. and Euclid Ave.

Harrisburg, Pa.—A. F. Smith, of Reading, is preparing plans for a depot for the Reading Road.

Providence, R. I.—The contract for the Elmwood car barn has been awarded to Horton & Hemenway, 86 Weybosset St., by the Union Railway Co. It is understood that the cost of this improvement will be about $100,000.

Georgian Bay, Canada.—W. Arthur Thomas, of Pittsburg, Pa., is preparing plans for a $25,000 club house to be built on Georgian Bay for Dr. J. McCandless and Stephen Stone, of Pittsburg.

Seattle, Wash.—Construction work will begin about Oct. 1 on the $250,000 brick and stone building to be erected on Second Ave. between University and Union Aves., by the Moore Investment Co., for Eastern capitalists. Architect, E. W. Houghton, 414 Collins Bldg.

Paterson, N. J.—The North Jersey Traction Co. proposes soon to erect at Market and Pine Sts. a car house from plans being prepared by Thomas Cressey, of Newark.

Brooklyn, N. Y.—Press reports state that work will soon be started on the steel car shed to be built by the Brooklyn Rapid Transit Co., at Ave. M and East 45th St. Cost, about $100,000.

Racine, Wis.—Frost & Granger, Chicago, have been retained by the Chicago & Northwestern Ry. Co. to design a new passenger station at Racine. The building will be constructed of pressed brick, stone and terra cotta, and will cost about $50,000.

Milwaukee, Wis.—Plans for 8-story (120 x 90) brick building for Gimbel Bros.' dry goods store at Grand Ave. and West Water Ave. have been prepared by D. H. Burnham, of Chicago, Ill.

Dubuque, Ia.—The Union Electric Co. contemplates rebuilding its car barns at a cost of $15,000.

Jacksonville, Fla.—The Barnett Estate will erect a 2-story brick building 120 x 70. Estimated cost, $35,000. J. D. Fernandoy, Administrator.

DWELLINGS.

Philadelphia, Pa.—Local press reports state that bids are wanted Sept. 9 for the erection of a parsonage for the 29th St. Methodist Episcopal Church. Plans and specifications may be had at the office of the Secretary of Trustees, 34th and Cumberland Sts.

New York, N. Y.—The City & Suburban Homes Co. has filed plans for 5 six-story tenements, to be built on 64th St. east of 1st Ave. Cost, $250,000. James E. Ware & Son, 3 W. 29th St., are the architects.
Ludlow & Valentine, 100 B'way, have completed plans for the 13-story apartment hotel to be built by the Seaboard Realty Co. at 44 to 50 W. 44th St. Cost, about $550,000.

Chicago, Ill.—Plans prepared by Robert T. Newberry, 171 La Salle St., have been accepted for a $75,000 apartment house, fireproof construction, to be built at Lake Shore drive and Pearson St. by the De Witt C. Cregier estate.
J .A. Wendell & Co. are about to build a $50,000 apartment house on Jackson Boulevard and Hamilton Ave. Architect, Perley Hale, 6833 Prairie Ave.
Plans, prepared by Henry K. Holsman, 153 La Salle St., for apartment houses to be erected at Wabash Ave. and Garfield Boulevard, have been accepted by the owner, Arthur Mulvey. Total estimated cost, $200,000.

Baltimore, Md.—Preliminary plans for an apartment house, to cost about $300,000, have been prepared by Charles E. Cassell, 404 Law Bldg.

Philadelphia, Pa.—Wilson Bros. & Co., Drexel Bldg., have been commissioned by a local syndicate to prepare plans for an apartment house, to be built at 39th and Chestnut Sts. Cost, about $500,000.

SCHOOLS.

McKeesport, Pa.—Bids are wanted Sept. 2 for the installation of a heating and ventilating system in the proposed school to be erected in the 10th Ward. D. P. Smith, Sec'y Bd. of School Controllers.

Lake City, Fla.—Bids are wanted Sept. 10 for the erection of 3 buildings and certain repair work at the Florida State Agricultural College, Geo. N. Wilson, Pres. Bd. of Trustees, Astor Blk., Jacksonville, Fla.

Benson, Ariz.—Bids are wanted Sept. 10 for the construction of a building to be known as the Reform School for Juvenile Offenders, at Benson. Architects, Frost & Rust, of Tucson, Ariz.

Weyauwego, Wis.—Bids are wanted Sept. 5 for erecting a high school, also separate bids for ventilating and heating same. W. H. Weed, Clk. School Bd.

Guilderland, N. Y.—Bids are wanted Sept. 12 for erecting an 8-room brick school. Winfield S. Keenholts, Clk. Bd. Educ., Union Free School, Dist. No. 7.

Waltham, Mass.—The contract for building the Chestnut St. primary school has been awarded to Lord Brothers for $25,600.

Shreveport, La.—Property owners have voted a special tax for the construction of 3 schools, to cost in all $80,000.

Warren, R. I.—Plans prepared by Albert H. Humes, of Pawtucket, have been accepted by the Building Committee for a $30,000 school, to be erected on Joyce St. and Railroad Ave. J. W. Martin, Chmn. of Com.

Garden City (L. I.), N. Y—The sum of $22,000 has been voted to build a school.

Detroit, Mich.—Plans are being prepared by Malcomson & Higginbotham, Moffat Bldg., for the H. S. Pingree school. Cost, about $45,000.

Royersford, Pa.—Seymour and Paul A. Davis 3d, of Philadelphia, are making plans for a 3-story brick and stone public school.

Troy, N. Y.—Plans, approved for alterations and improvements to school No. 5, call for an expenditure of $43,000. Architect, Edw. W. Loth, 253 B'way.

Westfield, N. Y.—William Allen, of North Tonawonda, has received the contract for building a $35,000 high school.

Dublin, Tex.—The Attorney-General has approved an issue of $17,000 school house bonds.

Independence, Kan.—J. H. and T. D. Brewster, of Cherryvale, have secured the contracts for building two schools. Cost, $39,900.

Niagara Falls, N. Y.—Plans for a high school, prepared by Orchard & Joralemon, Gluck Bldg., have been approved by the Board of Education, Authorized expenditure, $150,000.

Washington, D. C.—Bids are wanted Sept. 7 for plumbing fixtures in Birney School; also a boiler house with plumbing for Jefferson school. Wm. Tindall, Secy. Bd. Commrs. D. C.

Worcester, Mass.—The contract for the erection of a 6-room school on Sever St. has been awarded to A. A. Morton & Co., for $21,550.

Des Moines, Ia.—The West Des Moines School Board has rejected all bids for the construction of the new high school. A new plan is suggested which contemplates building the foundations only this year and plans for same will be prepared by Proudfoot & Bird, of Des Moines.

Berlin, Wis.—The City Clk writes that on Aug. 27 it was voted to issue $20,000 bonds for a new school.

STREET CLEANING AND GARBAGE DISPOSAL.

Allentown, Pa.—Local press reports state that new bids will be opened Sept. 17 for the construction of a garbage crematory.

Wilmington, Del.—The following bids are stated to have been received recently for the collection of ashes for the ensuing year: A. G. B. Anderson, at $8,000 (awarded); Franz Gengelbach, at $10,395 for 1 year or $20,790 for 2 years.

Lowell, Mass.—Mayor Dimon is in favor of the construction of a garbage crematory.

GOVERNMENT WORK.

Governors' Island, N. Y. Harbor.—Bids are wanted at the U. S. Engineer Office until Sept. 30 for building a pile dock and for dredging at Governors Island, as advertised in The Engineering Record.

Boston, Mass.—Bids are wanted at the U. S. Engineer Office, until Sept. 20, for the removal of wrecks of schooners "Ira Laffrinier" and "Mondego" in Nauset Harbor, Mass. W. S. Stanton, Lt.-Col., Corps of Engrs., U. S. A.

Ft. Leavenworth, Kan.—Bids are wanted Sept. 9 for constructing an addition to and alterations in one cavalry barrack building, including plumbing and steam heating. D. E. McCarthy, Q. M.

San Francisco, Cal.—Bids are wanted Sept. 20 for constructing a stone wall along the southern boundary of military reservation, Presidio of San Francisco. Oscar F. Long, Major and Quartermaster, U. S. A.

Philadelphia, Pa.—Lieut.-Col. C. W. Raymond, Corps of Engrs. U. S. A., writes that the following bids were opened Aug. 26 for constructing stone buttresses and depositing rip-rap stone for protecting timber bulkhead in Delaware River near Reedy Island; approximate tons of stone needed, 32,000: Martin E. McDonough, 1001 Chestnut St., Phila, Pa., $1.49 per ton of 2,000 lbs.; total, $47,680. Hughes Bros. & Bangs, Syracuse, N. Y., $1.40 per ton; total, $44,800.

Ft. Morgan, Ala.—Bids are wanted Sept. 10 for erecting one single set officers' quarters. Address, Constructing Quartermaster.

Seattle, Wash.—Bids are wanted Sept. 23 for constructing a lighthouse station at Admiralty Head, Wash. Maj. John Mills, Corps Engrs,, U. S. A.

Portsmouth, N. H.—The Navy Department has awarded a contract for the erection of a machine shop and boiler house at the Portsmouth Navy Yard to R. A. Griefen, of Chicago, at $97,880.

Seattle, Wash.—The Secretary of the Treasury has accepted the offer of a site, 184 x 240 ft., for the Federal building. Cost, $174,750.

New York, N. Y.—Bids are wanted Oct. 12 for constructing a plant for receiving, storing and delivering coal at the Navy Yard, New York. Appropriation, $60,000. Address Commandant, Navy Yard, New York. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Portland, Me.—Major S. W. Roessler, Corps of Engrs., U. S. A., writes that the following bids for placing stone on outer slope of breakwater at Rockland Harbor, Me., 23,000 tons, were opened Aug. 26:

Bidders.	Per ton.	Commence, days.	Complete.
Aaron Cleaves and Sylvester T Hamilton, Chebeague, Me.....	$1.05½	10	13 mo.
Romano V. Perini, Wilmington, Del.	.96	10	Dec. 31, 1902.
Eugene S. Belden, Hartford, Conn.	.87	30	150 working days.
William S. White, Rockland, Me.	.93	30	15 mo.

Washington, D. C.—Bids are wanted Sept. 10 for furnishing one 80-H.-P. horizontal tubular boiler for use in the mail equipment shops of the Post-Office Dept. C. Emory Smith, Postmaster-Gen.

Washington, D. C.—Bids are wanted Sept. 6 for bulkheading at the U. S. Quarantine Station, Delaware Breakwater, Del. James Knox Taylor, Superv. Archt., Treas. Dept.

Annapolis, Md.—The contract for erecting the power plant at the United States Naval Academy is stated to have been awarded to Sipe & Sigler, of Cleveland, O., at $38,000.

MISCELLANEOUS.

Tallulah, La.—Bids are wanted by the Board of State Engrs., New Orleans, until Sept. 10 for 600,000 cu. yds. levee work. A. T. Lane. Secy. Bd. Levee Commrs., 5th Louisiana Levee Bd., Tallulah.

Cincinnati, O.—Bids are wanted Sept. 4 for piling, planking, grading and stone backing for the protection of the bank of Ohio River at foot of Watson and Ridgeley Sts., and along the river front of adjoining property. Geo. F. Holmes, Clk. Bd. Pub. Service.

York Haven, Pa.—Press reports state that the cofferdam of the York Haven Power & Water Co. has been destroyed by the sudden rise in Susquehanna River.

Chicago, Ill.—Bids are wanted by the Lincoln Park Commissioners until Sept. 4 for constructing 800 lin. ft. of breakwater for the protection of the lake shore drive. Ambrose V. Powell, Consulting Engr., Rm. 1008 Chamber of Commerce Bldg.; Wm. W. Tracy, Pres.

Indiana Harbor, Ill.—Press reports state that the contract for constructing a new harbor has been let to Hausler & Lutz Towing Co., of So. Chicago. The harbor will cost $150,000 and expenses will be defrayed equally by H. C. Frick, the Michigan Land Co. and the Calumet Land & Improvement Co.

Stockton, Cal.—The contract for 240 ft. of concrete bulkhead on Stockton Channel has been awarded to Clark & Henry, of Stockton, at $28.80 per ft.

Philadelphia, Pa.—The city has received authority from the War and Navy Departments to proceed with the work of improving Schuylkill and Delaware channels, as contemplated in the appropriation of $200,000 made by Councils.

Roswell, Ga.—Bids are wanted Sept. 16 for an addition to the stone dam at Roswell, as advertised in The Engineering Record.

Manitowoc, Wis.—Dr. F. H. Gehbe has received a $10,000 contract for a 1,200-ft. pier for the protection of the sea wall in Lake Michigan.

Memphis, Tenn.—Park bonds to the amount of $250,000 are stated to have been sold.

NEW INDUSTRIAL PLANTS.

The Banner Buggy Co., St. Louis, is erecting a factory with about 400,000 sq. ft. floor area, and will use electricity for power transmission and lighting.

The Canadian Electric Light Co., Levis, P. Q., G. M. G. Holman, general manager, will put up a 50-ton ground pulp mill near its Chaudiere Falls station.

The Los Angeles, Cal., Sugar Co., will put up a plant large enough to slice 1,000 tons of beets daily, but will install machinery for but half that capacity at first.

In spite of contrary reports, The Engineering Record is assured that up to August 22 no contracts had been let for the second power canal of the Lake Superior Power Co. at Sault Ste. Marie, P. Ont. The canal will be 26 feet deep, 150 feet wide, and require 500,000 yards of rock and 40,000 yards of earth excavation.

Geo. B. Bearce, Lewiston, Me., president of the Bromston Pulp & Paper Co., states that contracts have been placed for part of the 9,000-H.-P. power development plant at Brompton Falls, P. Q. The engineer is I. W. Jones, Milton, N. H.

The Pike Mfg. Co., Pike Station, N. H., is putting up a factory at Littleton, N. H., where a 100-H.-P. water power plant will be installed, with a small steam auxiliary.

C. B. Griffith, Athens, Ga., will put up a flour and meal mill, to be run by electricity.

The Baltimore Vitrified Clay Co., Horace Slingluff, pres., will put a large plant, but details are not yet decided.

The Ozark Zinc Oxide Co., St. Louis, is in the market for corrugated iron and blowers for its new Joplin works.

The Robinson Mfg. Co., Muncy, Pa., will put up two 50 x 200-ft. machine and wood shops, a 50 x 80-ft. foundry, power house, smith shop, etc. A second-hand 125-H.-P. Corliss engine is wanted, and second-hand tools for both shops.

The Federal Lead Co., St. Louis, will build a new smelter.

BUSINESS NOTES.

The Phoenix Bridge Co., 410 Walnut St., Philadelphia, has doubled the capacity of its open-hearth steel department during the past year, increased the capacity of its rolling mills, and materially increased its shop facilities, the forging shop being equipped to forge by hydraulic pressure eye-bars up to 15 in. in width.

The Groton Bridge Co. has recently been incorporated with a capital stock of $50,000 by Fred. Mackey, A. D. Campbell and E. S. Burtenslaw, all of Groton, N. Y.

The Bethlehem Steel Co. has passed into the control of Charles M. Schwab and a new board of directors elected, as follows: R. P. Linderman, E. T. Stotesbury, E. M. McIlvain, Archibald Johnston, George F. Baer, J. P. Ord and Chas. McVeagh. Mr. McIlvain has been elected president, A. E. Borie vice-president, H. S. Snyder secretary, A. M. Cleaver treasurer, Archibald Johnston general superintendent.

Among contracts recently awarded the New England Structural Co., Boston, are the following: A 150-ft. single-span bridge at Mattapan, for the N. Y., N. H. & H. R. R.; two bridges at Chester, Mass., and the rebuilding of the Cottage Farm drawbridge for the Boston & Albany R. R.; an electric railroad bridge and double-track plate-girder bridges at Hadley and Hatfield, Mass., for the Boston & Maine R. R.; a foot bridge 300 ft. long for the American Woolen Company at Lawrence, Mass. This company will also furnish the steel framework for the 10-story Rice Bldg., Boston; the structural and ornamental iron work for the Lowell Textile School; the steel work for a large addition to the Washington Mills at Lawrence; a coke platform 1,800 ft. long by 15 ft. wide for the New England Gas & Coke Co., at Everett, Mass.

The Consolidated Electric Co., Greenwich, N. Y., is building an entirely new concrete dam which will afford a head of 52 feet. The company has placed orders with the Rodney Hunt Machine Co. for a 400-H.-P. turbine wheel and with the Stanley Electric Manufacturing Co. for a 300-Kw., 6,000-volt, two-phase generator, for direct connection to the water wheel; also high tension transformers, switchboard, etc. Henry Floy, 220 Broadway, New York, is consulting engineer for the Consolidated Electric Company.

Milliken Bros., Inc., 11 Broadway, New York, have obtained a grant of a large water-front property at the intersection of the Rahway River and Staten Island Sound, where an extensive plant for bridge and structural material and other classes of building supplies will be erected.

The F. D. Cummer & Son Co., Cleveland, manufacturers of the Cummer dryers, report the following recent sales: The Vulcanite Portland Cement Co., Phillipsburg, N. J., a coal dryer; Alpha Portland Cement Co., Easton, Pa., a coal dryer; Iroquois Portland Cement Co., Caledonia, N. Y., a clay dryer, a marl dryer and a coal dryer; Owen Sound Portland Cement Co., Owen Sound, Ont., a coal dryer; Hecla Portland Cement Co., Bay City, Mich., two marl dryers, a shale dryer and a coal dryer; The Rathbun Company, Desronto, Ont., a sand dryer; the Brooklyn Alcatraz Asphalt Co., Brooklyn, N. Y., an iron-ore dryer; Hammond Distilling Co., Hammond, Ind., a distillery slops dryer; Wisconsin Graphite Co., Steven's Point, Wis., a graphite dryer; John P. Squire & Co., East Cambridge, Mass., a tankage dryer; many of these are orders from previous purchasers of Cummer dryers. The company also reports having sold five portable railroad asphalt paving plants since January 1.

The C. Reiss Coal Co., Sheboygan, Wis., is equipping its coal docks with electricity. A 350-H.-P. Ball engine, direct-connected to a Milwaukee generator, furnishes the power. St. Mary's Hospital, Philadelphia, is being equipped with an electric plant, for which the Ball Engine Co., Erie, Pa., furnished the engines.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Sept. 2.	Artesian well, San Jose, Cal	Aug. 10
Sept. 2.	Barrackpore, Calcutta, India	July 13
Sept. 2.	Hopkins, Minn	Aug. 17
Sept. 2.	Pipe, Plymouth, Mich	Aug 24
Sept. 2.	Joliet, Ill	Aug. 31
Sept. 3.	Hendricks, Minn	Aug. 24
Sept. 3.	Reservoir, Endicott, N. Y Adv., Eng. Record, Aug. 24.	Aug. 24
Sept. 3.	California, O	Aug. 31
Sept. 4.	Pump station foundations, Geneva, O.	Aug. 31
Sept. 4.	Geneva, O Adv., Eng. Record, Aug. 24.	Aug. 17
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Valves, Cleveland, O	Aug. 17
Sept. 6.	Laurel, Neb Adv., Eng. Record, Aug. 31.	Aug. 31
Sept. 9.	Dam, Centralia, Ill	Aug. 31
Sept. 10.	Plans, Muskogee, Ind. Ter Adv., Eng. Record, Aug. 3.	Aug. 3
Sept. 11.	Garretson, S. D.	Aug. 24
Sept. 13	Fremont, O	Aug. 31
Sept 17.	Conduit, Cleveland, O	Aug. 31
Sept. 18.	Soerabaya, Java	July 20
Sept. 20.	Longmont, Colo	Aug 24
Sept. 21.	Washington, D. C	Aug. 17
Oct. 1.	Burlington, Ia Adv., Eng Record June 29	June 29
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3

SEWERAGE AND SEWAGE DISPOSAL.

Sept. 2.	Paris, Ky	Aug. 24
Sept. 2.	Paw Paw, Mich	Aug. 24
Sept. 2.	Glenville, O	Aug. 10
Sept. 2.	Coldwater, Mich	Aug. 31
Sept. 2.	Wausau, Wis	Aug. 17
Sept. 2.	Disposal plant, Kings Park, N. Y. Adv., Eng. Record, Aug. 17.	Aug. 17
Sept. 3.	Dayton, O	Aug. 10
Sept. 3.	Portland, Me Adv., Eng. Record, Aug. 24, 31.	Aug. 24
Sept. 3.	Harrison, N. J	Aug. 31
Sept. 3.	Wilmerding, Pa	Aug. 31
Sept. 3.	Binghamton, N. Y.	Aug. 31
Sept. 3.	Scranton, Pa	Aug. 31
Sept. 3	Rome, N. Y	Aug. 31
Sept. 3.	Milton, Pa	Aug. 31
Sept. 3.	Jersey City, N. J	Aug. 31
Sept. 4.	New York, N. Y	Aug. 24
Sept. 4.	Joliette, Que	Aug. 31
Sept. 5.	Newark, N. J	Aug. 31
Sept. 5.	Wilkinsburg, Pa	Aug. 31
Sept. 5.	Ligonier, Ind	Aug. 31
Sept. 6.	Indianapolis, Ind	Aug. 31
Sept 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Glenville, O	Aug. 24
Sept. 7.	Otto Pa	Aug. 24
Sept. 7.	McKeesport, Pa	Aug. 31
Sept. 9.	Fowler, Ind	Aug. 31
Sept. 9.	Plainfield, N. J	Aug. 24
Sept. 9.	Toledo, O	Aug. 31
Sept. 10.	Toledo, O	Aug. 24
Sept 10.	Dayton, O	Aug. 31
Sept. 10.	Cincinnati, O	Aug 24
Sept. 14.	Evansville, Ind	Aug. 31
Sept. 16.	Oshkosh, Wis	Aug 31
Sept. 18.	Kings Park, N. Y Adv., Eng. Record, Aug. 31.	Aug 31
Sept. 25.	Havana Cuba Adv., Eng. Record, June 29 to July 20, Aug. 17, 24.	June 29
Sept 27.	Boston, Mass Adv., Eng. Record, Aug. 31.	Aug. 31
Oct. 1.	Canyon City, Colo	Aug. 24

BRIDGES.

Sept. 2.	Decatur, Ind	Aug. 17
Sept. 2.	Raton, N. M	Aug. 24
Sept. 3.	Cambridge, O	Aug. 17
Sept 3.	Toledo, O	Aug. 10
Sept. 3.	Medo, Minn	Aug. 3
Sept. 3.	White Sulphur Springs, Mont	July 27
Sept. 3.	LaMoure, N. D	Aug. 10
Sept. 3.	Sherbrooke, Que	Aug. 31
Sept. 4.	Olivet, S. D	Aug. 3
Sept. 4.	Dayton, O	Aug. 31
Sept. 4.	Cleveland, O	Aug. 31
Sept. 4.	Mahwah, N. J	Aug 31
Sept 4.	Dallas, Ore	Aug. 31
Sept. 4.	Vicksburg Miss	Aug. 31
Sept. 7.	Springfield, O	Aug 24
Sept. 9.	Indianapolis, Ind	Aug. 17
Sept. 9.	Zanesville, O	Aug. 24
Sept. 9.	Weiser, Idaho	Aug. 31
Sept. 11.	Atlantic County, N. J Adv., Eng. Record, Aug. 31.	Aug. 31
Sept. 12.	Paulding, O	Aug. 31
Sept. 13.	Tipton, Ind	Aug. 31
Sept. 13.	Hamilton, O	Aug. 31
Sept. 17.	Willows, Cal	Aug. 31
Sept. 23.	Ogden, Utah	Aug. 31
Sept. 30.	Fredericton, N. B Adv., Eng. Record, Aug. 17 to 31.	Aug. 17
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
———	St. Petersburg, Russia	Aug. 17

PAVING AND ROADMAKING.

Sept. 3.	Kewanee, Ill	Aug. 31
Sept. 3.	Elizabeth, N. J	Aug. 17
Sept. 3.	Kenosha, Wis	Aug. 24
Sept. 3.	White Plains, N. Y	Aug. 24
Sept. 3.	Scranton, Pa	Aug. 31
Sept. 3.	Jersey City, N. J	Aug. 31
Sept. 4.	Cincinnati, O	Aug 24
Sept. 4.	Woonsocket, R. I Adv., Eng. Record, Aug. 31.	Aug. 31
Sept. 4.	New Brunswick, N. J	Aug. 31
Sept. 5.	Yonkers, N. Y	Aug. 31
Sept. 5	Wilkinsburg, Pa	Aug. 31
Sept. 5.	Wilmington, Del	Aug. 31
Sept. 5.	Des Moines, Ia	Aug. 24
Sept. 5	Findlay, O	Aug. 17
Sept. 5.	Corydon, Ind	Aug. 17
Sept. 7.	Cincinnati, O	Aug. 17
Sept. 7.	Washington, D. C Adv., Eng. Record, Aug. 17.	Aug. 17
Sept. 7.	East Cleveland, O	Aug. 24
Sept. 9.	Green Bay, Wis	Aug. 24
Sept. 9.	Cincinnati O	Aug. 17
Sept 9.	Barberton, O	Aug. 24
Sept. 9.	La Porte, Ind	Aug. 31
Sept. 9.	Chester, N. Y	Aug. 31
Sept. 9.	Union, N. J	Aug. 31
Sept. 10.	Mingo Junction, O	Aug. 31
Sept. 10.	Toledo, O	Aug. 17
Sept. 11.	Buffalo, N. Y	Aug. 31
Sept. 11.	Pittsburg, Pa	Aug. 31
Sept. 14.	Alliance, O	Aug. 24
Sept. 14.	Youngstown, O	Aug. 24
Sept. 14.	Shelby, O Adv., Eng. Record, Aug. 31.	Aug. 31
Sept. 14.	Marion, O	Aug. 31
Sept. 15.	Marion, Ia	Aug. 10
Sept. 16.	Cincinnati, O	Aug. 31
Sept. 17.	Oberlin, O	Aug. 31
Sept. 17.	Marinette, Wis	Aug. 31
Sept. 18.	Salem, N. J	Aug. 31
Sept. 18	Glenville, O	Aug. 31
Sept. 20.	Chagrin Falls, O	Aug. 24
Sept. 21.	Conneaut, O	Aug. 31
Sept. 25.	Havana, Cuba Adv., Eng. Record, June 29 to July 20, Aug. 17, 24.	June 29

POWER, GAS AND ELECTRICITY.

Sept. 3.	Franchise, San Rafael, Cal	Aug. 10
Sept. 3.	Media, Pa. Adv., Eng. Record, Aug 24.	Aug. 24
Sept. 4.	Altamont, Ill	Aug. 31
Sept. 5.	Cleveland, O	Aug. 17
Sept. 6.	Utica, N. Y	Aug. 31
Sept. 9.	Washington, D. C Adv., Eng. Record, Aug. 10 to 24.	Aug. 10
Sept. 9.	McIntosh, Minn	Aug. 24
Sept. 16.	Mascoutah, Ill	Aug. 31
Sept. 19.	Norway, Mich	Aug. 31
Sept. 20.	El Paso, Tex	Aug. 10
Sept. 21.	Steam generating equipment, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
Oct. 8.	London, England	Aug. 24

GOVERNMENT WORK.

Sept. 3.	Mechanical equip., San Francisco, Cal. Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Interior finish, San Francisco, Cal. Adv., Eng. Record, July 13, 20.	July 13
Sept. 3.	Canal work, Chicago, Ill Adv., Eng. Record, Aug 3 to 24.	Aug. 3
Sept. 3.	Bldg., Grand Junction, Colo	Aug. 17
Sept. 4.	St. Cloud, Minn Adv., Eng. Record, Aug. 3, 10.	Aug. 3
Sept. 4.	Bldg., htg., etc., Ft. Preble, Me	Aug. 17
Sept. 5.	Bldgs., Lawrence, Kan	Aug. 17
Sept. 5.	Bldg., Southport, N. C	Aug. 17
Sept. 5	Htg bldg., Reedy Island, Del. Adv., Eng. Record, Aug. 24, 31.	Aug. 24
Sept. 6.	Sea wall, Ft. Monroe, Va Adv., Eng Record, Aug. 17, 31.	Aug. 17
Sept. 6.	Nadeau, Kan	Aug. 17
Sept. 6.	Washington, D. C	Aug. 31
Sept. 7.	New York, N. Y	Aug. 10
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Sept. 3.	Htg. jail, Jeffersonville, Ind	Aug. 24
Sept. 3.	Court house annex, Macon, Ga	Aug. 24
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

General William Ludlow.

Down in the heart of commercial New York traffic suddenly ceased for a time on Wednesday, and the hurrying crowds of business people, deeply touched by the sad sight, stopped to stand with bared heads while nine companies of regular troops marched slowly to Trinity Church with the body of one of their most gifted officers. A little later a bugler within the church softly sounded "Taps," and the people waiting outside knew that the last military honors had been paid to General William Ludlow, a public servant of the highest type.

He came from a family of considerable standing in New York and Long Island. His military bent of mind was evidently an inheritance from his father, who was breveted major general for services in the Civil War, and it is worth noticing that a brother, Nicol Ludlow, is a rear admiral on the retired list. This inheritance of military spirit and the training at West Point, where he was graduated when nineteen years old, as eighth member of the class of 1864, was confirmed and molded by a gallant part in the Civil War. At an age when boys to-day are in the lower classes of colleges and technical schools, he was chief engineer of the twentieth army corps and marching through Georgia with Sherman. In a few months he was chief engineer of the Army of Georgia, and later became assistant engineer of the entire army under General Sherman. He was in a number of battles, and when given his first leave of absence in April, 1865, he had won by gallant and meritorious services the brevet rank of lieutenant colonel. All these facts are important as showing under what strenuous conditions his inherited character was strengthened and fixed along soldierly lines at an early age. The only adverse criticisms from reputable people which have been made against him came from those unable to appreciate the essential difference between military and civil ideas of promptness, activity, and obedience to orders from a superior.

At the close of the war he took up the usual duties of an engineer officer in times of peace. In 1867 he was raised to captain, and five years later was made chief engineer of the Department of Dakota. From 1876 to 1882 he was assistant under Cols. Kurtz and Macomb, and then served about six months as engineer secretary of the Lighthouse Board. During these years of routine engineering service his scrupulous honesty, unusually attractive personality and engaging frankness of speech won the friendship of all public-spirited and broad-minded people with whom he came in contact, and eventually led to his receipt of the greatest compliment paid to an engineer officer since the Civil War.

In the winter of 1882-83, the people of Philadelphia rose in wrath against the officials of the city. Under the leadership of a committee of 100, so-called, new officers were chosen and an attempt made to improve the administration of public affairs. The water department, particularly, was the subject of criticism, and there was an urgent demand for an intelligent executive engineer at its head. By a common impulse the committee turned to Captain Ludlow, who was widely known among the leading citizens. He agreed to accept the task if a leave of absence could be procured, so the committee appealed to Congress, then in session, and by a special act, passed on February 28, 1883, secured his services for three years. Here his executive ability and freedom from the indirect methods of politicians soon reduced chaos to order, shiftlessness to business, and jobbery to clean administration. The problem of the extension of the water-works was turned over to Mr. Rudolph Hering with orders simply to find the best source for an additional supply, and in every other direction broad-gauge, earnest and intelligent work, with specialists' assistance, was done for the public service.

While holding this office an attempt to bribe him was made, which is now a well-known story, but is worth telling again as illustrating the cutting scorn he showed toward dishonesty in any form. A contractor called at his office and during the conversation placed in a conspicuous place a bank note of large denomination. The talk continued quietly, and the contractor was offered a cigar from the commissioner's private box. Pleased at the success of his little deal he accepted with complacent self-esteem, which soon changed to fright when he was handed the bill, burning, to light tne cigar.

When the three years at Philadelphia were finished, with much credit to himself and advantage to the city, Major Ludlow became engineer commissioner of the District of Columbia. Service for five years on the Lighthouse Board succeeded his term in Washington, and he then went to London as military attache. While serving there he was called back to perform one of his most important public services, an examination of the Nicaragua Canal project, in which task he was associated with Messrs. M. T. Endicott and Alfred Noble. At this time everyone believed that the power over Congress of the Maritime Canal Company was so great that the country would be committed to its scheme without proper investigation. The Ludlow commission stopped this absolutely by a report which is one of the most creditable examples of professional literature, produced under adverse conditions, that we have had in recent years.

Of his work in Cuba after the Spanish War so much was printed in The Engineering Record last year that it is unnecessary to review it here. Havana was a charnel house when he took charge of the city; it compared favorably with many cities in the United States when he left it. With his little staff of devoted officers and civilian assistants he fought the battle of cleanliness as valiantly as he had fought that of humanity, and faced the storm of abuse and filthy innuendo from the rifraf of the city with as little concern as the bullets of an enemy in arms. It was a grand achievement that was his, not generally recognized at its full importance in this country nor in the Cuban capital, but one which should be commemorated in enduring bronze in a conspicuous place in that city.

On his return to this country he was commissioned to organize the Military War College, and for the purpose visited the headquarters of several European army departments. When the work was finished he was ordered to the Philippines, but consumption had seized him before he arrived out, and he was invalided home immediately. It was characteristic of the man that none of the usual hopefulness of the consumptive was shown by him. On the return voyage he discussed the disease calmly with the surgeon, talked over the quality of the creosote he was taking, and freely expressed a decision to die peacefully at home rather than among strangers in some distant sanitarium. And so he passed away as he wished, on August 30, in the home of a son-in-law. Honored by the army, respected by those who respect what is just and true, loved by all who knew him well, he has left behind a record which may well be held up as a model for the American soldier.

Highway Bridge Design and Construction.

If past improvement in highway bridge design and construction could be measured by the amount of matter which has been written about it there would be little left in the way of desirable progress in this particular field of engineering construction. It is highly probable that no other class of structural work has been subject to so much drastic criticism, and yet it is certain that none has on the whole experienced so little substantial improvement. This observation is not intended to be applicable to the large number of excellent iron and steel city street bridges which have been built during the past ten or fifteen years. In many cases they are admirable specimens of bridge work, not only in design but also in quality of material and in respect to the shop work put upon them. These structures, however, do not represent the general run of highway bridges as they are found throughout the country. The utterly disgraceful rattle-trap constructions which were so common twenty-five years ago and of which so many have fallen down are, it is true, no longer foisted upon an ignorant portion of the public; but the great majority of highway bridges are still frequently if not generally both planned and constructed so as best to serve the purposes of designing persons, whether contractors or county or town officials, or both, and with little or no regard to sound engineering procedures.

The remedy for such a vicious condition is neither simple nor easily applicable, nor can reform results be expected to be found widely distributed within a short time. Yet the subject is one worthy of the most careful consideration by every interested party, engineers, contractors and the general public. In country and most suburban districts, the chief difficulty lies in the fact that the county or town officials entrusted with the duty of securing these bridges are men almost invariably unqualified to appreciate the value of professional services in such a connection, and in far too many cases it is to be apprehended that "what there is in it" is the controlling consideration. These features of the case are played upon and made to do active duty by irresponsible and corrupt contracting agents against whose peculiar methods professional men and high-principled bridge builders can make no headway, for their scruples will not permit them "to fight the devil with fire." Any step taken, therefore, by any influential party to improve the status of highway bridge building or to advance the character of design or quality of material or shop work is worthy of being heartily commended.

Such a step has recently been taken by the American Bridge Company, and as it is supported by both the high standing of that company as bridge builders and the influence of the United States Steel Corporation, of which it is a part, doubtless much good to the cause of highway bridge construction may be accomplished. This step consists in the issue of "General Specifications for Steel Highway Bridges," of which some of the principal portions are printed immediately after these notes. As indicated by the title, these specifications are general and leave ample latitude for preferences of individual engineers or to meet local conditions. They begin by dividing all highway structures into six classes, each suitable for a prescribed grade of traffic, varying from the heaviest city street use to that on the lightest country road, including both heavy and light electric street railway traffic. The requirements of the preceding classification are admirably met by five types of structures beginning with rolled beams and ending with all-riveted or pin-connected trusses. The exclusion in this classification of open or articulated structures for spans under 80 feet in length is worthy of the highest commendation. The old practice, far too prevalent even at the present time, of using pin-connected trusses for spans below the above limit, has been productive of more evil than any other bad feature in highway bridge design. It has been the favorite feature available to shysters for reducing weight to a dangerous degree by adopting small cross-sections of main members while apparently giving all the metal required by computations. There are hundreds and probably thousands of such miserable rattle-trap highway structures all over the country, every one of them thoroughly unfit to be in use and most of them dangerous. The day of such vicious constructions would be past under such specifications as those of the American Bridge Company and others of a similar character. Equally wise, although not equally necessary, possibly, is the provision which would make trusses from 80 to 140 feet in length all-riveted, and which would permit the use of pin-connected trusses only in trusses over 140 feet in length.

Another direction in which highway bridge design has been too often defective is the assumption of too small moving loads. A reference to the American Bridge Company's specifications will show that no highway bridge designed under them is likely to be overloaded, while the provisions are not extravagant. The distinction between concentrated loads for floor members and uniform loads for trusses is, from an engineering point of view, eminently sensible. The matter of concentrated loads, particularly for railroad bridges, has been pushed much farther than needful for the best engineering results.

Other portions of these specifications relating to working stresses, rather unfortunately called "strains," details of construction and quality of material and of workmanship will be found to raise the design and construction of highway bridges to the plane of the best railroad work. This is as it should be, for there is no greater error than to suppose, in the interests of economy, that for some reason or other highway bridge work may be regarded as of less concern or as needing less scrupulous care in its own field than railroad bridge work. It seems seldom to be recognized in this connection that cheapness and economy may be and usually are quite inconsistent with each other.

These specifications constitute a distinct advance over ordinary requirements and indicate a desire on the part of the American Bridge Company to execute good work on well-designed plans, and their distribution among county engineers and other officials will be a genuine public service. The sooner such excellent general standards as these or other similar specifications come into general use the sooner will highway bridge building reach that degree of excellence which ought to characterize it in the interests of true economy and public safety.

Classification.—Bridges under these specifications are divided into six classes, viz.: Class A, For city traffic. Class B, For suburban or interurban traffic with heavy electric cars. Class C, For country roads with light electric cars or heavy highway traffic. Class D, For country roads with ordinary highway traffic. Class E_1, For heavy electric street railways only. Class E_2, For light electric street railways only.

Material.—All structures to be of rolled steel, except the flooring and wheel-guards of Classes A, B, C, E_1 and E_2, and the stringers, flooring and wheel-guards of Class D, which may be of timber. Cast iron or cast steel will be permitted only in machinery of movable bridges and in special cases for shoes and bearings.

Type of Bridges.—The following types of bridges are recommended: For spans up to 25 feet, rolled beams. For spans from 25 to 40 feet, rolled beams or plate girders. For spans from 40 to 80 feet, plate or lattice girders. For spans from 80 to 140 feet, lattice girders. For spans over 140 feet, lattice girders or pin-connected trusses.

Spacing of Trusses.—The width between centers of trusses shall in no case be less than one-twentieth of the span between centers of end pins or shoes.

Floorbeams.—All floorbeams in through bridges shall be riveted to the main girders.

Stringers.—Steel stringers shall preferably be riveted to the web of the floorbeams.

Solid Floor.—For bridges of Classes A and B a solid floor, consisting of stone, asphalt, etc., on a concrete bed, is recommended. For this case the flooring will consist of buckle-plates or corrugated sections, and the concrete bed shall be at least 3 inches thick for the roadway, and 2 inches thick for the footwalk, over the highest point to be covered, not counting rivet or boltheads.

Buckleplates.—Buckleplates shall not be less than 5/16 inch thick for the roadway and ¼ inch thick for the footwalk.

Dead Load.—In determining the weight of the structure for the purpose of calculating strains, the weight of timber shall be assumed at 4 pounds per foot B. M., the weight of concrete and asphaltum at 130 pounds, of paving brick at 150 pounds and of granite stone at 160 pounds per cubic foot.

The rails, fastenings, splices and guard timbers of street railway tracks, resting on cross-ties, shall be assumed as weighing 100 pounds per lineal foot of track.

Live Load.—The bridges of the different classes shall be designed to carry, in addition to their own weight and that of the floor, a moving load, either uniform or concentrated, or both, as specified below, placed so as to give the greatest strain in each part of the structure.

Class A, City Bridges.—For the floor and its supports, on each street-car track or on any part of the roadway, a concentrated load of 24 tons on two axles 10 feet centers and 5 feet gauge (assumed to occupy a width of 12 feet), and upon the remaining portion of the floor, including footwalks, a load of 100 pounds per square foot.

For the trusses, for spans up to 100 feet, 1,800 pounds per lineal foot of each car track (assumed to occupy 12 feet in width), and 100 pounds per square foot for the remaining floor surface; for spans of 200 feet and over, 1,200 pounds for each lineal foot of track and 80 pounds per square foot of floor; proportionally for intermediate spans.

Class B, Suburban or Interurban Bridges.—For the floor and its supports, on any part of the roadway, a concentrated load of 12 tons on two axles 10 feet centers and 5 feet gauge (assumed to occupy a width of 12 feet), or on each street-car track a concentrated load of 24 tons on two axles 10 feet centers; and upon the remaining portion of the floor, including footwalks, a load of 100 pounds per square foot.

For the trusses, for spans up to 100 feet, 1,800 pounds per lineal foot of each car track and 80 pounds per square foot for the remaining floor surface; for spans of 200 feet and over, 1,200 pounds for each lineal foot of track and 60 pounds per square foot of floor; proportionally for intermediate spans.

Class C, Heavy Country Highway Bridges.—For the floor and its supports, on any part of the roadway, a concentrated load of 12 tons on two axles 10 feet centers and 5 feet gauge (assumed to occupy a width of 12 feet), or on each street-car track a concentrated load of 18 tons on two axles 10 feet centers; and upon the remaining portion of the floor, including footwalks, a load of 100 pounds per square foot.

For the trusses, same as for Class B, except load on car tracks for spans up to 100 feet will be 1,200 pounds, and for spans of 200 feet and over, 1,000 pounds.

Class D, Ordinary Country Highway Bridges.—For the floor and its supports, a load of 80 pounds per square foot of total floor surface, or 6 tons on two axles 10 feet centers and 5 feet gauge.

For the trusses a load of 80 pounds per square foot of total floor surface for spans up to 75 feet; and 55 pounds for spans of 200 feet and over; proportionally for intermediate spans.

Class E_1, Bridges for Heavy Electric Street Railways Only.—For the floor and its supports, on each track a load of 24 tons on two axles 10 feet centers.

For the trusses, a load of 1,800 pounds per lineal foot of each car track for spans up to 100 feet; and a load of 1,200 pounds for spans of 200 feet and over; proportionally for intermediate spans.

Class E_2, Bridges for Light Electric Street Railways Only.—For the floor and its supports, on each track a load of 18 tons on two axles 10 feet centers.

For the trusses, a load of 1,200 pounds per lineal foot of each car track for spans up to 100 feet; and a load of 1,000 pounds for spans of 200 feet and over; proportionally for intermediate spans.

Impact.—To compensate for the effect of impact and vibration, 25 per cent. of the maximum strains resulting from the above-mentioned live load shall be added thereto.

Wind Pressure.—The wind pressure shall be assumed acting in either direction horizontally. First, at 30 pounds per square foot on the exposed surface of all trusses and the floor as seen in elevation, in addition to a horizontal live load of 150 pounds per lineal foot of the span moving across the bridge. Second, at 50 pounds per square foot on the exposed surface of all trusses and the floor system. The greatest result shall be assumed in proportioning the parts.

Momentum of Street Cars.—For longitudinal bracing of structures carrying street railroads, the momentum produced by suddenly stopping the train shall be considered; the coefficient of friction of wheels sliding upon the rails being assumed as 0.2.

Centrifugal Force.—When the structure carrying a street railroad is on a curve, the additional effects due to the centrifugal force shall be considered.

Permissible Tensile Strains.—All parts of the structure shall be so proportioned that the sum of the maximum loads, together with the impact, shall not cause the tensile strain to exceed:

On soft steel 15,000 pounds per square inch.

On medium steel 17,000 pounds per square inch.

Permissible Compressive Strains.—For compression members, these permissible strains of 15,000 and 17,000 pounds per square inch shall be reduced in proportion to the ratio of the length to the least radius of gyration of the section by the following formulae:

$$\text{For soft steel, } p = \frac{15{,}000}{1 + (l^2 \div 13{,}500r^2)}$$

$$\text{For medium steel, } p = \frac{17{,}000}{1 + (l^2 \div 11{,}000r^2)}$$

where p = permissible working strain per square inch in compression, l = length of pieces in inches, center to center of connection, and r = least radius of gyration of the section in inches.

No compression member, however, shall have a length exceeding 120 times its least radius of gyration, excepting those for wind bracing, which may have a length not exceeding 140 times the least radius of gyration.

Reversal of Strains.—The reversal of strain in members of bridges of Classes A, B, C and D need not be considered, but the members shall be proportioned for the strain giving the larger section.

For bridges of Classes E_1 and E_2 members subject to alternate strains of tension and compression in immediate succession (as counter stresses in web members or chords in continuous trusses) shall be so proportioned that the total sectional area is equal to the sum of areas required for each strain.

Combined Strains.—In case the maximum strains due to wind, added to the maximum strains due to vertical loading (including impact), shall exceed the following limits: on soft steel, 19,000 pounds per square inch, on medium steel, 21,000 pounds per square inch, properly reduced for compression, addition must be made to such sections until these limits are not exceeded.

Shearing and Bearing Strains.—The shearing strain on rivets, bolts or pins, per square inch of section, shall not exceed 11,000 pounds for soft steel, and 12,000 pounds for medium steel; and the pressure upon the bearing surface of the projected semi-intrados (diameter x thickness) of the rivet, bolt or pin hole, shall not exceed 22,000 pounds per square inch for soft steel, and 24,000 pounds for medium steel.

Plate Girders.—Plate girders shall be proportioned on the assumption that one-eighth of the gross area of the web is available as flange area. The compressed flange shall have the same sectional area as the tension flange; but the unsupported length of flange shall not exceed twenty times its width.

The shearing strain in web plates shall not exceed 9,000 pounds per square inch for soft steel and 10,000 pounds per square inch for medium steel.

Floor Timber.—The fiber strain on floor timber from dead and live load without impact shall not exceed 1,200 pounds per square inch on yellow pine and white oak, and 1,000 pounds per square inch on white pine and spruce.

Spacing of Rivets.—The distance from the edge of any piece to the center of a rivet hole must not be less than 1½ times the diameter of the rivet, nor exceed eight times the thickness of the plate; and the distance between centers of rivet holes shall not be less than three diameters of the rivet.

Tie Plates.—All segments of compression members connected by latticing only, shall have tie plates placed as near the ends as practicable. They shall have a length of not less than the greatest depth or width of the member, and a thickness of not less than one-fiftieth of the distance between the rivets conecting them to the compressed members.

Lacing.—Single lattice bars shall have a thickness of not less than one-fortieth, and double bars connected by a rivet at the intersection of not less than one-sixtieth of the distance between the rivets connecting them to the member; and their width shall be in accordance with American Bridge Company's standards, generally:

For 15-inch channels, or built sections with 3½ and 4-inch angles: 2½ inches (⅞-inch rivets).

For 12, 10 and 9-inch channels, or built sections with 3-inch angles: 2¼ inches (¾-inch rivets).

For 8 and 7-inch channels, or built sections with 2½-inch angles: 2 inches (⅝-inch rivets).

For 6 and 5-inch channels, or built sections with 2-inch angles: 1¾ inches (½-inch rivets).

Planing and Reaming.—In medium steel over ¾ inch thick, all sheared edges shall be planed and all holes shall be drilled or reamed to a diameter of ⅛ inch larger than the punched holes, so as to remove all the sheared surface of the metal.

Process of Manufacture.—All steel must be made by the open-hearth process, and if by acid process, shall contain not more than 0.08 per cent. of phosphorus, and if by basic process, not more than 0.05 per cent. of phosphorus, and must be uniform in character for each specified kind.

Physical Properties.—Steel shall be made of three grades: Rivet, soft and medium.

Rivet steel shall have: Ultimate strength, 48,000 to 58,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 26 per cent. Bending test, 180 degrees flat on itself, without fracture on outside of bent portion.

Soft steel shall have: Ultimate strength, 52,000 to 62,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 25 per cent. Bending test, 180 degrees flat on itself, without fracture on outside of bent portion.

Medium steel shall have: Ultimate strength, 60,000 to 70,000 pounds per square inch. Elastic limit, not less than one-half the ultimate strength. Elongation, 22 per cent. Bending test, 180 degrees to a diameter equal to thickness of piece tested, without fracture on outside of bent portion.

Pins.—Pins up to 7 inches diameter shall be rolled. Pins exceeding 7 inches diameter shall be forged under a steel hammer striking a blow of at least 5 tons. The blooms to be used for this purpose shall have at least three times the sectional area of the finished pins.

Steel Castings.—Steel castings shall be made of open-hearth steel containing from 0.25 to 0.40 per cent. carbon and not over 0.08 per cent. of phosphorus, and shall be practically free from blow holes.

Timber.—The timber shall be strictly first-class spruce, white pine, Douglas fir, Southern yellow pine, or white oak bridge timber; sawed true and out of wind, full size, free from wind shakes, large or loose knots, decayed or sapwood, wormholes or other defects impairing its strength or durability.

The Steam Plant in the Atlantic Mutual Building, New York.

The Atlantic Mutual Building, recently erected by the Atlantic Mutual Insurance Company as a modern office building, is 18 stories high and is located at the corner of William and Wall Streets, New York City. The structure, which was built from plans prepared by Messrs. Clinton & Russell, of New York, has all the modern improvements and conveniences usually found in an up-to-date building of this description, including steam heat, electric light, elevators, refrigerating plant and pumping plant for fire and domestic purposes. The pneumatic foundations and the chief features of the steelwork in the structure were illustrated in The Engineering Record of August 18, 1900. The steam plant is quite extensive, and serves to illustrate the current practice in such installations. The steam plant was designed by Mr. J. Hollis Wells, of Clinton & Russell, the electric plant by Mr. A. E. Wells, of New York. One of the features of the plant is the light and spacious engine room, which is in strong contrast with many similar plants and highly to be recommended.

The boiler plant consists of three Abendroth & Root boilers, one 225-horse-power and one 175-horse-power, set in a battery and one 225-horse-power set singly. The two 225-horse-power boilers have each 96 4-inch tubes, 18 feet long, set 12 wide and 8 high, and three steam drums 30 inches diameter and 20 feet long, giving a total heating surface of 2,270 square feet, or about 10 square feet of heating surface per horse-power. The grate area of the two larger boilers is 54.14 square feet each, giving a ratio of heating surface to grate area of about 41. The 175-horse-power boiler has 64 4-inch tubes, 18 feet long, set 8 wide and 8 high, and 2 drums of the same size as those on the other boilers, with a total heating surface of 1,520 square feet, or about 8.7 square feet of heating surface per horse-power. The grate area is 36.79 square feet, the ratio of grate area to surface being 41.

The boilers are hand fired and natural draft is obtained through a riveted No. 10 gauge black iron smoke flue leading to an iron stack, 44 x 66 inches in cross section and 264 feet high. Dampers are placed in each branch of the flue leading to the different boilers, and one 45-degree angle damper in the main flue, all controlled by hand. The fuel, which is buckwheat anthracite coal, is dumped from the street into a large bin directly under the sidewalk and from this bin is conveyed to the boilers in buckets suspended from an overhead railway, provided with scales for weighing coal. The steam pressure carried is about 110 pounds. The boiler specifications call for not less than 6,070 square feet of heating surface and 146 square feet of grate surface, which is equivalent to about 9.7 square feet of heating surface per boiler horse-power, and a ratio of heating to grate surface of about 41.6.

The specifications further prescribed that the tubes should be of the best quality of wrought iron, that the steam and water drums should be of Park Bros. or other approved open-hearth steel ½ inch in thickness, with horizontal seams double riveted and the circular seams single riveted, and equipped with proper manholes, etc. The mud drums are made of the best car-wheel mixture charcoal cold-blast iron tested to 400 pounds pressure. Specifications call for the usual fronts, cleaning doors, grate bars, supports, tools, etc. They provide that all pressure parts shall be tested and made tight under a hydrostatic pressure before they leave shop as follows: Sections 240 pounds, steam and water drums, 240 pounds; mud drum, 300 pounds. The boilers were also tested and made tight at 225 pounds pressure per square inch when erected on the foundations. The contractor was required to have the boiler tested and insured by the Hartford Steam Boiler Inspection & Insurance Co., or the Fidelity & Casualty Co., for one year at the expense of the manufacturer. The manufacturer was also required to comply with all the laws and regulations relating to steam boilers as prescribed by the city and State of New York. The specifications also provide for settings built of best hard burned selected Haverstraw Bay brick, laid with headers every third course in mortar of one part Portland cement, one part lime and three parts of sharp clean river sand. The side walls are 17 inches, center wall 24 inches, front walls 16 inches, rear walls 4 inches and bridge walls 24 inches thick. All portions of the setting exposed to the flames or products of combustion were required to be lined with fire brick equal to Maurer's Number 1, laid in best quality of fire clay batter and bonded in the wall at every third course.

Two Barr duplex feed water pumps are installed, with cylinders 6 and 4 x 6 inches in size. The boilers are also equipped with No. 8 Korting injectors. The feed pumps are brass fitted and are set on brick foundations faced with white glazed brick and capped with fine axed bluestone 4 inches thick. Copper drip trays are placed on the foundations under the pumps. The feed water is taken from the city main and passes through a condensing coil in the blow-off or drip tank to a Ward combination zinc box and feed-water filter, composed of six cast-iron cylinders 15 inches diameter and 5½ feet high over all. From the filter the feed water passes through the pump and thence through a Berryman feed-water heater to the boilers. The water is heated to about 160 degrees Fahrenheit in the condensing coil and is supplied to the boilers at 210 degrees Fahrenheit. A by-pass is arranged so that the feed water may be drawn directly from the main without passing through the condensing coil.

The boilers are fitted with single blow-off valves of the Fairbanks make. The blow-off discharges into the blow-off or drip tank. This tank is 40 inches in diameter and 8 feet long, and is constructed of the best charcoal hardened No. 1 iron ⅜ inch thick, with heads of the same material 7/16 inch thick. The tank is fitted with end manholes and a glass water gauge and is tested to withstand 150 pounds pressure per square inch. The condensing coil in this tank contains about 100 lineal feet of 2-inch heavy brass steam pipe, with extra heavy cast-iron headers, the object of the coil being to cool the water in the tank below 100 degrees Fahrenheit, as required by the Board of Health, before its contents are discharged into the sewer. In addition to the blow-off pipe, all drips from engines, pumps, radiators and steam, water and exhaust pipes are discharged into this tank through traps. The top of this tank is connected with the main exhaust to the atmosphere, outside of the back pressure valve, by means of a 2-inch vapor pipe. As the blow-off tank is blow the level of the sewer, it is necessary to pump the water to the sewer and a 5¼ and 3½ x 5-inch Barr duplex pump is used for this purpose.

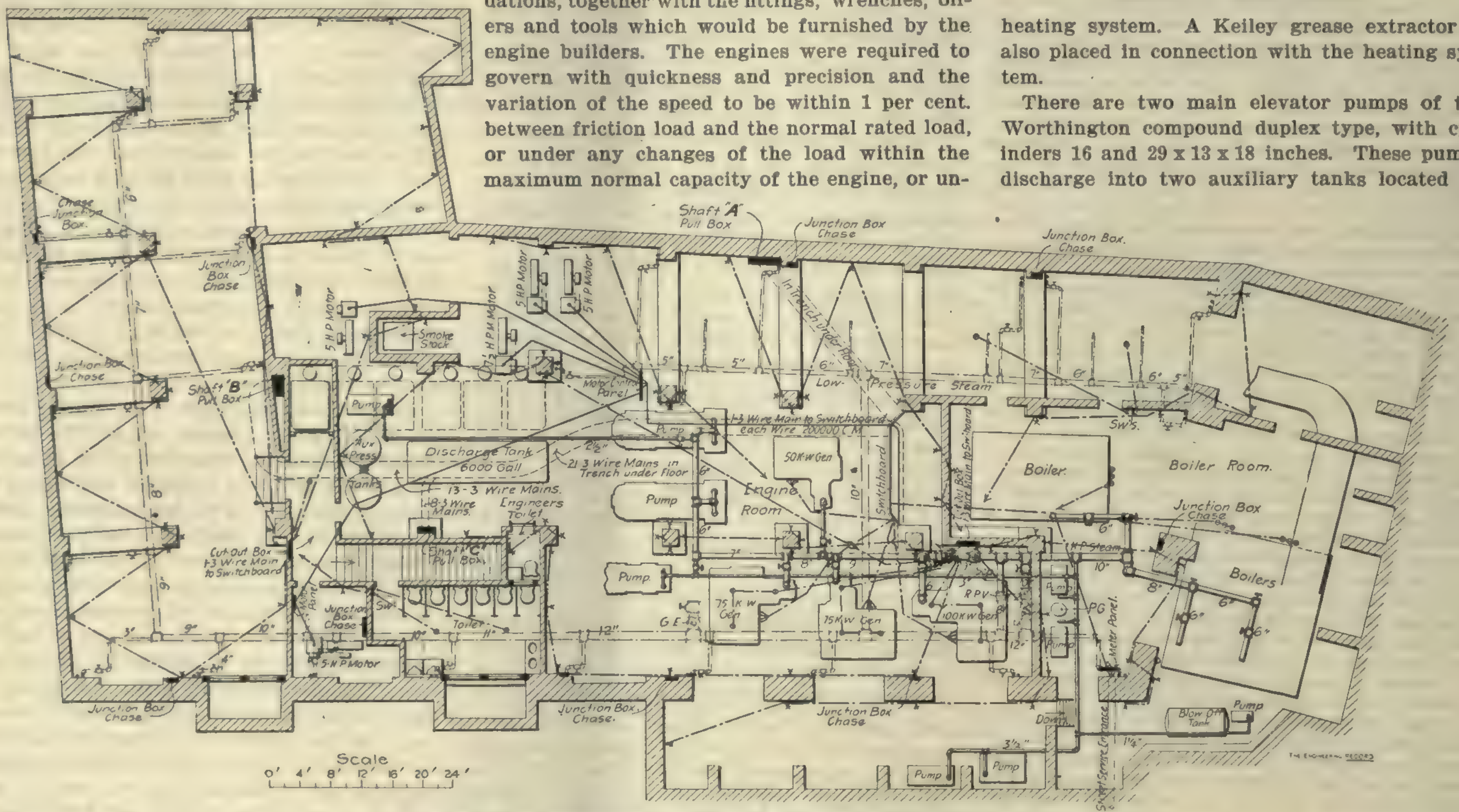
The feed-water heater, as mentioned, is of the Berryman type, and is of 600 horse-power capacity, with 4-inch inlet and outlet pipes, connected with pumps and boilers with polished brass piping. The feed-water and exhaust piping are both connected to the heater with by-pass arrangements, and the valves in the exhaust piping are so placed that all the steam may be made to pass through the heater to the atmosphere or around the heater to the atmosphere, or all the steam may be diverted to the heating system, or part may be sent through the heater and part to the heating system.

The main steam pipe from the boiler, as shown on the accompanying plans of steam piping, is 10 inches in diameter. Branches from the three boilers are connected with this 10-inch line, which is extended through the boiler room to the engine room and a 10-inch main header is there erected. A separate 10-inch main is provided, which leads from this header for the electric-light engines with a special 10-inch separator and a 10-inch quick closing gate valve to be used in case of accident. A 6-inch main line is extended from the header to connect with the elevator pump, fire pump, and house pump, and also to connect direct with the heating system. A separate 3-inch main is run to supply the boiler feed pump and blow-off tank pump.

There are four simple, automatic, high-speed, double disk, center crank, horizontal engines installed, made by the Ames Iron Works, of Oswego, New York. The engines are of the following sizes: one of 134 horse-power, 16 x 16-inch cylinder and a speed of 225 revolutions per minute; 2 of 100 horse-power, 15 x 14-inch cylinder, and a speed of 250 revolutions per minute; 1 of 75 horse-power, 12 x 12-inch cylinder, and a speed of 275 revolutions per minute. The engines are respectively direct-connected to multipolar generators made by the General Electric Co., Schenectady, N. Y.; one of 100 kilowatts capacity, two of 75 kilowatts capacity and one of 50 kilowatts capacity. The engines are equipped with Rites' governors, and a gravity oil system is used.

The engine specifications require that the engine shall be equipped for operating the above dynamos at 25 per cent. overload for two hours after a run of six hours under full load and that they shall be capable of standing, without serious straining or injury to any of the parts, a momentary overload of 75 per cent. It was required that the proposals for engines should give the following data and that the dimensions should not be less than those tabulated below:

Size of dynamo, kw..................	50	75	100
Diameter of cylinder, ins............	13	15	16
Length of stroke, ins................	12	14	16
Revolutions per minute..............	275	250	225
Size of shaft, engine, ins...........	5½	6	6½
Size of shaft, dynamo, ins...........	5	5½	6
Diameter of crank pin, ins..........	6½	7½	8¾
Length of crank pin, ins............	5½	6½	7¼
Diam. of cross-head pin, ins.......	3½	4	4½
Length of cross-head pin, ins......	4½	5½	6½
Length of main shaft and outboard bearings, ins.........................	11	13	15
Weight of governor wheel..........	..	..	..
Weight of engine complete, with and without sub-base.............	..	..	..



PLAN OF BASEMENT, SHOWING MECHANICAL PLANT.

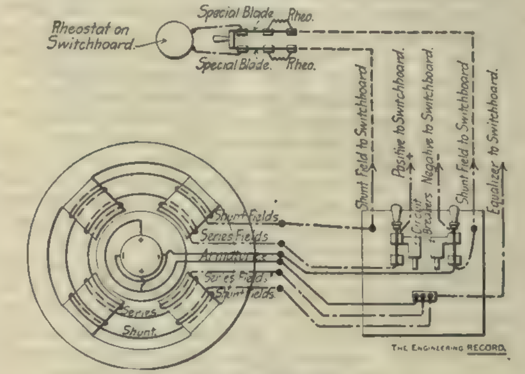
The guarantee was required as to the increase in friction horse-power due to increase of load from no load to full load; the guaranteed friction horse-power required to run engines with armature attached but brushes raised; and what guarantee, if any, and other necessary data concerning the same, as required by the architects' engineer. It was specified that the initial steam pressure at the boilers would be 80 pounds and the back pressure would not exceed 5 pounds and the point of cut-off should occur at quarter stroke. It was stipulated, however, that although 80 pounds pressure at the boilers was specified, the engines should be so designed and proportioned that a working pressure at the cylinder of 125 pounds could be safely guaranteed.

In addition to the above requirements the quality of the materials to be used in the different parts of the engine was specified, together with the general clauses relating to the erection of the engines, and the construction of the foundations, together with the fittings, wrenches, oilers and tools which would be furnished by the engine builders. The engines were required to govern with quickness and precision and the variation of the speed to be within 1 per cent. between friction load and the normal rated load, or under any changes of the load within the maximum normal capacity of the engine, or under changes of steam pressure not exceeding 5 pounds above or below the specified pressure.

The contractor was also required to guarantee noiselessness, the specification stating "the engines shall cause no noise or vibration sufficient to be objectionable or annoying at a distance of 10 feet in any direction, whether noise is caused by unbalanced parts, lost motion or the rush of steam through the ports and valves of the engine."

It was also specified that the engine builder make provision for indicator connections with three-way cocks and supply one Taber or Crosby indicator with each engine with suitable springs. The specifications required a test before the engines were finally accepted and a guarantee that if after 60 days' trial the engines did not fully meet the requirements of the specifications, the contractor should at his own expense remove the engines and supply others which conformed to the requirements as above outlined.

The exhaust steam from the engines, as well as that from the elevator pumps, fire pump, house pump, feed-water pumps, etc., is carried in the summer to the feed-water heater, and thence to the atmosphere, and in the winter a portion of the exhaust steam is used for heating the building. The main exhaust pipe is 14 inches in diameter, and a Keiley back-pressure valve is placed in this pipe outside the heater. The maximum back pressure maintained is 3 pounds, and as before explained, all or a portion of the exhaust steam may be diverted to the heating system. A Keiley grease extractor is also placed in connection with the heating system.



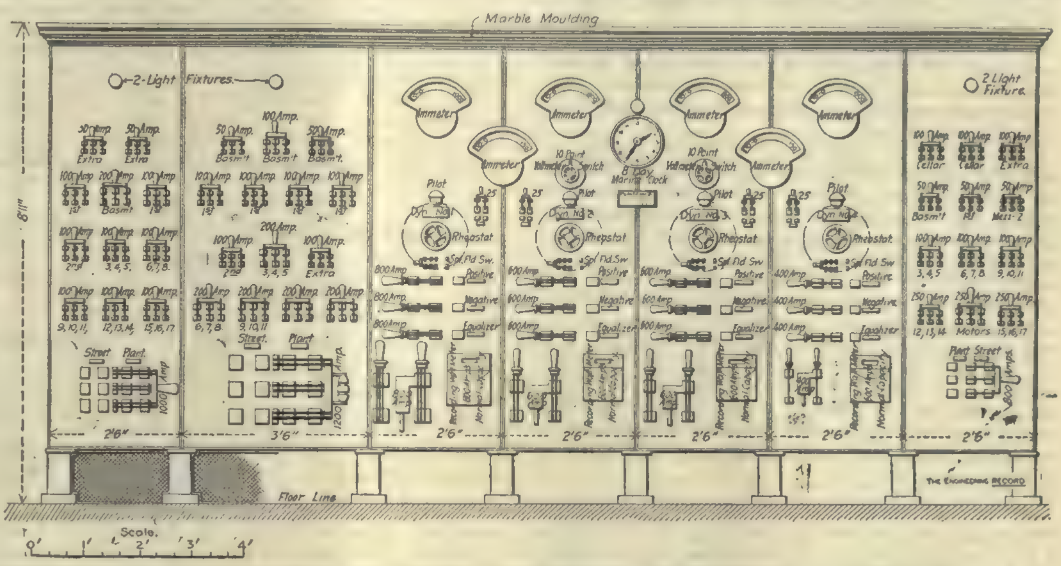
METHOD OF SHUNT CONTROL.

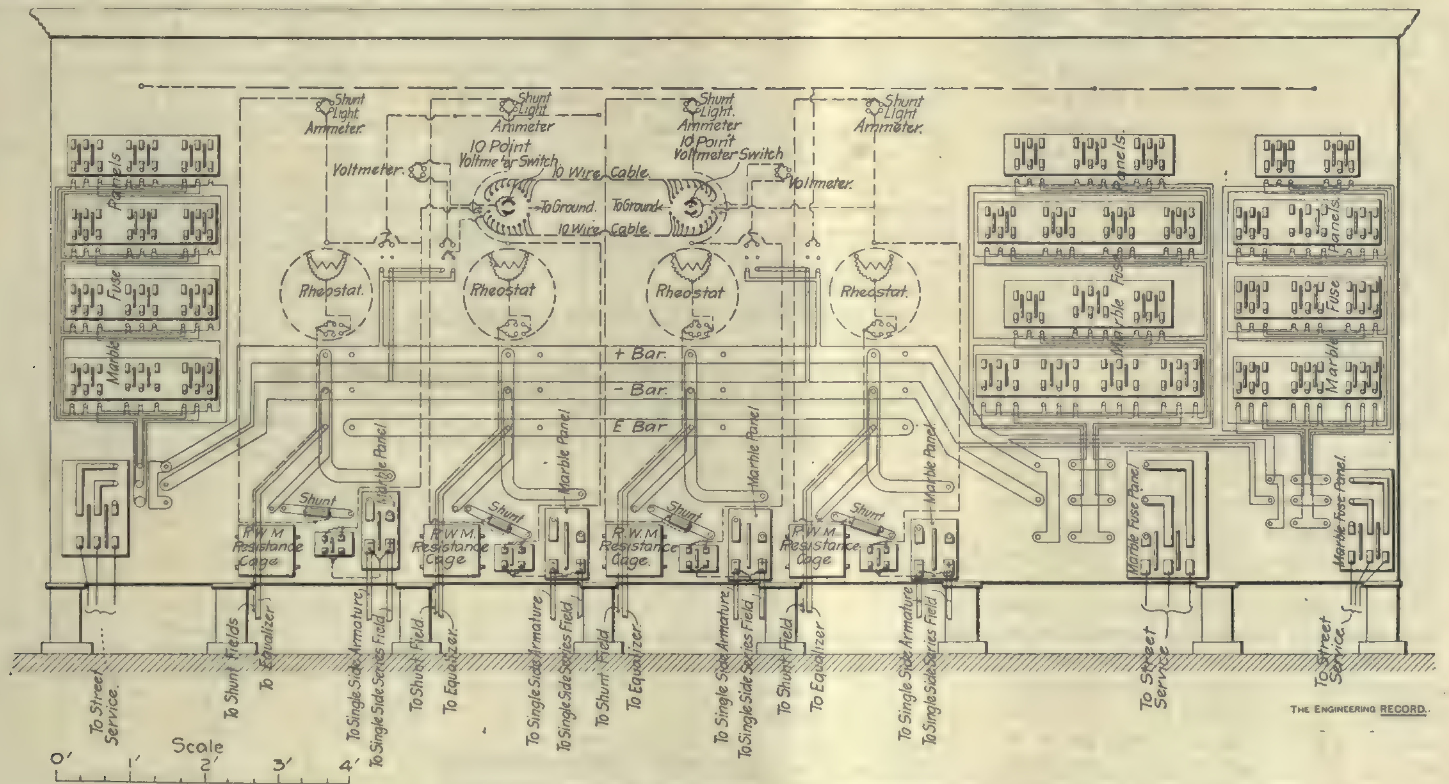
There are two main elevator pumps of the Worthington compound duplex type, with cylinders 16 and 29 x 13 x 18 inches. These pumps discharge into two auxiliary tanks located on the engine room floor, each 5 feet in diameter and 6 feet long. These tanks are connected with the main tank, which is located on the roof, by a 12-inch pipe. The main tank is 6 feet in diameter and 25 feet long. There are six elevators, erected by the Otis Elevator Co. They are of the vertical cylinder type, ratio 6:1 and speed 650 feet per minute. The hydraulic pressure carried in the elevator cylinders is 160 pounds per square inch. In addition to the main pump there is an auxiliary pump of the same type, with cylinders 14 and 20 x 10¼ x 10 inches, which is used at nights and on Sundays. A high pressure pump is also provided for the safe lift. The pressure used on the cylinder of the safe lift is 260 pounds per square inch. All the elevator pumps are equipped with the Ford governor.

A Barr duplex fire pump, with cylinders 14 and 10¼ x 10 inches, is located in the engine room. The suction pipe on this pump is so connected that water may be drawn direct from the street main, or from a sheet steel tank 8 x 8 x 8 feet in size, with a capacity of 2,400 gallons, located in the engine room. The discharge leads to two 6-inch stand pipes running through the entire height of the building, and connected at the top with a tank on the roof 8 x 8 x 15 feet in size, which is ordinarily used as a storage tank for house purposes. The two stand pipes have connections on the outside of the building, so that fire-engines may couple up direct to them and pump through them. A Barr duplex pump 10 and 7 x 10 inches is used for house purposes. There is also installed in the engine room a refrigerating plant erected by the Isbell-Porter Co., of Newark, which is used to supply iced water to the building. This is of the absorption type, and provides for utilizing exhaust steam and delivering the circulating water to the hot-water plumbing system.

The electric plant is designed to light the entire building, and also to drive several small motors operating ventilating fans. The first and second floors of the building are heated by indirect radiation, whereas throughout the remainder of the structure direct radiation is used. The motors are belted to Sturtevant fans used for the heating system on the two lower floors in the winter, and for ventilating these floors in the summer.

The generators, as before mentioned, are of the General Electric type, and of the sizes already given. They are direct connected to and mounted on the same bed with the engines. The engines and generators are set on hard brick foundations, with white enameled brick facing.





FRONT AND BACK VIEWS OF SWITCHBOARD.

The terminal conductors on the generators are a flexible cable, and are carried to white Italian marble terminal blocks, fastened to the generator. Mounted on each of these blocks is a marine-type circuit breaker and suitable clamps for connecting generators to switchboard. An arrangement whereby the shunt field of each generator may be controlled independently by two wires running to a separate switch on the generator panel of the switchboard is shown on the accompanying diagram of the generator connections. The use of this switch makes it possible to completely cut off the generators from the switchboard and is not generally seen. The rheostat for each generator has a capacity sufficient to reduce the voltage from 125 to 50 volts, and is so constructed as to control the voltage by half volt divisions between the limit of 110 and 125 volts. The voltage carried is 120. The following are some of the most important clauses taken from the generator specifications:

Compounding and Outfit.—The winding of generators shall be done in such a way as to prevent any falling in the voltage as the load increases, the brushes being at all times on the neutral point. The generators shall be compound wound and over compounded. The manufacturer shall figure the windings, etc., in such a manner that the following results may be obtained: For the 50-kilowatt machine, 0 amperes, 120 volts; 416.6 amperes, 122 volts; for the 75-kilowatt machines, 0 amperes, 120 volts; 625 amperes, 122 volts; for the 100-kilowatt machine, 0 amperes, 120 volts; 833 amperes, 122 volts.

He must base his efficiency, etc., upon an output of 416.6 amperes at 120 volts for the 50-kilowatt machine, 625 amperes at 120 volts for the 75-kilowatt machines, and 833.3 amperes at 120 volts for the 100-kilowatt machine, all and both measurements being taken by instruments being inserted in the circuit where connections are made to the apparatus and terminals on the white Italian marble panels.

The manufacturer is also to make allowance in his over-compounding for a 1 per cent. variation in the speed of the engine from full load to no load, or vice versa. The above generators to run in conjunction with the engines; . . . and shall maintain their voltage practically constant after a ten-hour run at full load. It is understood that the above generators will be connected to lights, motors and elevators, and the demand on their output will be severe and varied, and they shall be built accordingly.

Insulation.—The insulation to be everywhere of the highest quality and to show an insulation resistance of not less than one megohm on any of the generator circuits either hot or cold, and to be capable of standing a pressure of 1,200 volts alternating current without any injurious results to the insulation.

Operation.—To be capable of working in parallel, and when so working each generator must take its proper share and proportion of the load automatically.

Sparking.—The generators to be capable of operating from no load to 125 per cent. of the full-rated capacity without any sparking at the brushes whatever and without moving the brushes; and to be capable of taking momentarily 75 per cent. overload without undue flashing, and to be capable of operating without flashing when current is quickly opened or closed on the specified 25 per cent. overload.

Noiselessness.—The generators must run noiselessly and must be free from humming or hissing noises at the commutator, brushes, pole pieces, or elsewhere.

Temperatures.—During the trial run hereinafter specified, a temperature test will be made in the following way: Each generator shall be run six hours with its full specified load, and immediately on the termination of the above sixth hour a 25 per cent. overload shall be placed on the generator for two hours. Immediately on the termination of the above-mentioned eight-hour run the temperature will be taken in the usual way. The rise in the temperatures at the expiration of the above eight-hour run of each machine shall be as follows: Forty-five degrees Centigrade on armature and fields; 60 degrees Centigrade on commutator, above the surrounding atmosphere. In case the surrounding atmosphere as described below exceeds

25 degrees Centigrade, the rises in temperature will be corrected by ½ per cent. for each degree the surrounding atmosphere exceeds 25 degrees Centigrade. The atmospheric temperature to be an average taken from four thermometers placed not over 5 feet away from and on four sides of the generator.

Efficiency.—The commercial efficiencies at various loads will be determined upon the assumption that the friction of the engines as shown by the friction card remains constant throughout the entire range of loads specified.

The following efficiencies figured on the above and hereinbefore mentioned basis will be insisted upon:

	Full load.	¾ load.	½ load.
50-kilowatt machine, per cent.	91	89	88¼
75-kilowatt machine, per cent.	92	90½	90
100-kilowatt machine, per cent.	93	91	90

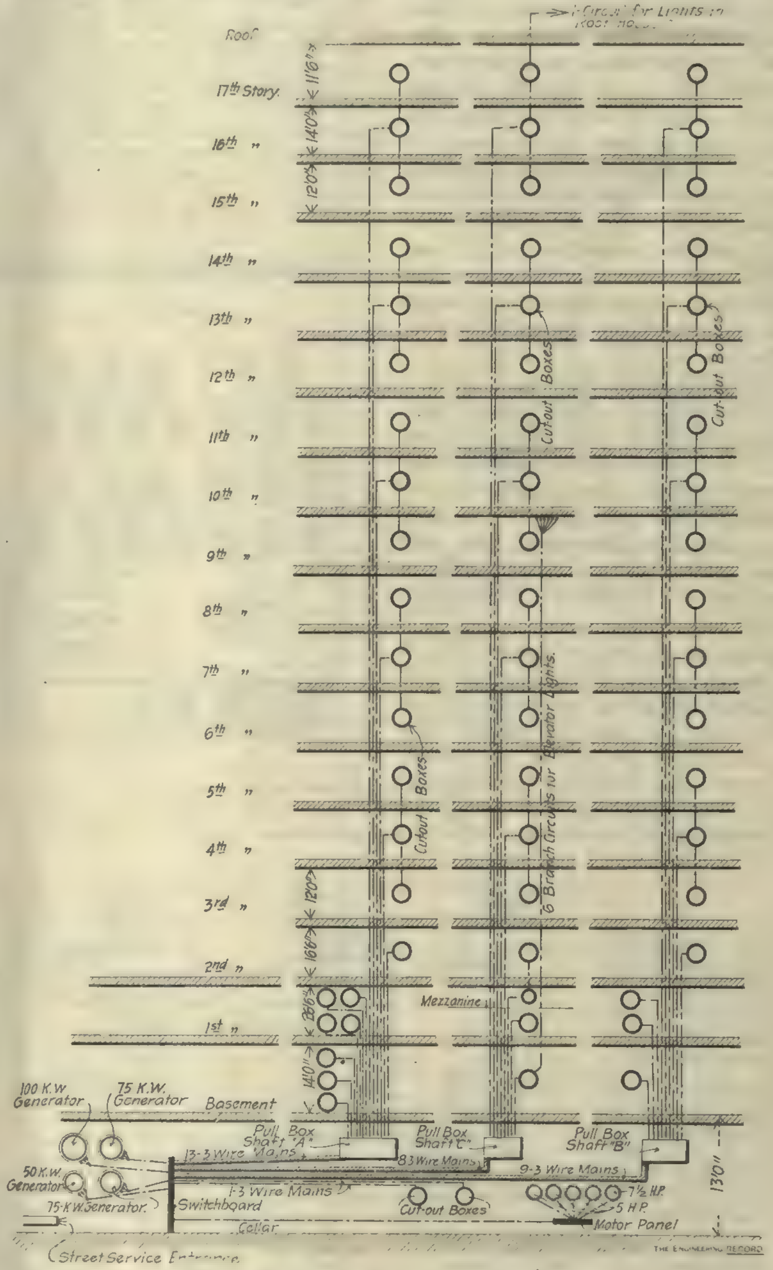
Copies of the factory test records of each generator must be submitted to the architects before final acceptance. These records must show the horse-power required to drive the generators under the various loads.

Guarantee.—Any part found defective during a period of one year from the date of acceptance of the plant shall be promptly replaced by this contractor. If, after 60 days' trial, the generators do not fully meet the requirements of the specifications, in the judgment of the architects, the contractor shall at once and at his own expense remove them and supply others that do, and if, after notice of ten days, he fails to do so, the owner may remove them at this contractor's expense.

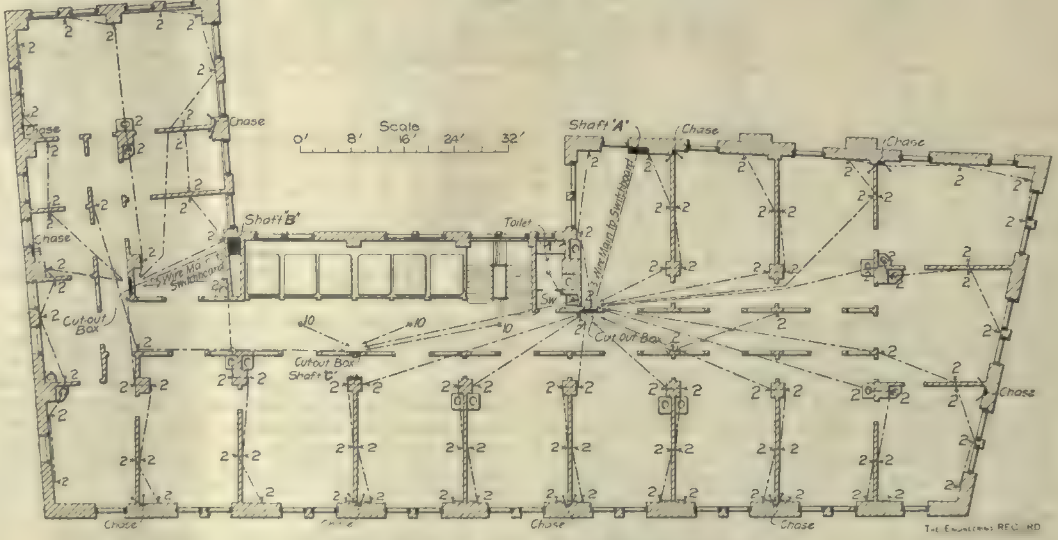
In addition to the foregoing clauses, the specifications have special clauses relating to the field coils, commutators, brushes, brush-holders, setting, templates and fittings, and the general clause regarding delivery and responsibility up to the time of acceptance, etc.

From the terminal block of the generators, the mains are carried under the floor to the rear of the switchboard in lead-covered cables laid in a wooden trough filled with asphalt. There are four generator panels on the switchboard, one for each machine, and the mains from the respective generators are connected with a circuit breaker of proper capacity at the lower left hand corner of each panel. In addition to the four generator panels, there are three feeder panels, as shown. The distributing system is divided into three parts. One feeder panel takes care of all circuits on the Wall street side of the building, which are carried up through Shaft "A" (location shown in the accompanying plans). A second panel is used for all the circuits on the opposite side of the building (Shaft "B"). The third panel, to the right in the accompanying cut, controls all the circuits for public lighting in the hall, lavatories, elevators, etc., carried up through Shaft "C."

The switchboard is constructed of the very best quality of genuine 2-inch "C. F." grade of white Italian marble, mounted on angle-iron frames in the usual manner. The specifications for the marble require that it shall be free from any foreign substance which might cause a leakage of current, and requires an insulation resistance between all conductors, when connected up in parallel, of at least 2 megohms. The back of the marble is painted with a high grade of insulating and water-proofing paint. The busbars, switches and connections on the switchboard are figured on the basis of 750 amperes per square inch of sectional area, and 100 amperes per square inch for busbar and nut contact surfaces. The sliding contacts are figured on the basis of 50 amperes per square inch of sectional area. All busbars, connections and switches are made of pure drawn copper (not cold rolled or sawed copper). All the switches are fitted with safety fuse holders, which are mounted on marble panels on the back of the board. The busbars and connections on the back of the board are plainly shown in the accompanying diagram. Each of the generating panels is fitted with the following instruments: One Empire ammeter; three single-pole double-throw switches; one Victor circuit-breaker; one Thompson recording wattmeter; one pilot lamp; one special field switch; one rheostat.



SCHEME OF WIRING TO DIFFERENT FLOORS.



TYPICAL WIRING DIAGRAM FOR UPPER FLOORS.

There are two voltmeters on the board, one being used as a reserve meter. With the voltmeters are installed two ten-point voltmeter switches mounted on the back of the board. They are so connected that readings may be obtained of the pressure of each of the generators, of the light busbars, of the negative light bars to ground, and of the positive light bars to ground.

Double-throw switches are used on the busbar connections for the purpose of having support for the blades when the switches are open. Each feeder panel is equipped with triple-pole single-throw switches controlling the various circuits, as shown on the cut of the switchboard, and also with a triple-pole double-throw switch, by means of which the various circuits may be thrown either upon the street service, should that ever be used, or on the plant.

The several motors are controlled from a separate panel, located as shown on the general plan of the engine room. From the main motor switch, located on the feeder panel at the right of the switchboard, as shown, a three-wire main is run under the floor to the motor panel, each of the three wires being 200,000 circular mils in cross section. On the motor panel are six switches, one for each motor, and one main switch.

The building is wired for approximately 7,300 lights, which would require a total of about 450 kilowatts capacity of generators, if all the lights were used at one and the same time. The capacity of the generators installed is 300 kilowatts, or about 65 per cent. of the total required, as it is assumed that a condition will seldom or never exist when all of the lights will be in service at one time. All the lighting wires are carried from the switchboard to the three shafts mentioned in armored conduit, laid in creosoted wood troughs filled with asphalt under the floor of the engine room. The wires are carried up these shafts to the cut-out boxes, or centers of distribution, on the various floors. (See elevation plan of wiring.) There are a total of 63 centers of distribution, as shown. All the feeders, sub-feeders, mains and sub-mains are installed on the three to two-wire system. The negative conductor has a carrying capacity equal to the capacity of the two outside or positive wires. In other words, three conductors are used instead of two, one being negative and the remaining two positive, and the various branches are connected across between the negative, and each of the positive wires so as to balance the load on each of the positive wires. This system was installed to accommodate the 240-volt street service, should that supply ever be desired or required. All the branches are installed on the two-wire system, and all circuits are connected at the central distributing point, as shown on the typical wiring plan, and there connected with double-pole switches and cut-outs. All wires are run in loricated armored conduits, and all the ends of the tubes are provided with suitable outlet bushings.

Some of the most important points covered in the specifications are as follows:

Loss of Potential.—The loss of potential shall be computed on the two-wire system, 120 volts, 3.1 watts per candle-power, and 1,000 watts per mechanical horse-power. The system of feeding is explained on the plans, and the contractor must verify all measurements at the building, and submit the result with the sizes and lengths of the conductors he intends using, to the architects for their approval.

The conductors shall be so calculated and proportioned that if all the lights and motors herein specified, or shown on the plans, were burning and running, the loss of pressure between the wire terminals of the generator feeders on the switchboard in the cellar, and any outlet in the building, shall not exceed 5 volts, of which not more than 3 volts may be allowed on the feeders and 2 volts on the branches. That is to say, that with a pressure of 122 volts on the above-mentioned terminals, the pressure on any panel board or other meter in the building when under full load shall not be less than 119 volts, and the difference between any two outlets in the building shall not exceed 3 volts.

Character of Insulation.—For all wiring to be installed the best grade of braided Okonite Habershaw Red Core, Grimshaw White Core or Bishop Gutta Percha insulated wire, as directed and approved by the architect, shall be used. All copper used throughout should be not less than 96 per cent. conductivity. For branches a parallel duplex wire shall be used. This wire shall be formed of two completely insulated wires, insulated as above specified, and braided together. The rubber on any of the above wires shall be extra heavy and of finest quality. For all feeders, sub-feeders, mains, sub-mains, etc., use three separate double-braided flexible wires, insulated as above specified.

All cables, wires, etc., through the entire installation which are larger than No. 10 B. & S. gauge shall be flexible and constructed in the following manner: No. 2 B. & S. gauge, and over in size, to be made up of strands of No. 18 B. & S. gauge or smaller. No. 3 B. & S. gauge, and under in size, to be made up of strands of No. 21 B. & S. gauge or smaller. All wires larger than No. 10 B. & S. gauge shall be stranded. No wire smaller than No. 14 B. & S. gauge shall be used. Use wire of such size that in no case shall the current to be carried exceed the lowest limit prescribed by the New York Board of Fire Underwriters or the Fire Department. Under no circumstances will joints or splicing of wires be allowed.

Contractor must submit samples of all sizes of wires he proposes to use, for approval before installing same, and all wires used must be like the approved samples in the architect's office, or they will be rejected and ordered to be replaced at the contractor's expense.

Insulation Resistance.—There must be an insulation resistance between conductors and between all conductors and the ground, of not less than 50,000 ohms. This includes all attachments, etc., except lighting fixtures. When these fixtures are all connected to the wiring, the resistance must not drop below 30,000 ohms. The insulation resistance, as above stated, for any one floor, on any one circuit which leads to switchboard, shall not be less than 300,000 ohms and 250,000 ohms, respectively.

Detailed specifications are also given for the switches, connections of fixtures, cut-out boxes, cut-out panels and other details of the wiring system.

The Definition of a Running Underground Stream.

An interesting suit between the Deadwood Central Railroad Company and John Barker has recently been decided by the Supreme Court of South Dakota, 86 N. W. Rep. 619, in which the definition of a running underground stream was the main point at issue. The company owned a lot in Deadwood and Barker owned the adjoining lot. In 1877 a prospecting tunnel was run from the former a short distance into the latter lot. At or near the tunnel's face water was encountered, which ran to the mouth of the tunnel and has been piped since 1890 to the company's reservoir. Two years ago Barker entered the tunnel and excavated from a point about 30 feet from its face a branch tunnel about 30 feet long extending a few feet into his own ground and there encountered the same flow of water. Afterward he constructed a sump on his own ground, substantially cutting off the supply at the face of the main tunnel, and was preparing to pump the water to the surface of his lot when the company brought this suit.

It was not disputed that the water in the old and branch tunnels was encountered within the lines of Barker's lot. The mouth of the tunnel is in a gulch from which the land rises in the direction of the tunnel. At the point where Barker's shaft was sunk the tunnels are 30 feet or more below the surface, and from that point the land continues to rise for a considerable distance. The company's lot is lower than the other.

The State statute on the ownership of water reads as follows: "The owner of the land owns water standing thereon, or flowing over or under its surface, but not forming a definite stream. Water running in a definite stream, formed by nature over or under the surface, may be used by him as long as it remains there; but he may not prevent the natural flow of the stream, or of the natural spring from which it commences its definite course, nor pursue nor pollute the same." In deciding the interpretation of this law, the court referred to the following decision of the California Supreme Court in Hanson v. McCue: "It (the percolating water) exists there free from the usufructuary right of others, which is to be respected by the owner of an estate through which a defined stream of water is found to flow. The owner may appropriate the percolations and filtrations as he may choose, and turn them to profit if he can. To hold otherwise would be to hold that the plaintiff here could lawfully claim a right to convert the lot of McCue into a mere filter for his own convenience. 'Such a claim,' said the Supreme Court of Pennsylvania in Wheatley v. Baugh, 'if sustained, would amount to a total abrogation of the right of property. No man could dig a cellar or a well or build a house on his own land because these operations necessarily interrupt the filtrations through the earth. Nor could he cut down the forest or clear his land for the purpose of husbandry, because the evaporation which would be caused by exposing the soil to the sun and air would inevitably diminish to some extent the supply of water which would otherwise filter through it.'" It is evident, therefore, that in this case it was necessary to decide whether or no, in the light of the law, the stream running out of the old mining tunnel and intercepted by the branch tunnel was percolating water.

One of the prospectors who drove the original tunnel testified that the water came in mainly from the bottom, through the gravel on the bedrock, and four more witnesses gave the same testimony. On the other hand, J. R. Hickox, a civil engineer, stated that after baling out Barker's sump, thus lowering the water below the top of the bedrock, a large stream of water was found coming in at one corner and a smaller one near by. Practically all the water was entering along a distance of 2 feet, and the quantity was about the same as flowed out. The water was coming in a stream through the gravel; there was no crevice in the rock and the flow was plainly on the surface of the bedrock in the gravel. The value of this testimony is settled as follows: "That these waters run in any well-defined channel, with well-defined banks, does not seem to be established by the evidence. But the evidence would seem to establish the fact that percolating or seeping waters accumulated at that point (the sump), and were uncovered or encountered at the face of the tunnel, and were detained there by the sump sunk by the defendant on his own ground. Underground streams of water, having defined banks, spoken of by the text-books and decisions, refer mainly to streams of water in the arid regions, which flow partly on and partly beneath the surface, but always in a well-defined channel and within well-defined banks. To hold, therefore, that water found in gravel, on or just above bedrock, with no fissure in the bedrock, and no well-defined banks, and which has not been traced beyond the point where it appears in the tunnel, constitutes a running stream, within the meaning of our statute and decisions, would be to establish a very dangerous doctrine, as affecting the rights of property owners, and would have a tendency to abrogate the well-established doctrine that the owner of land owns all within its boundary lines, extending downward and upward."

The Ground Water Supply of Chemnitz, Germany.

Among the many interesting works for supplying water to German cities there is probably none more novel to American visitors than the older portion of the works of Chemnitz, utilizing and reinforcing the ground-water of a brook called the Zwönitz. The only plant that resembles it in this country is that at White Plains, N. Y., described in The Engineering Record of August 25, 1900, and the points of similarity are few.

The tract on which the works are situated has an area of about 74 acres, extending for a distance of about 4,900 feet along one bank of the brook. The valley is underlaid by a stratum of shale and other impervious material, which supports a bed of water-bearing gravel and sand 6 to 10 feet thick. The top covering is a layer of sandy earth 1½ to 4½ feet thick. To husband the water in the gravel, the tract has been divided into four basins by means of three underground dams of clay puddle, running entirely across the collecting area on lines normal to the flow of the percolating water. The supply thus obtained is developed by 50 wells and 6,170 feet of earthenware drain pipe from 8 to 10 inches in diameter. These wells are connected with four collecting wells, which are connected in turn with a pumping station at the middle of the tract. The wells are about 130 feet from the brook and from 115 to 130 feet apart. They are built of concrete or brickwork and are 5 to 6½ feet in diameter at the bottom and 2 feet at the top; they are carried down until the impervious stratum is reached, and resemble a sewer manhole in vertical section, although the impervious stratum to which the walls are sunk acts as a substitute for the concrete bottom of the sewer manhole. The drain pipes are laid through the walls and rest directly on the impervious bed.

As the natural yield of ground water eventually failed to satisfy the draft on the works, attention was paid to an artificial increase in the amount by diverting a part of the brook to the neighborhood of the wells, where it sank into the ground. For this purpose a so-called filter canal was constructed, an open ditch running the length of the collecting area. It is excavated to the pervious gravel stratum, and has a width of about 13 feet and side slopes of 1 : 1½ and 1 : 1. The bottom of the slopes are faced with concrete to an elevation of about 20 inches above the bottom, and then with a riprap pavement. The bottom is covered to a depth of 12 to 18 inches with washed filter sand. The ditch is divided into several sections by gates, each section fed with water from the Zwönitz. The supply is clarified in a basin which is filled from the brook by gravity during high water and by pumping at other times. It flows into the ditch through aerating stairs of wood. During the winter other means of aeration are employed, placed in enclosed towers to which the water is pumped. Here it passes through beds of coke in sheet-metal vats 8¼ feet in diameter, placed one above another, a process which is stated to remove odor as well as aerate the water.

In addition to all these means of increasing the ground water, the entire tract about the canal and wells is irrigated with water from the brook. A marked pollution of the Zwönitz above this source of supply is caused by the discharge into the brook of the waste liquors of a paper mill. This did not disappear even after a purification plant was installed at the mill, and irrigation was accordingly taken up. The supply is collected in settling basins, which afford a reserve for periods of particularly bad water and for night drafts, and it is from these basins that the water is drawn for distribution over the land. The open distributing channels have just been faced with slabs of cement to prevent the burrowing of field animals. The water not utilized on the land finally flows down aerating steps into the filter canal.

The sand in the filter gallery is washed in a sort of portable cradle washer like that used in placer mining, and is operated by an impact-wheel driven by pressure water from the pumping plant. About a cubic yard of sand per hour can be washed in this apparatus with the help of three laborers.

These works, planned by Prof. Kaukelwitz, were built in 1871-74, and were extended many times. They eventually furnished daily from 1,300,000 to 1,600,000 gallons of ground water and 1,000,000 to 1,300,000 gallons of filtered brook water. About ten years ago the draft approached so nearly the supply from this plant that an 87,000,000 gallon reservoir covering nearly 10 acres was constructed farther up the Zwönitz at Einsiedeln to impound a surface-water supply from a catchment area of 1.04 square miles. The dam of this reservoir is a remarkably attractive masonry structure which, with the filter and other houses just below it, in no way detract from the natural attractiveness of the locality. An illustration of the dam was printed in the "Wochenschrift" of the Austrian Public Works for August 3, from which these notes are taken.

The masonry dam has a triangular cross-section and is founded on shale. It rises 67 feet above the natural ground surface and descends 24½ feet below it. It is 13 feet thick at the top, 47 feet at the surface of the ground and 65½ at its lowest level. It is curved in plan to a radius of 1,310 feet, and is 590 feet long. The masonry is heavy rubble concrete, with clay and mica shale for the hearting stone and more resisting quartzite and hornblende shale for the faces. The mortar was made of 1 part cement, ½ part lime and 5 parts sand; the mortar formed a third of the 30,800 cubic yards of masonry in the structure. As a waterproofing for the upper face, 12 inches of concrete with a cement-plaster finish was placed over the surface below the ground level, and a heavy cement-plaster coat with patent waterproofing finish was put on above the ground level. The coping of the dam is of brickwork, corbelled out from the face by arches, and two brick towers rise from the crest near the ends.

The waste-weir is at one side of the dam and is 82 feet long. It is fitted with stop planks 20 inches high; when these are removed its crest is 6½ feet below the top of the dam. The spillway from the weir is 28 feet wide and has several drops of 3 to 16 feet. It is partly in rock excavation and partly formed by a channel wall.

An Automobile Street Sweeper was recently tested in Hartford, Conn. It runs on four rubber-tired wheels and is fitted with a boiler, a 12-H. P. engine for propulsion and one of 6 horse-power for driving the brush. The latter is 6 feet in diameter and 7 feet long and revolves under a hood at the back of the frame. The brush sweeps the dirt into a box holding a ton, into which the exhaust steam is turned to dampen the refuse. The machine was designed by Mr. T. C. Collins, and is controlled by the Hartford Motor Machine Company.

Oil Furnaces for Heating Rivets are largely used on Section No. 3 of the New York Rapid Transit Railway, where Holbrook, Cabot & Daly are the sub-contractors. These furnaces are operated by one man, and each can supply as many as six riveting hammers when all are working on the same size rivets, so that under the conditions of this work their capacity is practically limited only by the distance to which the hot rivets can be passed, about 100 feet. The furnace consists of a small steel chamber, lined with fire-brick and open at both ends. At the rear end is a nozzle through which the supply of fuel oil is forced from the supply barrel on which the furnace is set. Two flexible hose connections are made to the compressed-air main running along the work; one of them provides pressure on top of the oil in the barrel to force it through the nozzle, and the other is brought to the jet to atomize it. The air and oil connections to the nozzle are made with steel pipes with throttle valves, by which the flame is controlled. Each furnace burns a half barrel of oil a day, which costs at wholesale $2.50 a barrel at the refinery. The furnaces are made by the Rockwell Engineering Company, New York.

The Cost and Durability of Brick Pavements in Ithaca.

Abstract of a paper presented to the League of American Municipalities by Prof. C. L. Crandall, Cornell University.

In March, 1892, an amendment to the charter of Ithaca, N. Y., was passed to allow the City Council to add to the general tax budget each year for ten years any sum up to $20,000 for permanent street improvements. This amount was to be kept as a separate fund and turned over to a pavement commission of five members. This commission was given full charge of the expenditure of the funds, both as to the streets to be improved and the character of the work. One-third the cost was to be assessed on the abutting property on each side, leaving one-third of the expense on the blocks and all the cost at the intersections to be paid from this fund. The abutting owner could pay the full assessment at once, or in five equal instalments, each payment after the first including all interest due. In the latter case the Common Council could issue bonds for the amounts due, and the funds obtained from their sale were to be turned over to the Commission. Under this act about $390,000 will have been invested by the close of the current fiscal year in macadam, Medina sandstone and brick pavements, mainly the last.

With the exception of one block, in 1896, where the sand and brick were laid directly on a regraded macadam roadway, all the brick have been laid on a 6-inch concrete base covered with a 2-inch sand cushion.

The requirements for concrete have been Rosendale cement, mixed dry, one to two, with clean, sharp sand, then wet and the broken stone added without gravel or stone dust. The original specifications allowed five parts of broken stone to be added to one of the cement and mortar; this was afterward changed to four parts, again to two, and finally to an amount no greater than could be used and have the mortar fill the voids.

The earth bed is required to be rolled with a 10-ton roller before placing the concrete, and any filling is to be made in 6-inch layers and each rolled. The contractor has the use of the city steam roller at a nominal cost above running expenses.

The curbing is required to be of Medina sandstone, 20 inches deep and 5 inches thick; dressed 10 inches on the face (afterward changed to 12 inches); 10 inches deep in the joints; the length to be at least 36 inches; each stone to be backed with 6 inches of gravel when set.

The 1892 specifications called for the joints to be filled with pitch. This was changed to sand in 1893, after a portion of the year's work had been completed, and a reduction in cost of about 10 cents per square yard effected for the remainder.

A one-year guarantee has been required, and 10 per cent. retained for the period in order to make good any defective material or workmanship should the contractor fail to do so after due notice.

Rattler, cross-breaking, crushing and absorbtion tests of the various sample brick have been made from time to time, but only a few of the results are obtainable from the records of the commission.

In the later contracts there has been a clause requiring the employment of local labor so far as it could be obtained at 15 cents an hour, but this year the requirement was made without regard to price. Under the recent contracts the money collected from frontage assessments does not become due the contractor until the collection has been actually made or the money raised from the sale of bonds. It may thus be several years after the work is completed before the contractor receives full pay for it.

The Ithaca people believe in wide roadways; 30 and 36 feet between curbs are the standards, with some as wide as 42 feet. The crown is from 6 to 8 inches above the gutter and the cross section a circular arc.

The population of the city, as shown by the last census, is about 13,000. The business portion centers about the two blocks of State Street between Cayuga and Aurora Streets. The principal railway depots are about a mile away, and they are connected by three brick-paved streets, Buffalo, Seneca and Green, and by State Street, which has an electric railway and is paved with both brick and Medina sandstone. Probably over one-half of the traffic from the depots and the country to the north and northwest reaches the business center by Seneca Street. A considerable portion crosses over to State on Cayuga Street, leaving the Seneca Street traffic lighter beyond the crossing than on the depot side if it. Cayuga Street extends north and south at right angle to Seneca and connects at one end with the leading approach from the country to the south and at the other with that from the north and northeast. It is also an important business street. The heaviest traffic in the city is believed to be in the vicinity of the intersection of State and Cayuga Streets.

In order to obtain some idea of this traffic a record was kept on the U. S. Roads Inquiry system, of all the teams passing on Seneca Street east of Cayuga (i. e., on the lighter-traveled part away from the depot), on Cayuga between Seneca and State, and on State east of Cayuga, from 5 A.M., hour by hour, until 10 P.M., for seven successive days beginning July 25, 1901. The table shows the average daily result.

The Cayuga Street block, between Seneca and State, was paved in 1892 with repressed brick "A" and it has thus been in use about nine years.

Average Daily Traffic on Three Ithaca Streets.

	Seneca.	Cayuga.	State.
Loaded one-horse wagon.....	95	231	290
Unloaded one-horse wagon..	53	97	108
Loaded two-horse wagon....	56	77	79
Unloaded two-horse wagon..	88	72	57
Unloaded four-horse wagon.	...	1	1
One-horse pleasure vehicle..	156	277	266
Two-horse pleasure vehicle..	23	54	61
Rubber-tired vehicle..........	18	39	25
Unharnessed horse or shod ox	4	6	5
Excessively heavy vehicle...	47	82	32
Total	550	886	924

The average daily traffic has probably been less than that recorded in the table. The chipping of the corners and the local settlement are both small. There were 22 brick with broken corners noticed in walking along the center of the roadway for a distance of 200 feet. Some 5 per cent. of the brick have considerable top wear, with a few depressions cut from 1/8 to 3/4 inch deep. The joints along the central portion average about 1/2 inch. The pavement is about half worn out.

The adjacent blocks on Cayuga Street, both

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXII, PRAGUE, CARLS BRIDGE.

This view gives one of the tower gateways; another is located at the other end. It was not until 1866 that the walls and bastions of which these gates formed a part were torn down, although their military usefulness had long before disappeared.

north and south, were paved in 1893 with the same brand of brick but with sand rather than asphalt joints, except for a portion of the adjacent block on the south. The portion to the north has larger joints, more local settlement, and more chipped and broken brick, but less top wear. On the first 200 feet there were some 50 brick broken in the center. On the first block south there were but few broken or chipped brick, the surface was fairly smooth, the wear small and the local settlement not great. The traffic is probably less than on the block between State and Seneca, but greater than on the block north of Seneca. The pavement is not half worn.

Two other blocks were paved in 1892 by the same contractors with the same brand of brick, both at the limit of the business center and on thoroughfares to the country. Both have been disturbed considerably in laying sewer and water pipes, but are in better condition than the State-Seneca block on Cayuga Street.

In 1894 Seneca Street was paved from Aurora to Plain, under a contract for "B" brick, which was subsequently modified to allow of the purchase of other brands in part. On the block having the daily traffic of 550 there were 80 broken brick noticed in walking once over the block a distance of 530 feet. The tops were worn in places 1/3 to 1/2 inch deep, making general depressions as well as local ones, and a rough street in sections. There were considerable local settlements. On the block to the east of this the top wear on the soft brick is from ½ to ¾ inch, while there are holes 2 inches deep due to wear and settlement. The brick are not badly broken. The joints on both these blocks are small. It is believed that the first block, Cayuga-Tioga, is over one-half worn out, and that the second block, Tioga-Aurora, is about two-thirds worn out. On the portion west of Cayuga Street, extending to Plain, it is believed that the pavement is not quite half worn out.

In 1895, paving blocks "C," showing 3 x 9 inches, with rounded corners, were laid on two blocks, and in 1896 similar blocks showing 8 x 3½ inches, were laid on several blocks. They are giving good service except that broken ends are quite noticeable in riding over the streets.

The brick laid in 1896 on a regraded macadam roadbed without concrete is preserving as good surface, so far as settlement and wear are concerned, as any of the brick pavements.

Some of the standing places for horses show serious chipping of the corners of the brick, making wide joints with but little top wear.

A portion of the brick laid in 1892 was on a 10 per cent. grade. This was quite slippery at first, but complaint soon ceased. Grades of about 9 per cent. are used on a pavement laid in 1899 on a street receiving most of the heavy teaming to Cornell University.

In closing it may be said:

The experience with brick paving in Ithaca extends over a period of 9 years. During that time the cost of concrete, sand and brick in place has been gradually reduced from $2.44 per square yard in 1892 to $1.43 in 1901, not including the salary list and general expenses. The total cost, outside of the general expenses estimated by the commission for several consecutive years at 30 cents per lineal foot of street, has been reduced from $2.65 in 1892 to $1.53 in 1899. The price for the bulk of the work in 1899 was higher on account of heavy rock excavation and a slight rise in the price of brick, and in 1900 on account of the work being done by the city. These reductions in cost have been effected under practically the same specifications, with the exception of the pitch joints.

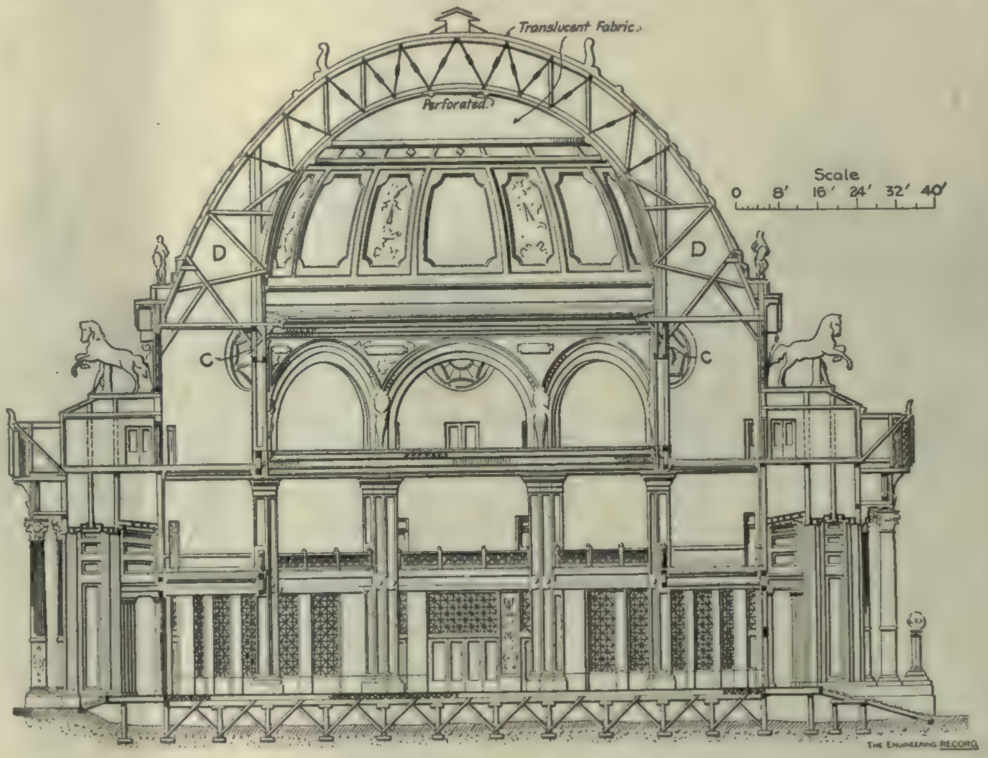
On the heaviest-traveled streets in a town of 13,000 inhabitants, only a small proportion of the pavement is half worn out after 7 to 9 years' service.

Good results have been obtained with regraded macadam without concrete.

Brick can be used on grades up to 9 per cent. without difficulty except in frosty or icy weather.

The Ethnology Building at the Pan-American Exposition.

The Ethnology Building at the Pan-American Exposition is a circular wooden structure about 140 feet in height and 150 feet in diameter, located on the north side of the Esplanade, east of the Court of the Fountains, as indicated on the plan published in The Engineering Record of July 21, 1900. On the north, south, east and west there are entrance extensions making rectangular projections about 18 x 52 feet in plan, which have an arched door flanked by pairs of columns and surmounted by a pediment. Over the pediment there is a large group of sculpture with an inscribed panel each side. Between the entrances there is an outside colonnade about 40 feet high carrying a circular cornice at the level of the pediment. Above this there is a row of statuary behind which the circular wall, about 120 feet in diameter, rises 30 feet to the springing line of the roof dome, which is 58 feet high. This is relieved by eight deeply-moulded staff ribs which divide it into radial panels ornamented by large sculptured figures and surmounted by an elaborate cornice which forms a crown concealing the upper part of the dome.



Cross-Section of Ethnology Building.

In the interior of the building there are eight 12 x 28-inch columns 110 feet high, at the angles of an octagon inscribed in an 89½-foot circle, between which and the concentric outer wall there are two galleries, one 25 feet and the other about 45 feet above the floor. Inside these columns the building is unobstructed and has a height of 120 feet to the top of the ceilng dome, which springs from a cornice 72 feet above the floor. The ceiling and roof domes are entirely separate and the air space enclosed between them is about 11 feet deep at the top and 22 feet wide at the bottom. The lower part of the ceiling dome is panelled, but the upper part, about 50 feet wide, is covered with translucent fabric to illuminate the interior from the corresponding portion of the roof dome which is covered inside the crown by a transparent fabric. In the center of the ceiling dome there is a 10-foot circular opening covered with a wooden grating to allow ventilation through a louvre in the roof directly above it.

The vertical section curves of the roof and ceiling domes are composed of circular arcs described from different centers and giving the effect of parabolic curves. The principal members of the dome framework are four diametrical trusses which intersect at the center and divide the circumference into eight equal panels. The top and bottom chords of these trusses are arcs of the domes of the roof and ceiling respectively. The top chord makes a small angle with the 8 x 12-inch wall column and is seated on the top of a short vertical timber bolted and keyed to its inner face. The bottom chord is tangent to the interior main post, and is secured to it by horizontal bolts through both members.

Each chord has a 10 x 12-inch cross-section made up of seven 10 x 1¾-inch dressed longleaf yellow pine planks in vertical planes with joints broken 2 feet and bolted together with 1⅛-inch bolts. The interior posts are continued, past the connection to the bottom chords, to the intersection of the top chords, and up to that point the web members of the truss are diagonals composed of pairs of 4 x 12-inch planks bolted on both sides of the chords and bolted to the post. Above the top of the post the web members are square vertical posts and pairs of diagonal rods with upset ends and pin connections. The middle seven panels of the bottom chord are reinforced by a continuous 10 x ½-inch curved steel plate bolted on each side. The chord pins are all 2 inches in diameter and pass through 10 x ½-inch reinforcement plates bolted to each side of each chord.

One truss is made complete with the top and bottom chords continuous across the apex of the dome; the other trusses are made in halves with the upper ends of their chords abutting in the center. The top chords are framed together at the center and are bolted between two horizontal circular steel plates, 1-inch thick and 24 inches in diameter. The bottom chords of one pair of semi-trusses abut squarely against the sides of the bottom chords of the through truss, and in the four corners between the members cast-iron 45-degree angle-blocks are set to receive the square ends of the bottom chords of the other four semi-trusses. Cast-iron shoes are also bolted and gained into the under sides of the lower chords near the ends, and from each one of them a pair of 2⅝-inch tension bolts is screwed up on the inside of a cast-iron ring which is suspended from the center of the dome and has a steel reinforcement tension ring shrunk around it, as shown in the detail of this principal tension joint.

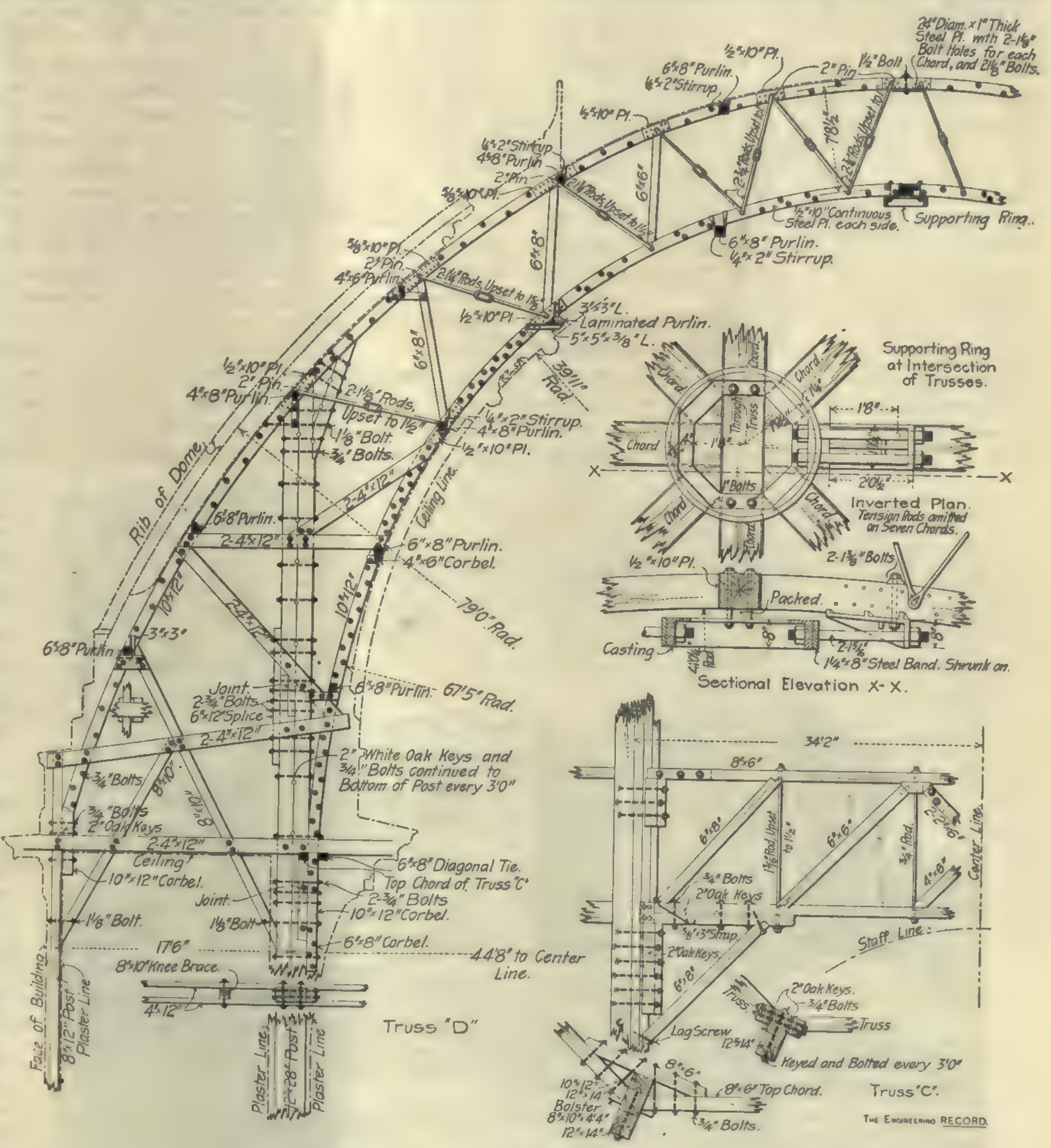
The ceiling purlins are supported by the bottom chords of the trusses. The two lowest ones are straight solid pieces of 6 x 8-inch timber which butt against the vertical faces of the chords and are supported on the upper edges of short horizontal pieces of 4 x 6-inch stuff bolted to the faces of the chords. The next purlin is a 4 x 8-inch piece which intersects the chord on a pin center and is suspended in a 2 x ¼-inch steel stirrup bolted to the truss. The next is a 6 x 8-inch laminated purlin at the fourth panel point from the crown. It has a diameter of about 50 feet, is made up of two 3 x 8-inch planks, and is supported on a pair of 5 x 5 x ⅜-inch horizontal cantilever angles bolted across the lower chord, one on each side. The next and highest ceiling purlin is a straight 6 x 8-inch timber suspended in a double-loop stirrup of twisted 2 x ¼-inch steel which engages the bottom chord of the truss.

For the roof dome there is a purlin at each panel point of the top chord of the truss up to the crown cornice, and all of them are supported on the upper sides of horizontal web members or on bracket pieces bolted to the truss. The 4 x 8-inch crown purlin and the 6 x 8-inch purlin intermediate between that and the apex, are supported in stirrups suspended from the upper surface of the top chord.

The trusses themselves are braced together only by the purlins and the sheathing boards and a 5 x 5-inch horizontal angle ring just outside the laminated purlin, which is supported on the cantilever angle and bolted to short vertical angles on the web members of the trusses. The heavy columns which support their lower chords and practically form vertical continuations of them, are united just below the lower-chord connections by 7-foot Howe trusses. These make an octagonal framework with short diagonal ties across each corner, as shown in the detail of the end of the truss and column connection. The top chord of each truss supports at two intermediate points, a circular timber sill about 83 feet in diameter, which carries the lower ends of the bottom chords of four short radial trusses in each panel between the main roof trusses. The radial trusses are about 16 feet long and correspond in depth and outline to sections of the main trusses. The upper ends of the bottom chords are supported on the laminated ceiling purlin and the adjacent angle-iron ring, and the lower end of the top chord is supported on a circular wooden plate about 122 feet in diameter, which is made of two 2 x 8-inch boards, laid flat and carried on the gallery ceiling joists, close to the wall columns. The chords are made of three 2 x 10-inch scarf boards, breaking joints and fastened together with ¾-inch staggered bolts 12 inches apart. The web members are pairs of 2 x 8-inch planks and the connections of the purlins to the chords are similar to those of the main trusses.

In the outer wall there are eight 8 x 12-inch vertical posts, supporting the main trusses, and between each pair of them there are two 8 x 10-inch, and two 10 x 10-inch intermediate posts, forty in all, which are connected at the top by a continuous circular girt, made of a 2 x 10-inch plank in a vertical plane, which supports the lower ends of the ceiling rafters. These are 2 x 10-inch planks in radial vertical planes, 2 feet apart at the girt, and supported at the upper ends by the circular plate which carries the short dome trusses. In each panel between these trusses there are two intermediate radial ceiling rafters composed of scarf boards made of two 2 x 12-inch planks. These are supported by the two intermediate lines of straight purlins and by the circular plate at the bottom and by the laminated purlin at the top.

Above the laminated purlin there are eight triangular ceiling panels between the main roof trusses at the apex. Each has thirteen rafters parallel to the center radial line of the panel. These are scarf boards made up of two 12 x 1-inch pieces and are supported at the lower end by the laminated purlin, four of them intersect the bottom chords of the main trusses and are supported directly by them, the remainder are supported by the upper straight purlin, which also supports the lower ends of the continuations of these rafters in the upper part of the panel. Three of them extend to the apex and are supported there by a laminated octagonal horizontal curb around the 13-foot vent opening in the center of the dome. The upper ends of the remainder intersect the truss chords and are supported by them, as in the lower part of the panel.



Framing Details of the Ethnology Building.

Up to the crown cornice, the rafters for the roof dome are radial scarf boards, made of two 2 x 12-inch planks, and are supported on top of the purlins; above this line they are similar to those in the upper panels of the ceiling dome.

The roof sheathing is covered with rubberoid and metal tile, and has ribs, moulding and ornamental work of staff. The ceiling has elaborate ribs and cornices made of staff furred out from the lower chords of the trusses and purlins.

The pediments over the entrances are supported on Howe trusses 6½ feet deep and 27 feet long, with 6 x 8-inch chords, 8 x 6-inch end posts, 4 x 6-inch diagonals and ¾, ⅞ and 1-inch vertical rods.

Mr. George Cary, Buffalo, was the architect of this building and the construction was detailed and supervised by the staff of the Exposition, Hon. Wm. I. Buchanan, director general; Mr. Newcomb Carlton, director of works; Gen. S. J. Field, chief engineer; Mr. Williams Lansing, supervising architect; Mr. J. H. Murphy, superintendent of building construction, and Mr. Harry Weatherwax, chief draftsman.

Gravel Road Improvements in Grand Rapids, Mich., are referred to as follows in the last annual report of City Engineer L. W. Anderson: "The 1½-inch layer of fine roofing gravel has been dispensed with, as it is found to cut up readily under heavy travel, especially in the spring. More fine gravel has been used to fill the voids in the medium grade, which has been brought to the finished surface with a slight sprinkling of the finer. This has reduced the amount of binder necessary, and should result in a more permanent roadway. To accomplish this a larger amount of rolling is required, and often the gravel has loosened under travel. Travel settles it into place after the first winter, and I believe a better roadway is secured."

Ventilating and Heating Friendship School, Pittsburg.

Warming a school building by a supply of fresh air distributed by plenum and exhaust fans is the scheme which was adopted for the Twentieth Ward, or Friendship, School, in Pittsburg. Both the fresh and vitiated air is moved through underground ducts, those for the fresh air being double and providing for an automatic mixture of cold and warm air as desired for each room at the base of vertical flues. The air supply is drawn at a point away from the building and 30 feet above ground. There being no radiators in the building, the only steam connections are those to the indirect heater coils, located near the boilers, and the steam system is quite simple. The plant is designed for a total air supply of 43,600 cubic feet of air per minute and for an exhaust of the same amount; it is based on a minimum supply of 30 cubic feet of air per minute to each pupil, allowing for one pupil to each 15 square feet of floor space in class rooms, auditorium, cloak rooms and teachers' rooms. The supply to the rooms in the basement is based on a change of air five times per hour and for the halls and corridors, three times per hour. Mr. C. M. Bartberger, of Pittsburg, was the architect.

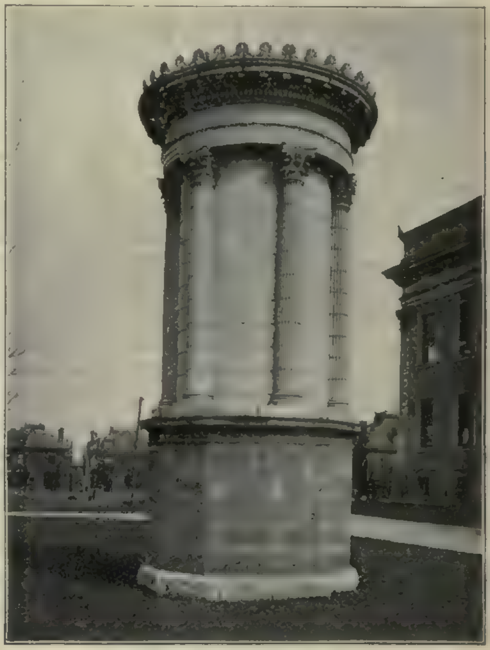
The building is two stories in height, besides the basement, and has a very pleasing exterior, as shown in the accompanying reproduction of a photograph of the building. In ground plan it is 94 x 175 feet in extreme dimensions. It contains 14 regular class rooms, which on the air-supply basis stated provide for 53 pupils in each case. Besides these there is a large auditorium in the second story, which is capable of seating 165 pupils, and three smaller rooms, bringing the total number of pupils to 961. Two rooms at each end of the basement are used as playrooms, and the rooms in between are occupied largely by the heating and ventilating plant. The central portion of the basement is occupied by the fresh-air blower, which is of the double-discharge type, each outlet supplying half of the building. The boilers lie in a room in front of this, while the exhaust fan, together with a gas engine which is used to drive the blowers, are located in a room to the rear. A room is also set apart for the entering fresh air, containing air filters.

View of the School Building.

The air supply, as stated, is taken from an elevation 30 feet above the lawn, down an air tower of artistic design, as shown in an accompanying cut, and located about 60 feet in the rear of the building; thence the air passes through an underground water-tight duct to the fresh-air room, shown on basement plan, where it is filtered by a series of cheese-cloth filters. From here it enters an underground duct to the supply blower. The supply blower is an American type three-quarter house double-discharge steel-plate blower with wheel 72 inches in diameter, inlets on both sides connected with the supply duct by sheet-steel connections. The blower delivers the air to the two banks of heaters as shown, each bank taking care of one-half of the building, and thence by underground ducts to the warm-air riser flues. A by-pass underneath the heaters carries cold air for tempering purposes to a series of ducts under the warm-air ducts; at the base of vertical flues are mixing dampers which are operated by Johnson pneumatic thermostats located in the various rooms. The construction of the underground warm and cold-air ducts, one underneath the other, is shown in an accompanying drawing. No ducts or pipes, save the steam pipes, are visible in the building. The fresh-air riser flues and the vent flues are of galvanized iron. The warm-air registers and vent registers throughout the building are of solid brass and of special design. Registers and risers were taken large enough to insure an average velocity of less than 250 feet per minute at the face of the registers, the idea being to obtain thereby a better circulation without drafts and with a uniformity of temperature. Considerable stress is laid on the low register and flue velocities.

The air is taken from the rooms through vent registers at the floor line, and thence by galvanized-iron flues to the basement, and by the underground ducts to the exhaust blower. This is a three-quarter house A. B. C. bottom horizontal discharge steel-plate blower with wheel 102 inches in diameter and inlets on both sides, connected by sheet-steel connections to the foul-air ducts. This blower discharges the air through an underground duct as shown to a point outside of the rear of the building, as indicated on the basement plan. For night use, and when school is not in session, it is arranged to revolve the air within the building. This is done by a series of trap doors in the fresh-air room and in the foul-air discharge duct. When the belt driving the exhaust blower is thrown on the loose pulley and the exhaust blower stops, the circulating trap door in the fresh-air duct closes and those in the foul-air ducts open, thus making a connection between the foul-air ducts and the fresh-air room.

The blowers are driven by a 32-horse-power Westinghouse gas engine, the exhaust of which is muffled so as not to be heard by the occupants of the building. Shafting is all overhead and is supported on shaft standards. All of the apparatus, with the exception of the boilers, is located practically in one room. All of the iron work is painted five coats of white enamel and striped with gold bronze. All exposed foundations are faced with white opalite tile. It was the desire of the Board of Education that this apparatus room should be a model of its kind.



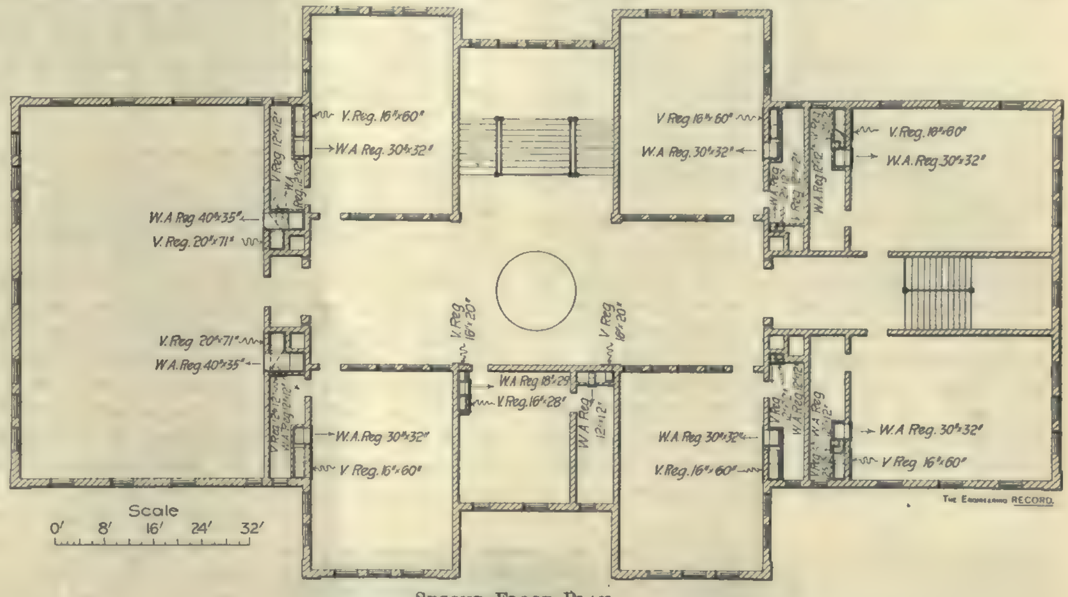
The Fresh-Air Inlet.

Mr. Bartberger, the architect for the building, writes that the air supply per pupil actually delivered to the building is considerably greater than that required by the contract. He says that a number of tests have been made that have established the fact that the diffusion obtained in the various rooms is exceptionally good. A test for carbon-dioxide made in one of the rooms in which two classes had been temporarily seated for an hour showed but slightly over 8 parts in 10,000, while with the regular number of pupils in the room the amount above that in the outside air was barely perceptible.

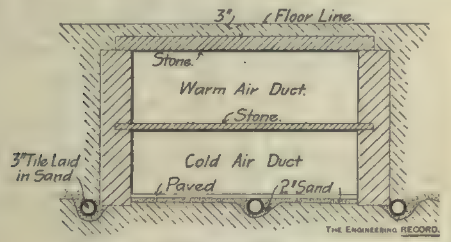
There are two boilers, located as shown, of the horizontal tubular pattern, 13 feet long and 60 inches in diameter, with 4-inch tubes, set in battery form and encased with extra heavy walls with finished pressed brick on the outside. The fronts are of ornamental full-front pattern of special design. The trimmings, water columns, steam gauges, water-gauge cocks and automatic feed-water appliances are of solid brass, highly finished and made especially to meet the existing conditions, a special effort being made, as stated, to combine beauty, utility and durability of parts. The boilers are connected so that either one or both may be used as the weather requires. They were tested to 150 pounds hydrostatic pressure, but are used as low-pressure boilers. Since the first of January, during the past winter, it was necessary to use but one boiler. Natural gas is used for fuel in the boilers, which favors the maintenance of a cleanly basement. The burner used is the Merrill side-wall burner, which was installed by Mr. E. C.

Merrill, of Pittsburg. The steam outlets are taken from dry pipes to insure dry steam of a high temperature for use in the heaters; safety-valve outlets with all other necessary outlets are provided. From the two 6-inch main outlets steam connections are made to a main manifold over the boilers and thence by a 6-inch main to two 5-inch lines to the main heater coils as shown on plans.

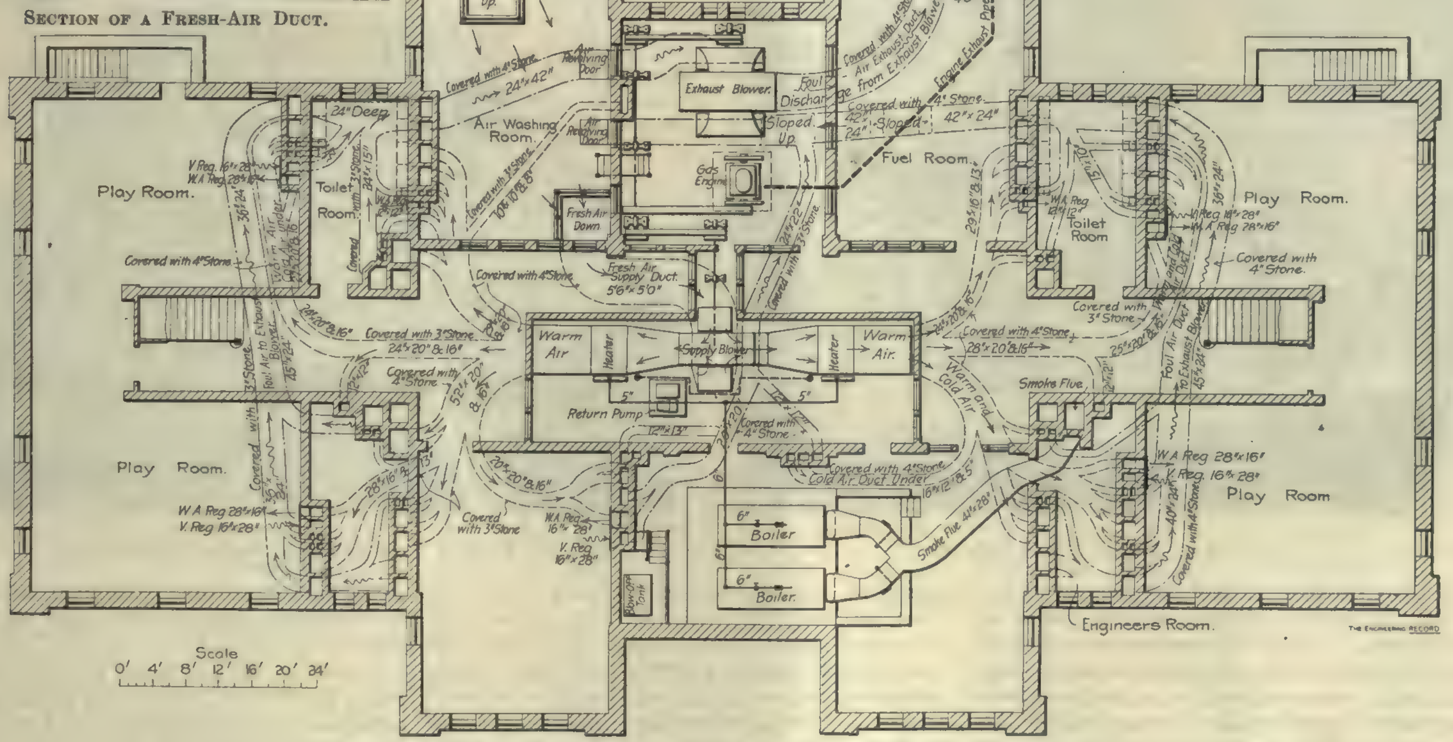
The heaters are of the American Blower Company's make and consist of five sections, each made up of cast-iron bases divided into two distinct compartments by a partition running the full length of same, with staggered vertical pipes for the heating surface, there being a total of 7,500 linear feet in the two heaters. The heaters are encased in sheet steel, with connections to blower and ducts as indicated. Each section is provided with valve connections from the steam manifold so that one or more sections may be used as the weather requires. All the valves are full nickel-plated. The drip and return connections are connected into a manifold and thence by pipe as shown, to a receiver. The water of condensation is returned to the boilers by a Snow automatic return pump; a by-pass connection to a Nason trap is provided, so that in case of accidents to the pump the condensation is carried to the sewer.



Second Floor Plan.



Section of a Fresh-Air Duct.



Basement Plan, Showing Underground Fresh Air and Exhaust Air Ducts.

VENTILATING AND HEATING THE FRIENDSHIP SCHOOL, PITTSBURG, PA.

C. M. BARTBERGER, PITTSBURG, ARCHITECT.

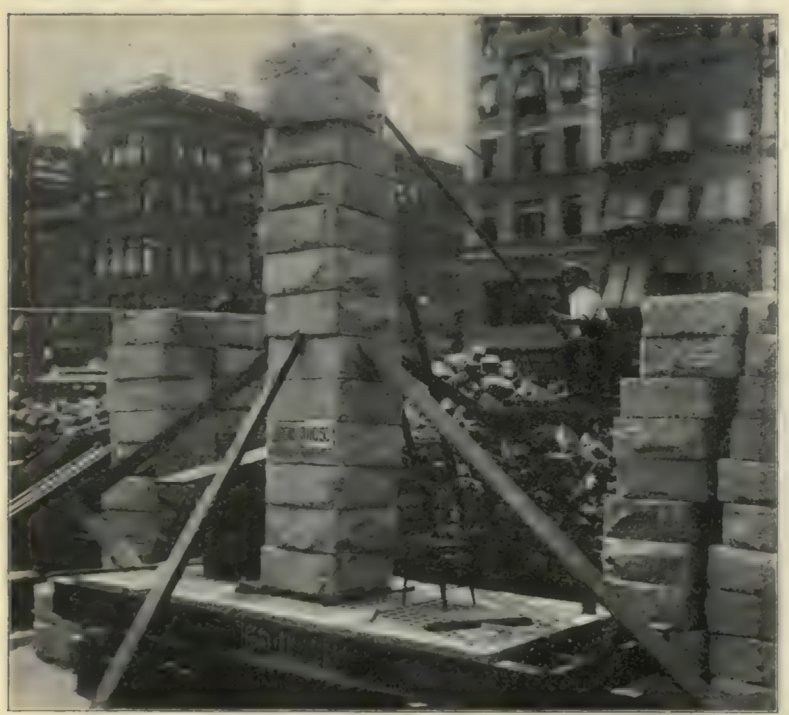
The Walls of the City Theater of Berne are supported on concrete foundation piers from 6½ to 15 feet square and from 23 to 33 feet deep, built in cofferdams of reinforced concrete, described in the "Genie Civil." The soil consists of sand, clay and gravel overlaid with made ground in which an open pit, 3 feet deep, was sunk with vertical sides. On the bottom of the pit was set a rectangular wooden curb 3 inches thick and 6½ inches wide. On the inner side of the curb were built three courses of horizontal 12-inch sheathing boards 2¾ inches thick, making a lining which extended to the surface of the ground and had a 6½-inch space all around between it and the sides of the pit. This space was rammed full of rich concrete reinforced by 7/16-inch horizontal rods 4 inches apart vertically. The ends of the rods were bent outwards to make acute angles at the corners of the pit. While the concrete outside the sheathing was setting, the pit was excavated 3 feet deeper and a similar section of lining built up from the bottom to meet the under side of the first section, to which it was joined by iron clamps 13 inches long, which were built into the bottom of the curb of the first section and projected half way through it in readiness to receive the top of the next section. The excavation was thus continued 3 feet at a time, lined with concrete faced with boards, until the pit was sunk entirely through the made ground. The lower edge of the lining was then reinforced by a heavy concrete ring with steel rods, which was supported on vertical posts as the excavation was continued in the natural soil. Pointed iron rods were driven through this girder ring close together at an angle of 45 degrees with the horizontal, to form a kind of poling boards which supported the roof soil while the excavation was enlarged laterally under them to provide for an extended base for the pier. The lower part of this excavation had vertical sides, beyond which the inclined rods penetrated from 12 to 16 inches. The bottom of the pit was enlarged sufficiently to reduce the foundation pressure to 4,000 to 6,000 pounds per square foot. The pit was rammed full of concrete, firmly locked to the lining by the horizontal ribs formed on the exterior between the beveled edges of the sheathing planks.

In Making Blue-Prints the most unmanageable and expensive part of the necessary apparatus has always been the large plate glass slab. A recent German patent is designed to do away with this part of the outfit, the tracing and sensitized paper being stretched over a board having a slightly cylindrical surface, for exposure to the sun. One side of the paper is held in a clip, the other being held by a rubber roller working in guides on either side, the adhesion of the rubber to the tracing serving to hold it tight over the paper.

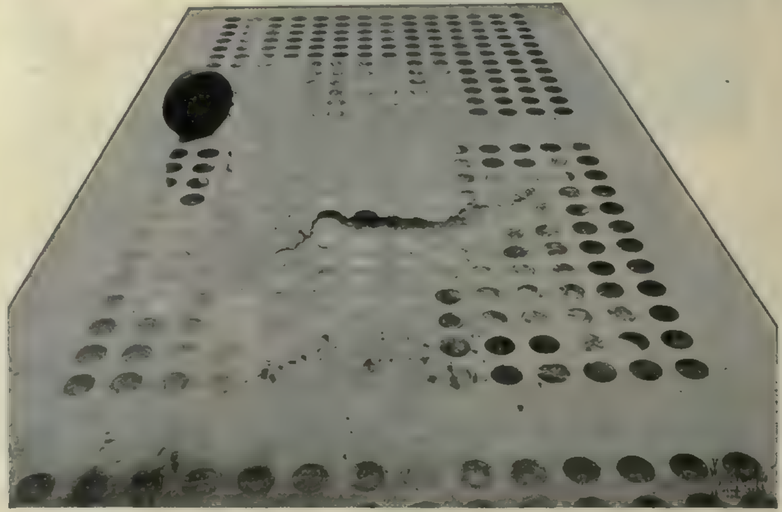
Test of a Vault-Light Slab.

A loading test of a full-sized steel-concrete sidewalk slab of the Ransome system was made at Union Square on August 27, at the request of Mr. William Barclay Parsons, chief engineer of the New York Rapid Transit Railroad Commission, and under his personal direction. The slab, of about 74 square feet area, was built at the site and was simply laid, like a flag-stone, across the top of a horizontal I-beam framework. It was not connected to the framework nor laterally braced or confined in any way and, structurally considered, might as well have been made in a factory, brought to place and laid on its supports.

Two 12-inch longitudinal I-beams, 13½ feet long and 5 feet apart on centers, were set on horizontal timber blocking and connected by three equidistant 5-inch 10-pound transverse I-beams framed to them with their upper flanges 2 inches below those of the 12-inch beams. On top of this level framework a 2-inch concrete slab was built, covering all the top flange surfaces of the 12-inch beams and divided into three panels, by transverse concrete ribs projecting below the lower surface 4 feet 2 inches apart to form fillers for bearing on the transverse beams. Ribbed and tapered glass lenses 2½ inches in diameter were set in the concrete in transverse and longitudinal rows 2¾ inches apart on centers, and in every space between the rows was bedded a 3/16-inch cold-twisted square steel rod. Falsework was set up under the beam frame and steel templates placed on it to center the lenses; then a rich mortar of Alsen's Portland cement and sharp, coarse sand, mixed wet, was rammed around the lenses, the steel rods were placed and the upper surface of the slab was finished smooth, the edges being filled in against side pieces which were removed after the cement set.



View of Slab when Fully Loaded.



View of Part of Top of Slab Showing Cracks.

Twenty-eight days after the slab was made it was tested by a very heavy static load in the presence of Mr. Parsons, several members of his staff, Mr. S. L. F. Deyo, chief engineer of the Rapid Transit Subway Construction Company, and other engineers and contractors. A steel disk, 8½ inches in diameter and 1½ inches thick, was set on the thin sand cushion on the center of the middle panel of the slab, and was loaded by rectangular 27 x 27 x 12-inch blocks of cut stone weighing about 914 pounds each. The first block was carefully centered on the disk and successive blocks were piled on it as exactly as possible on the center, so as to balance on the disk which concentrated the load on an area of 0.4 square foot. Wooden wedges were set loosely under the corners of the first stone to prevent it from tipping, but seldom or never received any pressure. The stones were added at intervals of ten or fifteen minutes by a boom derrick; thirteen in all were set on the slab and made a column about 13 feet high which weighed 11,882 pounds and was braced by four inclined shores set against the sides of the sixth stone.

The loads in pounds and corresponding deflections in inches were as follows:

Load	914	1,828	2,742	3,656	4,570	5,484	6,398
Deflec.	1/32	3/64	5/64	3/32	13/64	5/16	25/64
Load	7,312	8,226	9,140	10,054	10,968	11,882	.....
Deflec.	35/64	21/32	49/64	15/16	17/16	111/64	.....

Cracks commenced to develop in the center of the slab when a load of 5,484 pounds was reached; they extended toward the corners of the panel, making an outline somewhat similar to a four-pointed star. When the load was increased to 10,054 pounds the cracks reached nearly to the corners and opened on the under side, and portions of the slab commenced to scale off. At a load of 9,140 pounds several lenses cracked and the concrete under the disk began to shear, and under the final load of 11,882 pounds it had a relative vertical displacement of about 1 inch but had not been entirely separated from the rest of the slab. Many of the glass lenses in the center of the panels and near its diagonal lines, along the region of cracks, were broken, and the steel rods in the middle were distorted but not broken. The slab was broken but not destroyed and still sustained its load.

On August 29 an impact test was made by dropping a 914-pound stone from a height of 22 feet 8 inches. The stone was not wholly released at first and had a free fall of only about 17 feet striking on one corner just above one of the transverse beams, which it permanently deflected 4 inches. It made a 9 x 12-inch hole through the slab where it struck, and bent the steel rods but did not break them. It also broke twenty lenses near where it struck and four at the other end of the slab where it bounded. A second impact test was made by dropping the stone from a height of 19 feet 4 inches. It struck flat on one end in the middle of the end panel, smashed a large hole through the concrete and bent the steel rods, but did not fall through. The impact tests were intended to demonstrate the effect of objects falling from the second story or from sidewalk protection platforms to the vault roofs, and are considered to indicate that this form of construction would probably prevent serious damage inside the vault.

The slab was made by Tucker & Vinton, Inc., New York, and was stated to correspond exactly in quality, materials and workmanship to the vault lights manufactured by them for commercial purposes.

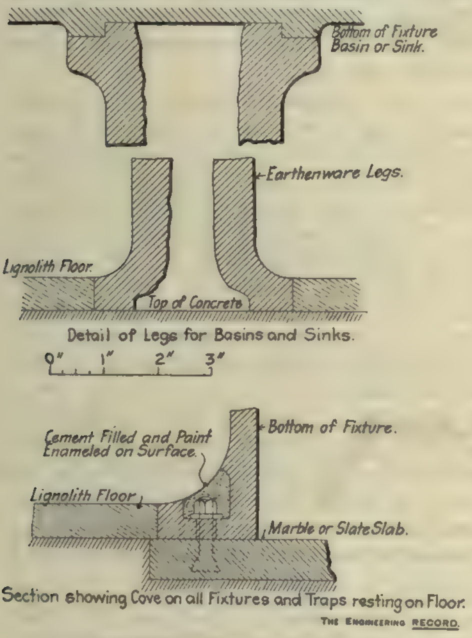
Plumbing in the Lying-In Hospital, New York.

The Lying-In Hospital on Second Avenue, New York, between Seventeenth and Eighteenth streets, is a 184 x 165-foot steel-frame nine-story and basement building with some interesting plumbing features. A water supply of more than 150 gallons a minute under ordinary street pressure is taken through connections from separate mains on two streets. After passing through two 3-inch meters, valved both sides, it is received in a 3½-inch main which is independently branched to the filters, to the suction tank and to the pumps, with check valves set to prevent backflow to the meters. The aggregate capacity of the meters is sufficient to supply over 200,000 gallons of water in 24 hours under average street pressure, and nominally the water passes through them to two Weaver filters and thence into a closed 6½-foot suction tank 12 feet high. There are by-passes and valves so arranged that the water may go through either or both of the filters or may pass by them and be delivered unfiltered to the pressure tank or to the house or boiler-feed pumps, or to the rising lines and supply all fixtures as far up as the street pressure will cause the water to rise.

Ordinarily all the water for the house supply is drawn from the suction tank by a steam pump and delivered through two 6-inch pipes to the pressure tank and to the fire line. The latter has a horizontal branch in the basement running the full length of the building and having four 4-inch branches, one to a siamese fire-engine connection in the street and three to risers in the corridors. Each riser has a 2½-inch outlet on every floor, including the basement, twenty-eight in all. Each outlet has a valve and 250 feet of best cotton hose on a swinging reel in a galvanized-iron box countersunk in the wall flush with the surface and provided with a plate-glass front horizontally pivoted at the top so as to close by gravity. The boxes are enameled white inside, and the entire fire system is tested to 350 pounds pump pressure.

There is a Quimby electric pump connected to the suction tank which delivers either to the pressure tank, to the fire line or direct to the house supply. Nominally the steam pump is in constant service with the pressure always on it, and the electric pump is held in reserve, but they are cross-connected and either or both can be operated at any time. The steam pump is governed by a Ford regulating valve operated by a pressure pipe from the outlet so as to cut off steam when the discharge pressure rises above 75 pounds, and admit it when it falls below that amount. The electric pump also has an automatic regulating attachment so arranged that when the gauge indicates 75 pounds discharge pressure it closes the switch and shuts off the current, turning it on again when the pressure falls.

Both pumps deliver into the lower part of a 6½-foot vertical cylindrical steel pressure tank 12 feet high, fitted with manhole, gauge-glass, pressure gauge, emptying pipe, etc. A 3-inch vertical pipe, open at the lower end, extends from the bottom of the tank inside up through the top to a connection with a distribution main running around the building on the basement ceiling to supply all the riser lines. The upper half of the pressure tank is filled with air, which is replenished when necessary by opening a valve in the electric pump and forcing it in with the water. This forms an air cushion which absorbs water hammer and maintains a more constant pressure in the house pipes. There is no distribution drum or central point of control for the different supply lines. Each of the six 1¼-inch and six 1-inch vertical risers has a valve, drip cock and emptying pipe at the point where it is branched from the distribution main, and is tagged with a key to the rooms or fixtures which it supplies.

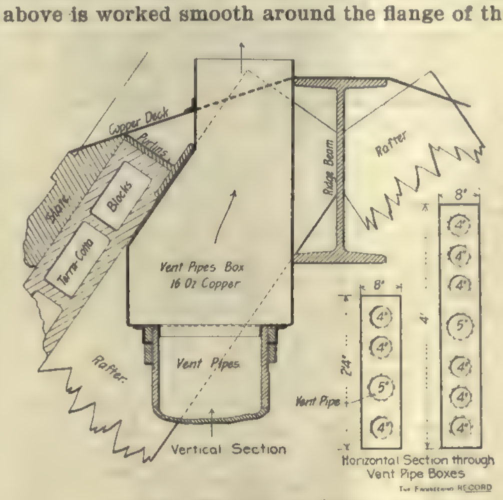

Bottom of Fixture Basin or Sink.
Earthenware Legs.
Lignolith Floor
Top of Concrete
Detail of Legs for Basins and Sinks.
0" 1" 2" 3"
Cement Filled and Paint Enameled on Surface.
Bottom of Fixture.
Lignolith Floor
Marble or Slate Slab.
Section showing Cove on all Fixtures and Traps resting on Floor.
THE ENGINEERING RECORD.

COUNTERSINKING AND COVING.

A Berryman heater, 3 feet in diameter and 12 feet long, is set horizontally in the pump room and connected to the pressure tank. It has a 2½-inch flanged outlet on top, through which it supplies a distribution line and system of risers parallel to the cold-water system. All fixtures are supplied with hot water, and from the tops of all riser lines there are ½-inch return circulation pipes to a 1½-inch header which enters the bottom of the heater. The heater contains 300 feet of 2-inch seamless drawn brass tubing, and was tested to 200 pounds hydrostatic pressure. It is controlled by a Johnson thermostat which shuts off the steam when the temperature of the water rises above 160 degrees.

All hot and cold-water, soil, waste and vent pipes are of galvanized steel, concealed as much as possible in the floors, walls and partitions. Where pipes are bedded in cement they were first thoroughly coated with asphaltic paint. Exposed pipes have two coats of enameled paint. All lines likely to discolor walls or ceilings by sweating are covered with waterproof asphalt paper, and all hot-water pipes are jacketed with non-conducting material and pass through floors in sleeves filled with mineral wool. Cast-metal sleeves and escutcheons are provided for all pipes and valves where they emerge from the ceiling and walls. The escutcheons are small and have cove moldings which are countersunk into the wall, and the plaster is finished up smooth over them so as to leave no corner or opening for the accumulation of dirt or germs. Floor lines of pipe are laid in trenches left in the concrete and covered with movable metal plates.

All the earthenware fixtures are of special pattern, made to order for this building, and are noticeable for their solidity and smoothness of finish and outline, and for the absence of joints and sharp angles to collect dirt. Where they are seated on marble or slate slabs the latter are countersunk flush with the surface of the concrete floor and the lignolith flooring above is worked smooth around the flange of the base and up to its cove so as to make a smooth continuous curve and seal the joint, as shown in the sketch. The nuts on top of the holding-down bolts are in deep recesses, and the space above them is filled with cement and finished with enamel paint. The sinks and wash-basins have plain porcelain legs seated on top of the concrete floor and having the lignolith surface worked up to the top of the flange and finished off smooth and continuous with the coved molding.

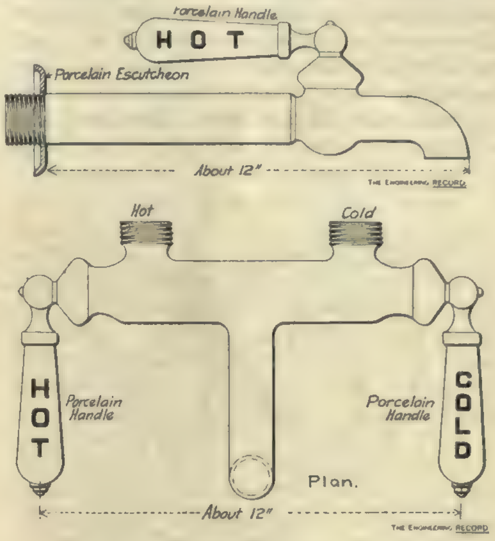


VENT PIPE BOX AT ROOF.

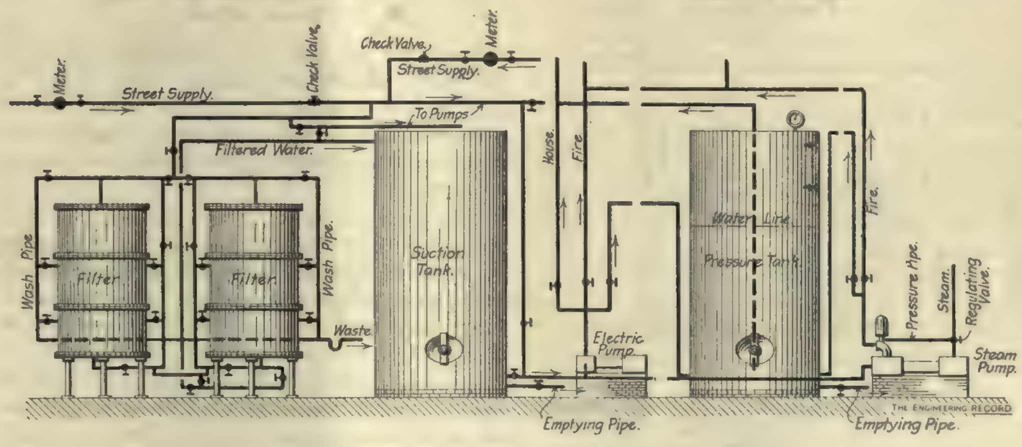
The sinks have a porcelain back made of the same piece as the body, and all are supplied with a special funnel-shaped waste and a porcelain strainer. The funnel has a flange countersunk deeply into the bottom of the sink, where it is seated on a gasket, is held in place by a kind of escutcheon screwed on the lower part and bearing on the under side of the sink bottom, and is connected to the trap by a short ferrule and slip joint. The sink faucets are made extra long and heavy, of special pattern without moldings. They have large porcelain handles and are fitted with porcelain escutcheons where they come through the wall. Most of the sinks have porcelain drain boards, made integral with the sink and at one or both ends, but in one room these are replaced by four 1-inch glass shelves with polished top, bottom and rounded edges, which are supported at the wall on nickel-plated brass clips, and have nickel-plated pins projecting from the bottom to engage the sink rim and prevent them from slipping off.

All the sinks and both square and corner wash-basins have their backs countersunk about ½ inch into the wall and the plaster finished up smooth around them to a continuous curve with the cove molding, thus showing no joint of definite connection with the wall. The corner wash-basins have curved backs to fit the rounded wall surface, and are supported on a single porcelain leg with the waste pipe running through the upper part of it and emerging through a slot in the back side. The wash-tubs have porcelain backs made in the same piece with the tub and countersunk into the wall surface, and are supported on porcelain legs countersunk into the floor. The baby baths are porcelain tubs mounted on high separate porcelain bases countersunk into the floor. The waste and overflow are at one end, made integral with the bath, and have a short horizontal pipe to the trap and vent on the opposite side of the wall. The hot and cold-water supplies are through special combination bibbs, set in the wall above the waste pipe. In the operating room there is a special porcelain bath-tub 72 inches long, 18 inches deep and 18 inches wide inside. It is set on two brick piers about 14 inches high, which are plastered and have rounded corners and coved angles, top and bottom, at the intersection with the floor and with the tub. It is provided with two large special cocks set in the wall above each end, each having both hot and cold-water handles and a spray nozzle to discharge a thin, wide sheet of water.

The cement floors are pitched to a catch-basin



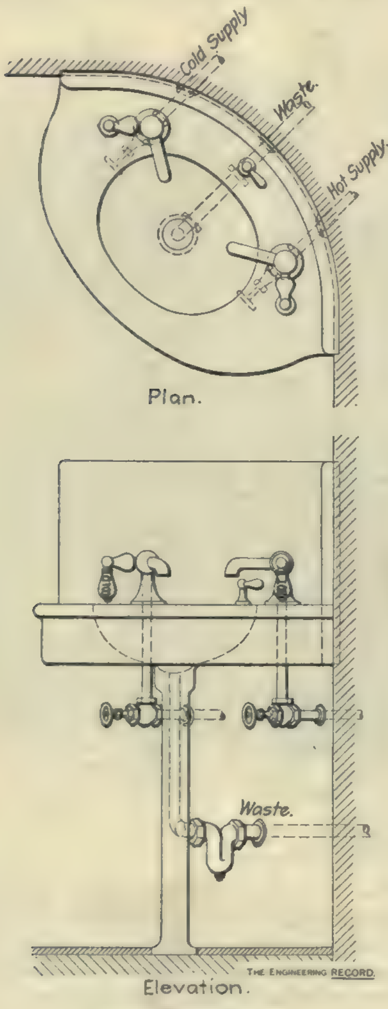
SPECIAL FIXTURES.



INSTALLATION OF FILTERS, PUMPS AND TANK.

and strainer, so that they can be flushed with a hose. Most of these floor-drains are supplied with hot water for flushing, and all have funnel-shaped wastes and porcelain strainer plates in countersunk seats so as to be flush with the floor surface. A number of the floor-drains have Tucker flushing jet syphon traps, illustrated in The Engineering Record of July 6, 1901, in the description of the plumbing in the Prudential Building. These traps have a cold-water flush through special valves concealed in the walls. The wastes from the laundry washers and extractors discharge into a cast-iron floor trench which pitches to a funnel-shaped trap 4 inches in diameter and is covered with perforated cast-iron plates set flush with the floor surface.

In the central portion of the Second Avenue front of the building there are two groups of vent pipes which are not carried through the roof but are connected to tight copper boxes just below the terra-cotta tiling. There are two of these boxes of similar cross-section, one 4 feet long, with six 4-inch pipes, and one 5-inch pipe opening into the bottom of it, and the other one 28 inches long, with four pipes. Each vent pipe has a double outside sleeve which locks it, like a jam nut, on a flange on the bottom of the box as shown in the detail, or is soldered fast to the copper bottom. A single outlet from the top of the box passes through the copper deck and communicates freely with the outer air through openings in the ridge.



Corner Wash-Stand.

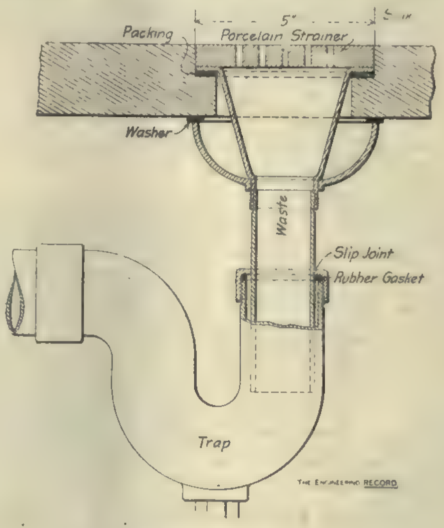
Mr. R. H. Robertson was the architect of the building, and Mr. John Tucker was the contractor for the plumbing and gas fittings.

A Very Large Well is being sunk at Lincoln, England, under the direction of Mr. Percy Griffith, Assoc. M. Inst. C. E., London. It will be 2,176 feet deep and lined with 30-inch pipe for a depth of 400 feet and 12-inch pipe below. The contract for the work calls for its completion in four years at a cost of £14,605.

Trade Publications.

Trade publications containing information of value to The Engineering Record's readers are gladly noticed under this head. There is no space in this journal, however, except as paid advertisements, for mention of the freakish monstrosities of the "ad-smith." The things barred out generally have printed on the cover something like "Tag, You're It," with a picture of skinny children romping in a physically impossible manner. On the first inside page is the notice, in another fancy font, "Now we've caught you, just a word you really should read. It's like finding money in the street." Turning over another page, there will be found, in more lurid colors, "Somebody's Something is a sure winner; better than a royal straight flush." This keeps up until the "ad-smith" thinks he has earned his fee. These things may be all right for chewing gum and corsets, but they are not worth writing for and will receive no further notice in this journal.

A system of tramrails and trolleys of many types used for the overhead conveyance of materials in industrial plants and warehouses is described in a new circular of the Brown Hoisting Machinery Co., 26 Cortlandt St., New York. The trolleys are of plate and cast-iron patterns and run on the top of beams and bars or on the lower flanges of I-beams. They range in size from a 2-wheel ¼-ton type to an electric trolley of 5 tons for lower-flange support and a 20-ton crane trolley for running on top of girders.



Waste in Sink.

Disk fans driven by belt, engine and electric motor; gas and gasoline engines, air compressors, electric lighting plants and acetylene generators, all of patterns serviceable in buildings, are fully illustrated in a new catalogue of the L. J. Wing Mfg. Co., 95 Liberty St., New York.

Electric locomotives weighing from 2 to 20 tons, designed primarily for collieries, but also employed in industrial establishments, are fully illustrated in a new catalogue of the Jeffrey Mfg. Co., Columbus, O. The standard type has the motorman's seat in the center, protected by the frame, while the gondola type has it at one end. Views are also given of an electric lorry, pumping outfit and transfer car.

The technical library issued by Joseph T. Ryerson & Son, Chicago, has recently received two additions which are worthy of filing permanently. The first is a discussion of boiler bracing and braces by W. H. Wakeman, with an appendix giving cross-sections of boilers, showing the spacing of tubes, the position, number and sizes of braces commonly used, and other valuable data. The second pamphlet is a detailed description of Little Giant pneumatic drills and hammers, explaining their construction, giving rules for their care, and listing the various sizes.

A system of automatic temperature regulation for both houses and public buildings is described in a pamphlet issued by the National Regulator Co., 204 Dearborn St., Chicago. The thermostat is a rubber tube with brass fittings, the temperature changes of the tube opening and closing a valve which regulates the compressed air or gas passing to the operating motors. The latter work by adjusting the dampers and fire-doors of small plants or the radiator valves of large installations.

The pulley, steam and electric types of disk wheels made by the Buffalo Forge Co., Buffalo, N. Y., are illustrated and listed in a small catalogue just published. It is particularly interesting for the sketch of the various industrial uses of these wheels for ventilating and drying purposes, the illustrations showing installations in malting and dye houses, paper mills, laundries and cooling towers. The numerous uses for which Buffalo "B" volume blowers, built by the same company, are adapted, are also well described in another handsomely-illustrated booklet containing many valuable tables. Still another of these useful publications gives an illustrated description of steel-plate planing-mill exhausters for removing the refuse from wood-working machinery, emery wheels and other tools. One of the new features of this use of fans is a separator for collecting the shavings, which is illustrated in a special folder.

A revised edition of the circular of the Westinghouse Electric & Mfg. Co., on switchboards for two and three-phase circuits at 100-600 volts, has been issued. It gives full details of panels for generators, feeders and rotary converters of various types. Another bulletin describes standard switchboards for direct-current lighting and power circuits at potentials not exceeding 750 volts. It illustrates generator, rheostat, load, feeder, fuse and blank panels and gives directions for making various combinations of these for any service.

The teaser equipments for operating newspaper plants are noteworthy for absence of waste of current in regulating the speed of the motor and for the lack of heavy draft on the source of electrical supply when starting. The importance of these advantages is explained in a well-illustrated bulletin prepared by the Bullock Electric Mfg. Co., Cincinnati. Another recent bulletin gives an illustrated description of the plant of the Consumers Park Brewing Co., Brooklyn, N. Y., where the machinery is operated electrically.

A minute description of the construction of the various types of "Royal" steam and hot-water heaters, the method of setting them, and of the way to use them to the best advantage, is given in a well-illustrated 44-page catalogue published by the Hart & Crouse Co., Utica, N. Y.

The Pierce, Butler & Pierce Mfg. Co., Syracuse, N. Y., has issued two new descriptive catalogues of its heating boilers. One of them describes the Florida type for steam, which was the first boiler made by the company, and the Tropic type, the first water heater; the first is made in three styles and the second in two. The other catalogue describes the Perfect boiler, a portable square type, with a very large part of the heating surface direct fire surface.

A discussion of the strength of concrete floors stiffened with expanded metal and corrugated bars has just been issued in handsomely-illustrated form by the St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo. It explains the construction of various systems of concrete-steel floors, gives a valuable analysis of their strength, and furnishes many useful tables of their breaking loads. The illustrations also show sections of conduits, canals, roofs, culverts and other structures in which concrete reinforced by steel was employed. The book is one every architect, engineer and builder using concrete will find of permanent value.

A 72-page catalogue, well illustrated and printed, has been issued by the Gurney Heater Mfg. Co., 74 Franklin St., Boston, to describe the

400 Series, Doric, Bright Idea, Pony, Deflance and Jacket boilers and heaters, the Duet, Tremont, Harvard and Narrow radiators, and accessories for heating plants. The list of types and sizes is a long one, and accompanied by tables, descriptions of details and similar useful data.

The allied Westinghouse companies have issued a 40-page pamphlet outlining the character of their products and explaining the nature and location of the various Westinghouse exhibits at the Pan-American Exposition. It is a model of artistic engraving and printing, and gives much useful information in condensed form. Particularly interesting is a unique diagram of the distribution of current from the plant of the Niagara Falls Power Co. to all consumers between the generating station and the last substation in Buffalo.

Drop forgings of iron, steel, copper, bronze and aluminum are the sole product of J. H. Williams & Co., Richards and Bowne Sts., Brooklyn. They make standard lines of wrenches, hooks, eye-bolts, rope-sockets, gas-engine parts and similar forgings, and make a specialty of work done to order. These subjects are explained in a well-printed catalogue of 75 pages.

An interesting description of an important engineering work, the Rideau water route from Kingston to Ottawa, is given in a handsomely illustrated addition to Mr. Geo. H. Daniels' Four Track Series, published by the New York Central & Hudson River R. R. The useful folder on the river and rail routes between Albany and New York, in the same series, has passed into another edition.

A small pamphlet has been issued by the Jeffrey Mfg. Co., Columbus, O., to serve as an index to the various classes of machinery it makes. Conveyors and elevators of many types, both belt and screw, screens, crushers, cars, buckets, chains, coal washers, cutters and drills, and mining locomotives are among the products illustrated.

The H. B. Smith Machine Co., Smithville, N. J., has issued a handsomely printed description of the line of automatic tenoning machinery which it has developed since the first tool of the sort was brought out by H. B. Smith in Lowell, Mass., over 50 years ago.

The combined magnetic braking and electric car heating apparatus manufactured under F. C. Newell's patents is described in a pamphlet issued by the Westinghouse Air Brake Co. The apparatus includes a double-track shoe combined with a powerful electro-magnet, which, when energized by current produced by the car motors acting as generators, is strongly attracted to the rail by magnetic force; there are also wheel brakes acting in the usual manner, simultaneously with the track brakes, and an electric heater of new design and large thermal storage capacity.

Personal and Obituary Notes.

Mr. David J. Williams has taken charge of the open-hearth furnaces at the Cambria Company's new plant at Franklin, Pa.

Mr. D. P. Jones, chief engineer of the Niagara Falls Hydraulic Power & Mfg. Co., has been forced to resign that office on account of ill health.

City Engineer H. Vannatta, of Nelsonville, Ohio, was suffocated on August 24 while endeavoring to assist a workman from a sewer filled with gas.

Messrs. Austin Lord Bowman, John G. Van Horne, John Waterhouse and Charles S. Warner have moved their offices from No. 71 to No. 29 Broadway.

Lieut.-Col. David P. Heap and Lieut. Robert P. Johnston, Corps of Engineers, U. S. A., have been designated members of the California Debris Commission.

Mr. John A. Fish, of Boston, has become associated with the Walker & Pratt Mfg. Co., of that city, where he will have charge as manager of the wholesale boiler department.

Lieut. Clarke S. Smith, Corps of Engineers, U. S. A., has been assigned to assist Capt. John S. Sewell, who has charge of the construction of the U. S. Government Printing Office.

Mr. Henry Rustin, who planned the very successful electric illumination of the Pan-American Exposition, has been given a gold medal for his achievement by the superior jury of awards.

Mr. George W. Vaughan has been appointed division engineer of the western division of the New York Central & Hudson River R. R., and Mr. Charles E. Lindsay division engineer of the Pennsylvania division.

Mr. Elmer G. Manahan, who has been connected with the Metropolitan water-works, Boston, for six years, has resigned to go to the Bureau of Water Filtration, Pittsburg, where he will have immediate charge of work under Mr. Morris Knowles. Mr. Harold K. Barrows has also resigned from the Metropolitan works after two years' service, to become assistant professor of hydraulics at the University of Vermont.

George Austin Quinlan, a director of the American Society of Civil Engineers, died in Houston on August 30. He was born in Bridgeport, Conn., in 1838, and began work in 1856 as a rodman on the Chicago & Northwestern Ry. He then went to the South, later to Egypt, and finally, in 1866, to the Houston & Central Texas Ry., with which he was afterward continuously connected. He rose steadily from the rank of locating engineer to the office of vice-president and general manager.

Mr. Wm. L. Darling, who has just been appointed chief engineer of the Northern Pacific Ry., was graduated from the Worcester Polytechnic Institute in 1877 and two years later entered on his long connection with that railway system. For a few years he was engaged on other roads, chiefly the Burlington, but he has been essentially a Northern Pacific man throughout his career. The location and construction of the Little Falls cut-off, the Elkhorn branch and the mountain portion of the Coeur d'Alene branch were under his personal charge. He has been the assistant chief engineer for some time.

Purdy & Henderson, civil engineers, New York, have incorporated with a capital of $50,000 and the following officers: Mr. Lightner Henderson, president; Mr. Leonard E. Brownson, Havana, Cuba, vice-president; Mr. Charles E. Berger, treasurer and New York manager; Mr. A. R. Wheeler, secretary. Mr. C. T. Purdy retains his interest in the business, but relinquishes its management to become chief engineer of the George A. Fuller Co., New York, to which he is now devoting his entire time. Purdy & Henderson have offices in New York, Chicago and Havana. Their business in the United States is strictly professional, but in Cuba, in addition to general engineering work, they are acting as mercantile agents and doing contract work.

Baron Mori, one of the leading railway men of Japan, was killed in a railway accident on July 13. He entered the class of '75 at the Rensselaer Polytechnic Institute under the name of J. Yamamoto, but left during the second year on account of illness. Some years later Mr. J. A. L. Waddell, a classmate, who was then living in Tokio, met him again. He had been adopted into the Mori family and was chief engineer of the Nippon Ry. He rapidly rose in the service of the road to the position of president, which he held for some years and then resigned, although retaining a connection as consulting engineer. He was raised to the peerage two years ago. Mr. Waddell writes that he was an eminently practical man, and the character of the railway property he built up proves conclusively that he compared favorably with the best American railway men.

At the meeting of the American Society of Civil Engineers on September 4 the following candidates for admission were elected: Members. Prof. Alfred E. Burton, Massachusetts Institute of Technology; Everett W. Lewis, assistant engineer, N. P. Ry., Twin Bridges, Mont.; Chas. H. Moore, first assistant engineer, Erie Railroad; Kyoichi Murakami, consulting engineer, Osaka, Japan; Asa E. Phillips, assistant engineer, department of engineering, Washington, D. C.; Joseph Ripley, U. S. assistant engineer, Sault Ste. Marie, Mich.; Albert L. Schultz, American Bridge Co., Pittsburg; William C. Smith, engineer, A. Guthrie & Co., St. Paul; Geo. D. Snyder, city engineer, Williamsport, Pa.; S. W. Stacpoole, engineer, Santa Gertrudis Jute Mills, Orizaba, Mex.; H. R. Stanford, civil engineer, U. S. N., San Francisco; Robert W. Waddell, city engineer, Kansas City, Mo. Associate Members. Harry F. Bascom, Atlas Portland Cement Co., Allentown, Pa.; Gustave M. Braune, Southern Bridge Co., Birmingham, Ala.; William T. Dorrance, assistant engineer, Buffalo, Rochester & Pittsburg Ry., Rochester, N. Y.; James R. Elliott, principal assistant to Wm. Glyde Wilkins, Braddock, Pa.; Willard E. Herring, locating engineer, Choctaw, Oklahoma & Gulf R. R., Coalgate, Ind. T.; A. S. Hobby, Jr., U. S. assistant engineer, Santiago, Cuba; Geo. G. Honness, assistant engineer, Passaic Water Co., Paterson, N. J.; Henry C. Humphrey, inspector, State Dept. of Public Works, Syracuse, N. Y.; Joseph Jacobs, assistant general bridge inspector, Southern Pacific Ry., San Francisco; Prof. Lewis J. Johnson, Harvard University; Prof. Milo S. Ketchum, University of Illinois; Frank B. Knight, Lidgerwood Mfg. Co., New York City; Richard S. McCaffery, superintendent, Everett Copper Co., Medlin, N. C.; William M. Venable, assistant engineer, National Contracting Co., Boston; Frank E. Weymouth, assistant engineer, Canal Commission, Washington.

Three Tests of a Small Steam Pump for boiler feeding are described in "Engineering." The tests lasted 20 minutes each and were made on a compound direct-acting pump with steam cylinders 6 and 9½ inches in diameter, a 6¼-inch plunger and a 10½-inch stroke. The tests were made by Mr. J. Rutherford Blakie, resident engineer of the Penrose Street electric lighting station, Walworth, London. The boiler pressure was 160 pounds per square inch and the pump was rated to supply 2,400 gallons per hour. The results of the tests were as follows:

Test.	1	2	3
Strokes, number	700	500	320
Pumpage, lbs.	7,329	4,886	3,141
Condensed steam, lbs.	73	56	42
Pumpage ÷ condensation	100.3	87.25	74.78
Delivery pressure, lbs.	172	172	172

What Constitutes a Domestic Water Supply has had to be settled by the English courts recently in two disputes, outlined in the "Journal of Gas Lighting." The first was between a boarding-house keeper and the Yarmouth Water-Works Company. The company claimed that the supply should be classed as one for business purposes, since the landlord sold the water along with other things to the boarders. The landlord claimed that the water was used only for domestic purposes, and that it was the use of the water which settled the nature of the supply. The company's contention was upheld. The second case was between a boarding school and the Barnard Castle Urban District Council, which furnished water to the school swimming tank. The Council held that the water for the tank was not a domestic supply, for the school was a private business, but the judge decided against the claim. If such a proposition was admitted, he said, the water used by the boys for washing their hands, in cooking their food and otherwise, would be a trade supply, which was an extravagant construction of the law.

An Investigation of Oiled Roads in Southern California has recently been made by a committee of the Board of Supervisors of Sacramento County. At one place they found the work done by contract at the rate of $1 per barrel of oil in place. The plant used included two storage tanks, together holding 550 barrels, two smaller heating tanks, an oil-burning boiler and pump for forcing heated oil into a sprinkling wagon, and small accessories. One man runs the plant exclusive of sprinkler. The oil is heated to 180 degrees Fahr. for the first application and to 230 degrees or more for the second, and may be transported for 10 miles in the steel tank of the sprinkling wagon without detrimental loss of heat. In other districts, where the oil is applied cold, the cost is about two-thirds as much, but the result is not so good. In one county, a public heating plant has been built which supplies three districts, and another is under construction. The use of oil is widespread in Southern California, both in towns and in the country, and meets little opposition. Particular mention is made of the good condition of a dirt road over which 3 to 7-ton loads are hauled to a beet sugar plant; this road was graded last spring, and sprinkled twice with about 200 barrels of oil per mile at each application. This is about twice the quantity generally used. The committee recommends oiling existing macadam roads and then covering them with sand or decomposed granite.

Pneumatic Tools operated from a 500-horsepower Ingersoll-Sergeant compressor plant at Union Square are being used very extensively on the Holbrook, Cabot & Daly contract for Section No. 3 of the New York Rapid Transit Railway, which has about 8,000 feet of four-track steel construction. The reaming and riveting on the steel work is all done by pneumatic tools. In a comparative test on different rivets a gang of three men and a heater drove about 50 rivets in two days, and a pneumatic hammer with two men and half the time of a heater drove over 300 rivets in two and a half days. Forty per cent. of the hand rivets and only about two per cent. of the machine rivets were condemned by the inspector. The compressed air has a pressure of about 90 pounds at the power house and above 80 pounds at all places on the line. There are, in the 5-inch distribution pipe three 5 x 3-inch tees on every block, and connections are made to them for the machines, but as the tees have proved to be the weak places in the line and have caused considerable trouble by breaking, it is now believed that it would be better to have only one tee in each block, and that there would be no trouble in carrying the supply to the machines through 200 feet of 2-inch branch pipe. Originally the main air pipe was laid with screwed sleeve connections and no expansion joints, and when the weather became very hot the expansion caused many breaks at the tees which necessitated shutting off the pressure until repairs could be made. Afterward telescopic expansion sleeve joints were inserted every two blocks, since which no trouble has been experienced from breakages.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Melrose Park, Ill.—Bids are wanted Sept. 16 for furnishing and setting up an air compressor in the pumping station, as advertised in The Engineering Record.

Fort Grant, Ariz.—Bids are wanted Sept. 16 for constructing a reservoir and laying water pipe at Ft. Grant. Address Major J. W. Pope, Ch. Q. M., Denver Colo.

Marshall, Mich.—Recorder R. F. Grant writes that on Aug. 29 it was voted to issue $40,000 bonds for water and light improvements.

Winthrop, Minn.—Village Recorder C. E. Larson writes that on Aug. 27 it was voted to issue $10,000 bonds for improving the water-works and electric light plant.

Victor, Colo.—Supt. of Water-Works J. J. McCarthy, writes that the city proposes to build an additional reservoir and dam next spring. Estimated cost $20,000. F. V. Bodfish, Engr. in Charge.

Governor's Island, N. Y. Harbor.—See "Government Work."

Ellensburg, Wash.—City Clk. Geo. Sayles writes that it is proposed to construct water-works, but nothing definite has been done.

Cleveland, O.—Local press reports state that bids will soon be wanted for between 40,000 and 50,000 water meters.

Los Angeles, Cal.—City Clk. C. H. Hance writes that on Aug. 28 it was voted to issue $2,000,000 bonds for the purchase of the water company's plant.

Clifton, Kan.—Mayor S. H. Hamilton writes that water-works are to be built at a cost of $6,000. Pump and engine have been bought but other materials are not yet contracted for.

Wagoner, Ind. Ter.—The City Clerk writes that a vote will be taken Sept. 10 on the issue of $100,000 bonds for water-works.

Elyria, O.—A correspondent writes that the extension of the existing water-works and absorption of same by private parties is contemplated.

Anna, Ill.—City Clk J. L. Hammond writes that Iglehart & Co. of Carbondale, Ill., have made a proposition to the city to construct water-works, but no action has as yet been taken.

Edmonton, Alberta, N. W. Ter.—The municipality contemplates installing water-works, drainage and sewerage. W. Chipman, of Toronto, Consulting Engr.

Springfield, O.—The Water Works Trustees have decided to ask for authority to issue $10,000 additional water-works bonds.

Hempstead (L. I.), N. Y.—This village has voted in favor of purchasing the plant of the Hempstead Water Co. for $50,000.

Washington, Pa.—Bids are wanted Sept. 21 for building a dam or reservoir on the Shields farm, in N. Franklin Township. The amount of earth to be moved is estimated at 125,000 cu. yds. J. V. Clark, Supt. Citizens' Water Co., Washington.

Urbana, O.—Consulting Engineer Snyder, of Columbus, is stated to have recommended the construction of a steel standpipe having a capacity of 275,000 gals.; also the taking up of 6-in. main on E. Lawn Ave. and replacing same with 12-in. main. Estimated cost, $25,000.

Blue Earth City, Minn.—The City Council proposes to expend $7,000 in improving the pumping station and water mains.

Mexia, Tex.—Press reports state that fire destroyed the pumping station of water-works, 2 miles west of town.

Ladonia, Tex.—Press reports state that the Electric Light and Water-Works Co. proposes to put in water-works machinery.

Lewisburg, Tenn.—The proposition to issue bonds for a municipal water and lighting plant is said to be under consideration.

Shreveport, La.—It is stated that this city proposes to purchase the water-works plant.

Wakefield, Mass.—The Wakefield Water Co. has offered to sell its plant to the town for $300,000.

Batesville, Ind.—The proposition to construct water-works is under consideration.

Elmore, Minn.—Bids are wanted Sept. 9 for about 10 blocks of water main extensions. S. C. Moore, Village Recorder.

National Home, Wis.—Bids will be received at the Treasurer's Office, until Sept. 10, for furnishing and laying water main pipes and fittings, also gas pipe and fittings. J. E. Armitage, Treas.

Mountain Lake Park, Md.—The Garrett Water & Light Co., a local concern with a capital of $100,000, is to be organized with a charter under the laws of West Virginia. The object of the company is to supply Mountain Lake Park and Loch Lynn Heights with water and light. The charter will also include the right to build and operate an electric railroad between Deer Park, Loch Lynn, Mountain Lake Park and Oakland. The incorporators are George C. Sturgiss, Morgantown, W. Va.; F. T. Martin, Fairmont, W. Va.; P. T. Garthright, of Mountain Lake Park, Md., and others.

Cloquet, Minn.—According to plans and estimates made by Patton & Frank, the total cost of constructing water and sewerage system is $133,000.

Bonanza, Ore.—Bonanza Irrigation Co. has been incorporated, with a capital of $10,000. Incorporators: E. S. Terwillinger, John S. Sheek and James H. Driscoll.

Roswell, N. Mex.—The Arid Land Reservoir Co. has been incorporated by James F. Hinkle, Wendell M. Reed, Richard F. Barnett and others, of Roswell. The object of the company is to store the waters of the Rio Hondo in Lincoln and Chaves counties and its tributaries and to construct an inlet canal 2¼ miles long, an outlet canal 18 miles long, and another canal 14 miles long. Capital stock, $250,000.

Ft. Yates, N. D.—Bids are wanted Sept. 30 for the construction of a water system at the Standing Rock boarding school. W. A. Jones, Commr. of Indian Affairs, Washington, D. C.

Ft. Mansfield, R. I.—See "Government Work."

Auburn, N. Y.—Bids are wanted by the Water Board until Sept. 11 for the construction of a building at the lower pump house; also for foundations for engine and pump therein.

Glenwood, Minn.—Bids are wanted Sept. 17 for the improvement and extension of the water-works. Loweth & Wolff, of St. Paul, Minn., Engrs.

Stanley, Wis.—The following bids for the complete installation of a water-works and sewerage system were opened Aug. 29 by City Council: Fitzgerald & Norris, Duluth, Minn., $23,043; P. W. Galloway, Chicago, Ill., $22,290; E. T. Webster, Dubuque, Ia., $20,801 (awarded); J. M. Healy, Chicago, Ill., $21,500; King & Steele, Duluth, Minn., $23,865; Aliex Sang, Duluth, Minn., $23,081.

Steamboat Springs, Colo.—Frank V. Alkire, Engr. in Charge, writes that surveys are now being made for an irrigating canal to be built by the Deer Mountain Ditch & Irrigation Co. Amount of land under the ditch, about 10,000 acres. W. B. McClelland and others are promoters.

Sacramento, Cal.—Press reports state that the Committee of Citizens has decided in favor of securing a water supply from the Sacramento River, with necessary mechanical filtration plant.

Los Angeles, Cal.—The Seaside Water Co. has filed a certificate showing the creation of a bonded indebtedness in the sum of $600,000 for the purchase of water rights and the development of its plant.

Guthrie, Okla. Ter.—City Engr. T. A. White is preparing plans for wells; an abundant supply of water has been struck at 40 ft. on Island Park.

St. Louis, Que.—The following bids for extending the water supply to the north and south sides of Canadian Pacific Ry., were opened Aug. 27 by Town Engr. J. Emile Vanier, Montreal, Que.: Henault & Rebin, Montreal, $34,480; Charpentier & Chevalier, Montreal, $33,863; Bastien & Valiquette, Montreal, $33,500 (awarded). Engineer's estimate, $33,844.

Fonda, Ia.—Bids are wanted Sept. 14 for erecting a brick power house at the water plant. S. E. Leece, Mayor.

Hendricks, Minn.—Bids are wanted Sept. 17 (extension of date) for water-works. J. J. Flather, Engr., Minneapolis.

St. Paul, Minn.—Bids are wanted by the Water Board until Sept. 11 for furnishing 6,000 ft. of 6-in pipe.

Tullahoma, Tenn.—Bids are wanted by the Water and Light Commissioners until Sept. 18 for furnishing material and constructing a complete system of water-works and electric lights. There will be required about 435 tons of cast-iron pipe and specials, 52 fire hydrants, 30 valves, 75,000-gal. steel tower and tank 120 ft. high, 100-Kw. dynamos, motor, transformers, arc lamps, etc., 750,000-gal. power pump, brick reservoir, 2-story brick building, 6½ miles of 4, 6 and 8-in. pipe laying, 11 miles of electric transmission line and 5 miles of distribution. Granbury Jackson, Engr., 211 Union St., Nashville.

Stewartville, Ill.—New bids will be asked by the City Council for the construction of water-works, estimated to cost $15.000.

Bedford, Ia.—City Clk. Jas. W. Beauchamp writes that it was voted Sept. 3 to issue $15,000 bonds for a water-works system.

Boston, Mass.—The following bids were opened Aug. 27 for Section 15 of the Weston Aqueduct, Weston, Met. Water Works: A, Winston & Co., Clinton, Mass., $171,645 (awarded); B, the National Cont. Co., New York, $197,556; C, Atkins & McGovern, Boston, $198,485; D, H. P. Nawn, Boston, $212,130; E, the C. H. Eglee Co., Boston, $221,672. For detail bids see accompanying table:

Oakland, Cal.—Press reports state that plans prepared by former City Engr. Clement for storm sewers in the annexed district have been approved and will be carried through with but little change. Estimated cost, $200.000.

Erie, Pa.—The Councils have ordered an ordinance drawn authorizing the issue and sale of bonds to the amount of $170,000 to cover expense of taking sewage out of Mill Creek, in substantially the manner recommended by the "Mill Creek Commission."

Oshkosh, Wis.—Bids are wanted Sept. 23 for furnishing material and constructing a sewer in Minnesota St. Frank Monahan, Chmn. Bd. Pub. Wks.

Detail bids, Section 15, Weston Aqueduct Met. Water-works.

Items and Quantities.	A	B	C	D	E
Earth excav. in open trench, 37,000 cu. yds.	$.42	$.40	$.45	$.50	$.65
Earth excav. in reservoir, 12,000 cu. yds.	.37	.40	[illegible]	.30	.45
Borrowed earth, 34,000 cu. yds.	.32	.30	.30	.35	.45
Rock excav. in open trench, 19,000 cu. yds.	1.40	2.00	1.75	2.00	2.00
Overhaul, 18,000 cu. yds.	.01	.02	.01	.02	.02
Excav. from tunnel, 3,800 cu. yds.	5.00	6.00	6.00	6.00	6.80
Stone filling over arch in tunnel, 600 lin. ft.	1.00	1.00	1.50	1.00	1.00
Tunnel drainage, 700 lin. ft.	.50	1.00	1.00	1.00	.75
Br. mas. in open trench, laid in nat. cement mortar (1:2), 1,600 cu. yds.	11.00	13.00	12.75	12.50	13.50
Nat. cement concrete mas., in open trench (1:2:5), 7,400 cu. yds.	3.80	4.55	5.00	4.75	4.75
Port. cement concrete mas. in open trench (1:2½:4½), 6,700 cu. yds.	5.10	5.55	5.50	6.50	5.85
Port. cement concrete mas. for lining in tunnel (1:2½:4½), 330 cu. yds.	7.00	6.55	6.00	7.50	6.80
Port. cement concrete mas. for lining in tunnel (1:3:6), 640 cu. yds.	6.00	6.60	5.00	7.00	6.00
Port. cement concrete mas. for backing in tunnel (1:2½:4½), 20 cu. yds.	3.50	3.275	3.00	3.75	3.40
Port. cement concrete mas. for backing in tunnel (1:3:6), 100 cu. yds.	3.00	3.30	3.00	3.50	3.00
Dim. stone mas. laid in mortar, 150 cu. yds.	30.00	25.00	30.00	40.00	40.00
Face dressing of pointed work, 2,000 sq. ft.	.55	.50	.40	.50	.40
Dry rubble stone masonry, 40 cu. yds.	3.00	4.00	5.00	6.00	5.00
Dry rubble stone paving, 100 cu. yds.	3.00	3.00	3.00	5.00	5.00
Riprap, 100 cu. yds.	1.00	1.00	3.00	3.00	1.50
Lumber placed in found., 5 M. ft. B. M.	35.00	40.00	40.00	40.00	40.00
Laying iron pipe for culverts, 55 tons	10.00	10.00	5.00	10.00	10.00
Placing iron-work in screen and terminal chambers, 80 tons	10.00	10.00	10.00	10.00	10.00

Boston, Mass.—The following bids were opened Aug. 27 for Section 11 Weston Aqueduct, Wayland, Met. Water-Works: A, Winston & Co., $148,635 (awarded); B, T. Stuart & Son Co., $157,270; C, The National Cont. Co., $160,780; D, Jas. D. Kelly, Pawtucket, R. I., $170,390; E, Beckwith & Quackenbush, $170,913; F, H. P. Nawn, $172,995; G, Long & Little, $174,685; H, The C. H. Eglee Co., $176,600; I, Atkins & McGovern, $177,435; J, Chas. G. Belden & Co. $204,405. For detail bids see accompanying table.

Garrett, Ill.—Town Clk. J. F. Adolph writes that the following bids for constructing about 18,567 ft. of from 24 to 8-in. tile drains were opened Aug. 24 by the Drainage Commrs. of Drainage Dist. by User No. 1: Summitville Tile Works, Montezuma, Ind., per G. R. Witney, $6,270; W. E. Dee, Chicago, Ill., per M. Mansfiel, $9,500; Chas. R. Lewis, Tuscola, $6,300.

Nampa, Idaho.—The proposition to issue bonds for a sewerage system is stated to have carried.

Detail bids, Section 11, Weston Aqueduct, Wayland, Met. Water-works.

Items and Quantities.	A	B	C	D	E	F	G	H	I	J
Earth excav, 111,000 cu. yds.	$.32	$.35	$.35	$.39	$.30	$.40	$.37	$.40	$.45	$.48
Borrowed earth, 30,000 cu. yds.	.25	.30	.25	.25	.27	.30	.29	.35	.30	.33
Rock excav., 2,000 cu. yds.	1.50	1.90	2.00	2.00	1.50	2.00	2.00	2.00	2.00	3.00
Overhaul, 5,000 cu. yds.	.01	.01	.02	.01	.02	.02	.02	.02	.01	.03
Brick mas. in nat. cement mortar (1:2), 2,050 cu. yds.	11.00	12.00	13.00	13.00	12.50	12.50	14.00	13.00	12.50	13.50
Nat. cement concrete mas. (1:2:5), 11,200 cu. yds.	3.80	3.95	4.00	4.50	5.24	4.25	4.60	4.50	4.50	5.50
Port. cement concrete mas. (1:2½:4½), 6,800 cu. yds.	5.30	5.25	5.55	5.50	6.00	6.00	5.75	5.75	5.50	5.50
Dim. stone mas. laid in mortar, 10 cu. yds.	50.00	30.00	25.00	35.00	50.00	50.00	40.00	50.00	30.00	25.00
Face dressing of pointed work, 300 sq. ft.	.60	.40	.50	.40	.45	.50	.60	.50	.50	.50
Dry rubble stone mas., 20 cu. yds.	4.00	4.50	4.00	3.00	4.50	6.00	3.50	5.00	5.00	5.00
Dry rubble stone paving, 20 cu. yds.	4.00	4.00	3.00	1.00	4.50	5.00	3.50	5.00	3.00	5.00
Lumber placed in found., 5 M. ft. B. M.	35.00	40.00	40.00	30.00	33.00	40.00	35.00	40.00	40.00	40.00
Laying iron pipe for culverts, 40 tons	10.00	6.00	10.00	10.00	8.00	10.00	15.00	10.00	5.00	20.00

Boston, Mass.—The following bids were opened Aug. 27 for Sections 8 and 10, Weston Aqueduct, Wayland, Met. Water-Works: Winston & Co., Clinton, Mass., $146,139 (awarded); T. Stuart & Son Co., Newton, Mass., $155,509; Long & Little, Leominster, Mass., $162,399; Atkins & McGovern, Boston, $162,655; the National Cont. Co., New York, N. Y., $163,233; H. P. Nawn, Boston, $164,635; Beckwith & Quackenbush, Boston, $169,467; the C. H. Eglee Co., Boston, $172,570; Bruno, Solomone & Petitte, E. Boston, Mass., $175,538; H. A. Hanscom & Co., Boston, $183,155; Chas. G. Belden & Co., Quincy, Mass., $204,640.

The detail bid of the successful bidder, Winston & Co., was as follows: Earth excav., 71,000 cu. yds., 30 cts.; borrowed earth, 80,000 cu. yds., 18 cts.; rock excav., 1,700 cu. yds., $1.75; overhaul, 10,000 cu. yds., 1 cent; brick masonry, laid in natural cement mortar (1 : 2), 2,000 cu. yds., $11; natural cement concrete masonry (1 : 2 :5), 12,000 cu. yds., $3.85; Portland cement concrete masonry (1 : 2½ : 4½), 7,050 cu. yds., $5.30; dimension stone masonry laid in mortar, 5 cu. yds., $50; face dressing of pointed work, 140 sq. ft., 60 cts.; dry rubble stone masonry, 20 cu. yds., $4; dry rubble stone paving, 20 cu. yds., $4; lumber placed in foundations, 3 M ft. B. M., $35; laying iron pipe for culverts, 15 tons, $10; placing ironwork in siphon chambers, 105 tons, $10.

SEWERAGE AND SEWAGE DISPOSAL.

Greenville, Pa.—Bids are wanted Sept. 23 for pipe sewers, as advertised in The Engineering Record.

Leicester, England.—Plans and bids are wanted by the Sewage Works & Farms' Committee of the Leicester Corporation until Oct. 1 for pumping machinery in connection with the borough sewage disposal at Belgrave and Beaumont, Leys Farm. Full particulars may be obtained at the Borough Surveyor's office on payment of the sum of £5. E. George Mawbey, M. Inst. C. E., Boro. Engr. and Surveyor.

Edgewood, Pa.—Bids are wanted Sept. 9 for the construction of a sanitary sewer on Elm St. R. L. Smith, Boro. Engr., 1011 Park Bldg., Pittsburg.

Washington, D. C.—See "Government Work."

Birmingham, Ala.—Bids are wanted Sept. 18 for 7,000 lin. ft. of 8-in. pipe sewers. Julian Kendric, City Engr.

Salina, Kan.—J. P. Force, of Columbus, O., is stated to have prepared plans for a sewer system and a sewage disposal plant for this city.

Newark. N. J.—The Board of Works has approved plans for the construction of storm water sewers to relieve the section bounded by So. Orange Ave. and Academy St. Cost, $10,000.

So. Portland, Me.—The City Council has authorized the construction of the north branch of Ocean St. sewer and Summer St. sewer, also the issue of $10,000 bonds for payment of same.

Rome, N. Y.—The City Engineer has been requested to prepare an estimate of the cost of constructing sewers on several streets.

Cloquet, Minn.—See "Water."

Lockport, N. Y.—The City Engineer has been directed to prepare plans and specifications for a sewer in Lock St.

Bowling Green, O.—Henry Gantz is stated to have received the contract for constructing sewers in several streets for $35,287.

White Plains, N. Y.—Bids are wanted Sept. 9 for constructing a lateral sewer in East View and Oakley Aves. and a trunk sewer from the easterly terminus of Oakley Ave. to sewer across Hall swamp. John J. Brown, Pres. Bd. of Village Trustees.

St. Paul, Minn.—Bids are wanted Sept. 9 for the construction of sewers on Cypress and Winslow Sts., and until Sept. 12 for a sewer in Van Buren St. F. O. Hammer, Pres. Bd. Pub. Wks.

Edmonton, Alberta, N. W. T.—See "Water."

Great Falls, Mont.—City Engr. C. W. Swearingen writes that the following bids were opened August 19 for sewer work, to include 4,408 ft. of 9-in. pipe sewer with 11 manholes and 1 flush tank, the trench to average 15 ft. in depth excavated in equal parts earth, soft rock and solid rock: T. R. Hinds, Butte, Mont., $10,371 (awarded); Jas. Ryan, Butte, $11,248; Daniel McKay, Great Falls, $11,445; Gust Lund, Great Falls, $11,926; Peter Oren, Butte, $12,055; H. R. King, Great Falls $12,437.

Milwaukee, Wis.—Bids are wanted Sept. 10 for constructing Section No. 4 of the West side intercepting sewer. Chas. J. Poetsch, Commr. of Pub. Wks.

Oelwein, Ia.—Bids are wanted Sept. 16 for the construction of sanitary sewers to be made of salt-glazed vitrified pipe. H. V. Hoyer, City Clk.

Austin, Tex.—The only bid received Aug. 26 for the extension of Warburton Ave. sewer was from Chas. Pearsall & Son at $10,500. New bids will be received by the City Clerk on Sept. 23.

Des Moines, Ia.—The City Council has passed a resolution for the extension of sewers in Lake, Oak and Highland Parks.

Delray, Mich.—Press reports state that the lowest two bids received July 27 for constructing the proposed sewer, were John G. Affeld & Son at $41,900 and John Wanger at $47,997.

Mt. Vernon, N. Y.—The Commissioner of Public Works has been instructed to prepare plans for a lateral sewer in Elm and Railroad Sts.

Oswego, N. Y.—The City Engineer has been instructed to prepare plans and estimates of the cost of constructing Helen St. sewer.

Bridgeport, Conn.—Health Officer McLellan recommends the construction of a trunk sewer in Arctic St.

New York, N. Y.—Bids are wanted Sept. 16 for constructing a private sewer in school 182, Unionport, Boro. of Bronx. Richd. H. Adams, Chmn. Com. on Bldgs., Bd. Educ.

Stanley, Wis.—See "Water."

Hartford, Conn.—It is stated that bids are wanted Sept. 15 for constructing 2,400 ft. of 30-in. brick intercepting sewer and until Oct. 1 for pipe sewers in Wilson St., to cost about $9,000. C. H. Bunce, City Engr.

Swissvale, Pa.—The contract for constructing the 5th section of the sewerage system has been awarded to John Dell, of Braddock, for $24,800.

Haddonfield, N. J.—The contract for constructing a system of sewerage and sewage disposal has been awarded to John Quinlin of So. Amboy, for $30,689.

Columbia, S. C.—The Council has elected R. W. Shand, W. J. Murray, Edward Ehrlich, Dr. J. W. Babcock and Chas. Narey as the Sewerage Commission, to take entire charge and supervision of the construction and completion of a system of sewerage for this city.

Yonkers, N. Y.—Bids are wanted Sept. 23 for the extension of the Warburton Ave. outlet sewer, consisting of a crib pier and a cast iron pipe outlet sewer. John Pagan, Jr., City Clk.

Iola, Kan.—The question of constructing a sewer system is under consideration.

New Brunswick, N. J.—Local press reports state that bids will be received by the City Council until Sept. 10 for sewers in portions of 3 streets.

Omaha, Neb.—Bids are wanted Sept. 13 for pipe sewers in sewer district No. 265. Wm. Coburn, Secy. Bd. Pub. Wks.

Oneida, N. Y.—Albert E. Loomis, of the Board of Public Works, has prepared amended plans for the sewerage system in the 5th Ward on the North Side and the 3d Ward in the west end of the city.

Cincinnati, O.—Bids are wanted Sept. 16 for sewers and drains in several streets. Geo. F. Holmes, Clk. Bd. Pub. Service.

Toledo, O.—Bids are wanted Sept. 23 for 8, 10, 12 and 15-in. circular pipe sewers in several streets. John E. Connell, City Clk.

BRIDGES.

Chillicothe, O.—Bids are wanted Sept. 13 for furnishing material and constructing the superstructure and substructure of a 100-ft. single span bridge on Richmond Dale and Jackson Pike, to be 16 ft. wide and have a capacity of 100 lbs. per sq. ft. Harry S. Adams, Co. Aud.

Chicago, Ill.—Bids are wanted by the South Park Commrs. until Sept. 11 for constructing a granite-faced concrete and steel bridge, 180 ft. long and 80 ft. wide, on Jackson Park. J. F. Foster, Engr.; E. G. Shumway, Sec'y.

Rutland, Vt.—The bids for a steel bridge which were received Aug. 19 have been rejected and new bids called for to be opened Sept. 16 before the Board of Aldermen.

Milwaukee, Wis.—Ch. Engr. D. J. Whittemore has been selected by the Milwaukee R. R. Co. to confer with the city officials regarding a new bridge across Menominee River east of West Water St. bridge, which is to be replaced by the city with a bascule structure.

Chicago, Ill.—Press reports state that the Normal School Trustees have decided to build an iron bridge across Kishwaukee River, connecting the Normal campus with the Ellwood addition.

La Crosse, Wis.—Press reports state that the Milwaukee R. R. Co. has decided to make various improvements to its system and adjacent to La Crosse, including the rebuilding of the iron bridge across Mississippi River. Probable total expenditure, $100,000.

Kansas City, Mo.—The Railroad and the City have agreed to construct a viaduct at Allen St. Cost, $80,000; $72,000 for the viaduct proper and $8,000 for the approaches which are to be built by the city.

Tullytown, Pa.—The Nelson & Buchanan Co., New Chambersburg, Pa., is stated to have secured the contract for building a bridge at Main St. for $6,368.

Connellsville, Pa.—It is stated that as soon as plans have been completed bids will be asked by the Connellsville Bridge Co. for constructing the Youghiogheny River bridge between Connellsville and New Haven.

Bloomfield, Mo.—Mr. Huffman has been ordered to estimate the cost of building a bridge on Essex and Gray Ridge Road.

Waterloo, Ia.—The City Council is considering the construction of a Melan arch bridge across Cedar River, to cost $50,000.

Erie, Pa.—Plans are being formulated for the building of an iron overgrade bridge over Penna. R. R. tracks on Buffalo Road, east of East Ave., to carry roadway, walk and street car track. Buffalo Road is practically on level grade. Railroad company will require about 20 ft. clear heading, 170 ft. to be spanned in one or two spans.

Battle Creek, Mich.—It is stated that the Council has awarded the contract for plans and specifications for Jefferson Ave. to the American Bridge Co., of Toledo, O.

Newport, Ky.—The construction of a viaduct at 6th St., connecting with Bellevue, is said to be under consideration.

Momence, Ill.—Press reports state that plans are being prepared for a bridge, to be constructed across Kankakee River, on the State line.

Swampscott, Mass.—A hearing will be given the Board of Selectmen, by the County Commisisoners, Sept. 27, on the proposed construction of a bridge at Essex St., over the Boston & Maine R. R.

Jefferson, Ore.—J. B. Tillotson is stated to have submitted to the County Courts of Linn and Marion the lowest bid for rebuilding the bridge across Santiam River, at Jefferson, at $5,674.

Pratt City, Ala.—It is stated that bids will be received at the office of the County Board of Revenue, Birmingham, until Sept. 10, for constructing a one-span steel bridge across Village Creek, at Pratt City. Address J. F. B. Jackson, Ch. Road Superv., Birmingham.

Long Island City, N. Y.—The Local Board has adopted a resolution providing for the terminating of the approaches of Ravenswood bridge on East River at 10th St., L. I. City, and to ask the Board of Estimate and Apportionment to appropriate $5,000,000 to carry on the work of constructing said bridge.

Northfield, Mass.—Local press reports state that Francis Schell, of New York and Northfield, has offered the town a gift of $32,000 for a bridge across Connecticut River about half a mile above the Central Vermont R. R. bridge.

Terre Haute, Ind.—The County Council has, it is stated, indefinitely postponed the building of the bridge over Wabash River at Main St.

Chicago, Ill.—Local press reports state that bids will soon be asked for constructing a bridge at W. Division St., on the west side of Goose Island, to cost about $150,000.

Reading, Pa.—The Highway Committee of Councils has decided to report in favor of the ordinance granting the Reading Bridge and Warehouse Co. permission to construct an overhead steel or iron bridge at So. 6th St.

Topeka, Kan.—The residents of Mission Township have petitioned the County Commissioners to construct a $16,000 bridge across Kaw River at the sugar mill.

Bemidji, Minn.—Bids are wanted Sept. 13 for the construction of a bridge across Mississippi River between Sections 19 and 20 in Bemidji. W. Wright, Chmn. Co. Bd., Bemidji.

Milwaukee, Wis.—Bids are wanted Nov. 1 for the construction of a highway bridge across Milwaukee River from Broadway to Lake St. Chas. J. Poetsch, Commr. of Pub. Wks.

Paducah, Ky.—Press reports state that plans are being drawn for a $500,000 bridge to be built by the Illinois Central R. R. Co. over Tennessee River, 17 miles from Paducah, on the Louisville division.

Seattle, Wash.—The Seattle Bridge Co. is stated to have received the contract for constructing a bridge over Spokane Ave. to W. Seattle, for $16,645.

PAVING AND ROADMAKING.

Green Bay, Wis.—City Clerk Kerr writes that the contracts for paving Jefferson and Cherry Sts. have been awarded to J. K. Delaney of Green Bay, at $25,764, and T. J. McGrath, Green Bay, at $16,500, respectively.

Birmingham, Ala.—Bids are wanted Sept. 18 for 5,000 cu. yds. earth excavation; 1,400 cu. yds. slag; 1,400 cu. yds. chert; 1,500 sq. yds. brick gutter paving; 2,200 sq. yds. vitrified brick driveways; 18,000 sq. yds. vitrified brick on concrete and 49,500 sq. yds. cement sidewalk. Julian Kendrick, City Engr.

Indianapolis, Ind.—Bids are wanted Sept. 13 for grading and paving with brick in 4 streets. Albert Sahm, Chmn. Bd. of Pub. Wks.

Edgewood, Pa.—Bids are wanted Sept. 9 for grading, curbing and paving Pennsylvania Ave. for a distance of 300 ft. R. L. Smith, Boro. Engr., 1011 Park Bldg., Pittsburg.

Upper Alton, Ill.—The Village Council has passed a resolution providing for paving a portion of College Ave., at an estimated cost of $23,000.

Jerseyville, Ill.—The City Council has passed an ordinance providing for the paving of a portion of Pearl St.

Niagara Falls, N. Y.—A petition is being circulated, asking for the paving of Pierce Ave.

Stapleton, N. Y.—The Board of Public Improvements has decided to repave Bay St., on both sides of the trolley tracks, with granite block, at an estimated cost of $13,700.

Seattle, Wash.—Stirrat & Goetz are stated to have submitted the lowest bid for macadamizing a portion of E. Madison St., at $28,823.

Sheboygan, Wis.—Press reports state that bids received for macadamizing N. Seventh St. have been rejected.

San Francisco, Cal.—The Board of Public Works has granted a petition of Chauncey R. Winslow and others requesting the paving of Pacific Ave., between Franklin and Fillmore Sts., excepting one block with bituminous rock.

Graham, Ind.—Graham township is reported to have voted in favor of the construction of 26 miles of gravel road.

Ossining, N. Y.—The Village Trustees have decided to issue $300,000 bonds for road improvements.

Irwin, Pa.—Bids are wanted Sept. 11 for $50,000 bonds for grading and paving. S. D. Sauffer, Boro. Secy.

Savannah, Ga.—It is stated that bids are wanted Sept. 21 for 10,000 yds. of brick paving, etc. G. M. Gadsden, Dir. Pub. Wks.

Hancock, Mich.—It is stated that bids are wanted Sept. 10 for brick paving on Quincy St., to cost about $25,000. S. D. Austin, Engr., Milwaukee, Wis.; A. J. Scott, Mayor.

Kenton, O.—According to press reports this city is preparing to issue $15,000 paving bonds.

Lima, O.—Bids are wanted Sept. 13 for grading, curbing and paving with sheet asphalt on Brice Ave. 1,900 sq. yds., and on Richie Ave. 1,725 sq. yds. C. E. Lynch, City Clk.

Muncie, Ind.—Bids are wanted Sept. 23 for the improvement of Brotherton St. F. W. Clevenger, City Clk.

Union, N. J.—Bids are wanted Sept. 9 for improving a portion of Main St. by flagging, curbing and paving the roadway with Belgian block. Chas. Singer, Jr., Town Clk.

Erie, Pa.—Bids will probably be asked, to be received Sept. 16, for repaving State St., 12,000 yds., with brick on sheet asphalt, with 3-ft. brick gutters. Estimated cost, $25,000.

Des Moines, Ia.—Bids are wanted Sept. 19 for about 8,398 sq. yds. of asphalt paving on W. 8th St. G. A. Eberhart, Chmn. Bd. of Pub. Wks.

Youngstown, O.—Bids are wanted Sept. 21 for paving on one street and curbing on two streets. C. E. Cross, City Clk.

East Chicago, Ind.—Bids are wanted Sept. 16 for improving Tod Ave. for a distance of 2,900 ft. by macadamizing and curbing with limestone. H. E. Jones, City Clk.

Peoria, Ill.—The Board of Local Improvements has decided to pave Peoria Ave. with brick on a gravel foundation.

Moline, Ill.—The Tri-City Construction Co., according to reports, has secured the contract for brick pavement on a portion of 16th St., at $16,300.

Buffalo, N. Y.—Local press reports state that the Board of Public Works opened the following bids Aug. 30, for improving Hamburg Turnpike: *a*, Roadway, 26 ft. wide, 11,350 cu. yds. of filling and 6 sluices; *b*, roadway, 20 ft. wide, 800 cu. yds. of filling and 12,225 sq. yds. of stone foundation: Miller & Franklin, *a* $16,000, *b* $14,500; Mosier & Summers, *a* $8,945, *b* $11,945; John Mumm, *a* $8,800, *b* $13,900; Ryan & Danahy, *a* $13,900, *b* $12,890; J. Seabell, *a* $8,990, *b* $11,300; German Rock Asphalt Company, *a* $14,777, *b* $13,154.

Brainerd, Minn.—The Council has authorized the City Engineer to prepare plans and specifications for macadamizing and paving 6th St. S.

St. Paul, Minn.—The Board of Public Works on Aug. 28 is stated to have awarded the contract for macadamizing East Seventh St. with granite, to the James Forrestal Co., of St. Paul, at $29,745.

Milwaukee, Wis.—The contract for paving E. Water St. is stated to have been awarded to the Western Paving & Supply Co., at $2.45 a sq. yd.; total, $12,669.

Glen, N. Y.—Local press reports state that a road is to be built, with State aid, from Fultonville to Glen, about 4 miles, at a cost of $36,000.

Lakewood, N. J.—The County Board of Freeholders has agreed to build a State road, 7½ miles long, from Lakewood to Point Pleasant, at a probable cost of $25,000.

Alexandria, Va.—Ordinances have been passed by the City Council providing for the paving of portions of King and Alfred Sts. with vitrified brick.

Seattle, Wash.—Sterrat & Goetz are stated to have submitted the lowest bid for macadamizing East Madison St., from Broadway to 23d St., at $28,823.

Sioux City, Ia.—The City Council has decided to readvertise for bids for repairing and repaving the 4th St. viaduct. The lowest bid received Aug. 13 is reported to have been $18,374.

Newark, N. J.—J. Roosevelt Shanley is reported to have secured the contracts for granite block pavement on Chapel St. and Vernon Ave. at $13,638 and $29,082 respectively. The awarding of the contract for brick pavement on these streets was laid over indefinitely.

The following ordinances have been passed by the Board of Public Works, on third reading: Paving of Franklin St. with asphalt or creosoted wood, Pennington St. with granite or brick, and Lincoln Ave. with asphalt, brick or telford.

New Brunswick, N. J.—Bids are wanted Sept. 19 for brick pavement on Spring alley and Seaman St.; telford pavement, 12 in. deep on Kirkpatrick St., and for curbing and guttering with round stone on Mine St. Chas. A. Oliver, Chmn. Sts. & Roads Com.

Kewanee, Ill.—City Engr. John Eaton Shepardson writes that contracts for paving Chestnut and Prospect Sts. have been awarded as follows: To A. E. Rutledge & Co., of Rockford, Ill., 6,101 cu. yds. of excavation at 20 cts., and 11,112 sq. yds. of brick paving at $1.73; to Stamsen & Blome, of Chicago, 8,006 lin. ft. of combined concrete curb and gutter at 53 cts.

Lowell, Mass.—P. F. Bradys, Supt. of Streets, writes that the following bids for furnishing material and laying about 18,000 sq. yds. of sheet asphalt pavement on Broadway and Suffolk St. were opened Aug. 31: Prices given are per sq. yd. with 10 and 5 year guarantee respectively: Union Paving Co., Worcester, $2.74, $2.49; Boston Asphalt Co., Boston, $3.20, $2.79; Merrimack Paving Co., Lowell, $2.73 (awarded), $2.60.

Salem, O.—B. M. French, City Engr., writes that the City Council has passed plans and resolutions to lay 28,500 sq. yds. brick pavement and 5,300 sq. yds. asphalt block.

Chester, N. Y.—Bids are wanted Sept. 16 (extension of date) for furnishing labor and material for a telford road. W. A. Lawrence, Village Pres.

Indianapolis, Ind.—Bids are wanted Sept. 16 for brick pavement on portions of Adelaide St. and first alley north of 13th St.; also for cement sidewalks on several streets. Albert Sahm, Chmn. Dir. Pub. Wks.

POWER PLANTS, GAS AND ELECTRICITY.

Los Angeles, Cal.—The Ice & Cold Storage Co. has applied for a 30-year refrigerating pipe line franchise and bids for same will be received by the city until Sept. 24.

Abbeville, La.—A. G. Nauck, Mgr. of the proposed electric light plant, writes that bids are wanted on high-speed automatic engines of 25 and 80 H.-P., 2 boilers of 75 H.-P. each; also 300 and 1,000 light dynamos. Estimated cost of plant, $12,000.

Winthrop, Minn.—See "Water."

Providence, R. I.—Geo. B. Francis, Ch. Engr. of the R. I. Suburban Ry. Co., writes that plans have been prepared for a power station on Manchester St., said building to have a floor area of 200 x 150 ft. and be supported on a piling and concrete foundation. Bids are now being received for the foundation work.

Lewisburg, Tenn.—See "Water."

Altoona, Pa.—The Common Council, by a vote of 12 to 5, on Sept. 2 passed ordinances over the Mayor's veto, authorizing the Bell and United Telephone & Telegraph Cos. to place their wires in underground conduits, in the streets, avenues and alleys of the city. Select Council passed the same ordinances over Mayor's veto Aug. 19, by a unanimous vote.

St. Joseph, Mo.—City Electrician W. C. Stewart writes that it is proposed to improve the electric light plant at an estimated cost of $6,000.

Bradner, O.—Town Clk. H. C. Ahlf writes that the proposition to put in a municipal electric light plant at a cost of $12,000 will be voted upon Sept. 28.

Denver, Colo.—A bill before the Board of Aldermen provides for the granting of a 20-year franchise to Charles A. Marshall to construct and maintain, in the streets, pipes and mains for a new steam heating plant.

Marshall, Mich.—See "Water."

Spokane, Wash.—It is stated that the Spokane Gas Co. contemplates spending $700,000 for improvement, extensions and probable removal.

Bakersfield, Cal.—Press reports state that the California Power Co. proposes to build a power house that will cost $1,750,000. The directors of the company are: Henry Fisher, John S. Cravens, George B. Ellis, W. S. Tevis, F. P. Morrison ,D. O. Johnson and H. H. Sinclair.

Tullahoma, Tenn.—See "Water."

Rochester, N. Y.—The Citizens Light & Power Co. is about to erect a $150,000 fireproof building on the river bank. Architect Thos. E. Murray. Builders, A. Friederich Sons.

Rockville, Md.—W. W. Welsh writes that the municipality will not rebuild the electric light plant recently damaged by fire, but that the plant will be offered for sale, the town to purchase light from party operating said plant.

Fremont, O.—Two ordinances are before the Council, one granting to A. H. Jackson, W. E. Proctor, T. H. Jungk and W. W. Esch the right to lay pipes along the streets and alleys of the city for the purpose of supplying hot water or steam for heating purposes, and the other granting to the same parties the right to string wires and set poles for the purpose of furnishing electricity for heat, light and power.

Tacoma, Wash.—Press reports state that Commissioner of Public Works Clark will receive bids Sept. 11 for 300 alternating-series arc lamps to cost about $7,500, and 240 electric light meters to cost about $2,500.

Mountain Lake Park, Md.—See "Water."

Buffalo, N. Y.—The Western New York Power Co. has been incorporated with a capital stock of $50,000 to furnish electricity for heat, light and power purposes in various cities in that part of the State; Ed. S. A. McLeod, W. F. Frampton, and Fred. B. Hartzell, of Buffalo, are reported directors.

Gainesville, Ga.—A. J. Warner, of Dahlonega, is reported president of a company which proposes to build a water-power plant on the Chattahoochee River to run an electric railway.

Troy, O.—The Trustees of the Electric Works have been authorized to install a plant for heating buildings, utilizing exhaust steam.

Jacksonville, Fla.—An appropriation of $30,000 has been made to repair and improve the electric light plant.

St. Paul, Minn.—Local press reports state that the Edison Electric Light & Power Co. has obtained a permit to erect an $8,000 building in which it will place machinery, to cost about $85,000, to augment the Apple River plant.

Oroville, Cal.—The Bay Counties Power Co., San Francisco, is said to have plans to erect a large water power plant 20 miles northeast of this place on French Creek.

Saginaw, Mich.—The Council has authorized the construction of a municipal lighting plant.

Black River Falls, Wis.—Wm. Burgess, of Duluth, Minn., Pres. of the Black River Falls Co., writes that an electric plant is to be built at an estimated cost of $300,000. Engr. in Charge, Thos. McGilvray, of Duluth.

Mangum, Okla. Ter.—Col. A. J. McGeagh, of Chicago, is said to have a franchise for establishing an electric-light. ice, steam laundry and water-works plant.

London, England.—Bids will be received by the London County Council at Spring Gardens, S. W., until Oct. 8, for furnishing and supplying two 2,500 I.-H.-P. vertical steam engines, each coupled direct to a three-phase 1,500-Kw. generator working at 6,500 volts between conductors, each with an exciter, and for one 750-Kw. reversible synchronous motor generator with exciter, designed so that either the low-tension or the high-tension side of the set will act as generator, and for the erection of these sets in the Council's generating station at Greenwich. Also for nine 300-Kw. synchronous motor generators working at from 550 to 600 volts on the low-tension side, each with an exciter, and for three 50-Kw. induction motor generators, working at from 200 to 225 volts on the low-tension side, and the erection of these sets in sub-stations provided by the Council. Drawings, form of contract, specifications, etc., may be obtained at the Engineer's Department, County Hall, Spring Gardens, S. W., upon the payment of £3. G. L. Gomme, Clk. of Council.

Keokuk, Ia.—In a report upon the development of the water power of the Des Moines rapids, Lyman E. Cooley states that the most practicable plan is to construct a dam and canal on the east side of the river, the canal extending five miles north, and the dam extending out into the river from the head of the canal. This would produce 43,000 horse-power and would cost about $3,600,000. The addition of a tail-race at a cost of $1,050,000 would increase the available horse-power to 50,000.

Pittsfield, Mass.—Bids are wanted by the Berkshire Ry. Co. until Sept. 11 for a power station in Pittsfield. Chas. K. Stearns, Engr., 93 Federal St., Boston.

ELECTRIC RAILWAYS.

San Bernardino, Cal.—Application having been made to the City Board of Trustees for a franchise to construct, operate and maintain, for a term of 49 years, a single track electric railroad on E St.; bids for same will be received by them until Sept. 24. Legare Allen, City Clk.

Traverse City, Mich.—The citizens of Peninsula Township have voted $20,000 bonds toward the building of an electric railway, 18 miles long, to Old Mission.

Alpena, Mich.—The Alpena, Gaylord & Western Ry. Co. has been granted a franchise.

Tiffin, O.—An electric railway between Tiffin and Kenton, via Sycamore and Nevada, is said to be contemplated.

Conneaut, O.—The Conneaut & Southern Ry. Co. has been incorporated, with a capital stock of $10,000, to build a railway from Conneaut to Kingsville. Incorporators: George J. Chapman, Clifford W. Smith, George W. Cleveland, and others.

Bethel, O.—The Clermont County Commissioners have granted a franchise to the Suburban Traction Co., G. R. Scrugham, Pres., to operate an electric railway over the Ohio turnpike. This line will be constructed from Einwood, Cincinnati, to Bethel, a distance of 25 miles, and will pass through the towns of Mt. Washington, Cherry Grove, Withamsville, Amelia ,Batavia and Bethel.

Canastota, N. Y.—The Canastota & Morrisville Railway Co. has been incorporated with a capital stock of $200,000 to construct an electric road 15 miles long in Madison County, connecting Canastota with Morrisville. The directors are Leander W. Burroughs, John Reidy, of Morrisville; Wm. H. Patten, of Canastota, W. Emmett Coe, of Peterboro, and others.

Ensley, Ala.—Articles of incorporation have been filed for the Steel Cities Railway Co., with a capital stock of $500,000. J. W. Minor, of Ensley, is Pres., and P. A. Eubank; of the same place, Sec. The company will build a system of electric railroads connecting the towns of Ensley, Pratt City, Wylam, Adamsville, Brookside, Fieldstown and Bessemer, forming a system of about thirty miles of road.

Portland, Ore.—The West Side & Suburban Ry. Co. has been incorporated by W. N. Sayre, J. W. Selover and A. Graydon with the purpose to build an electric line from Portland to Forest Grove. Capital, $250,000.

San Jose, Cal.—The Board of Supervisors has awarded electric railway franchises covering 90 miles of road to George T. Dunlop, of Gilroy.

Atlantic City, N. J.—The Chelsea Heights Traction Co. has been incorporated, with a capital of $100,000, by Kennedy Crossan, of Philadelphia, John T. Dyer, of Scranton, and I. G. Adams, of Atlantic City, for the purpose of running a line from the lower section of this city to Pleasantville.

Mankato, Minn.—Press reports state that Engineer Burch, of Minneapolis, has been engaged to make surveys and estimates for the proposed electric road for this city and towns in this vicinity.

Belton, Tex.—O. L. Braily and C. T. McFreary have petitioned for a franchise to build an electric railway from Belton to Temple, a distance of about 8 miles.

El Paso, Tex.—Mayor Hammett has signed the ordinance granting the El Paso & Juarez Traction Co. right of way for an electric street railway system in the city.

Danville, Ill.—It is stated that an electric railway connecting Danville with the Ft. Wayne & Southwestern line, is contemplated.

Moline, Ill.—The Moline, East Moline & Watertown Street Ry. Co. has asked for a franchise to operate the line over the streets of this city. Col. U. P. Hord, Promoter.

Carlisle, Pa.—The City Council has granted a franchise to the Baltimore, Westminster & Gettysburg St. Ry. Co. According to press reports, the company will lay over 100 miles of track.

Wabash, Ind.—L. S. Nelson, of Fort Wayne, representative of the Ft. Wayne & Southwestern Traction Co., has petitioned the City Council for a franchise.

Denver, Colo.—The Denver Tramway Co. is about to build a $40,000 brick and stone electric power house, at Platte and 15th Sts.

Freedom, Pa.—A charter has been granted to the Freedom & Conway Electric St. Ry. Co. to construct a road 2 miles long, from Freedom to Economy Township; capital, $12,000. William Redwood Wright, of Philadelphia, is the President. The line will be an extension of the Beaver Valley Traction Co.'s lines in the valley.

Erie, Pa.—The Erie Rapid Transit St. Railway Co. will soon connect with Erie electric motor lines on east City Limits.

Apollo, Pa.—Engineers are at work perfecting the plans for the proposed electric railway to connect Apollo, Vandergrift and Leechburg.

Harrisburg, Pa.—The Harrisburg & Lewisberry Railway Co. has been incorporated with a capital of $42,000. J. K. Foreman, of Cumberland County, is the President. The route is from New Cumberland to Lewisberry, a distance of 7 miles.

Stevensville, Mont.—Attorney George T. Baggs has asked for a 20-year franchise to operate an electric railway.

Meeme, Wis.—The citizens have voted in favor of granting a franchise to the Milwaukee Electric Light & Power Co. for constructing an electric railway.

Independence, Kan.—I. B. Walker is said to be the promoter of an electric railway which is to connect Independence, Coffeyville and Cherryvale.

Nelliston, N. Y.—Civil Engr. Chas. S. Taylor is reported to have completed portion of survey for the proposed electric railway for the Mohawk River Traction Co. through Canajoharie to Sharon Springs.

Mountain Lake Park, Md.—See "Water."

Dayton, O.—According to local press reports it has been officially announced by the Great Western Construction Co., operating the Dayton, Springfield & Urbana electric railroad, and building the Columbus, London & Springfield line, that the power house for both roads will be located at Medway, 12 miles west of this city.

Walla Walla, Wash.—O. R. Ballou has been granted a franchise to build an electric railway in the city.

Marietta, O.—The Washington County Traction Co. is reported organized, with a capital stock of $250,000, to build at once an electric railway to Newport.

Utica, N. Y.—See "Business Buildings."

Michigan City, Ind.—Rosecrans & Salter, of Chicago, are reported to have completed a survey for an electric railway, to extend from Indiana Harbor to this place, a distance of about 30.5 miles.

Toledo, O.—The Toledo, Columbus, Springfield & Cincinnati Railway Co. is reported formed, largely from the Lima, Lewistown & Bellefontaine El. Ry. Co., and is to bring 119 miles of road under construction within 90 days.

Cleveland, O.—It is stated that the Cleveland & Chagrin Falls and the Cleveland, Chagrin Falls & Eastern Rys. have voted $40,000 for improvements.

The Mandelbaum-Pomeroy Syndicate is reported to have decided to extend the Cleveland, Elyria & Western Railway to Toledo.

Ephrata, Pa.—The Conestoga Traction Co. is stated to have begun surveys for a line to Adamstown.

Waynesboro, Pa.—The Chambersburg, Greencastle & Waynesboro El. Ry. Co. has been granted a franchise in this place.

Rose, N. Y.—The Clyde El. Power and Ry. Co. has, according to press reports, secured franchises, and the road will soon be built; application was supported by Chas. W. Field, of Clyde, and Ed. T. Moir, of Marcellus.

Durham, N. C.—Press reports state that the Durham Electric Co. will build 8 miles of street railway and will spend $300,000.

Indianapolis, Ind.—Allen Shewman, of Kokomo, and Jas. Lynn, of Wabash, are named directors of the Indiana Central Ry. Co., to build a line from Indianapolis to Peru, 75 miles long.

Grand Rapids, Mich.—The Grand Rapids, South Haven & Kalamazoo R. R. Co. is reported organized with a capital of $800,000 to build an electric road in western Michigan.

Tontogany, O.—Bids are wanted Sept. 17 for a franchise to construct, maintain and operate by electricity or other motive power, except steam, a street railway on several streets. John S. Matthews, Village Clk.

RAILROADS

Akron, O.—The Barberton, Akron & Eastern Ry. Co. has been incorporated, with a capital of $25,000, to construct a railroad from Barberton to Akron and from Akron to connect with the Wheeling & Lake Erie at Mogadore. C. D. Crouch, of Akron, is one of the incorporators.

Moravia, N. Y.—The Syracuse, Skaneateles & Moravia R. R. Co. is reported to have decided to begin construction very soon.

Harrison, Ark.—Local press reports state that bids will be received by the Allegheny Improvement Co., at Eureka Springs, until Sept. 15, for the grubbing, grading and masonry on the 60 miles extension of the St. Louis & Northern Arkansas R. R. from Harrison, Ark., southeast. Address J. G. Steacy, Asst. to the Pres. & Gen. Mgr. of Construction, Eureka Springs.

Salinas, Cal.—It is reported that a surveying party is in the vicinity of San Miguel, on the Estrella, running a line for a proposed railroad into the oil-fields near Coalinga, in San Luis Obispo County, and Bakersfield from tidewater.

Edmonton, Alberta, N. W. Ter.—The Edmonton & Lesser Slave Lake R. R. Co. is having a preliminary survey made from Edmonton to Athabasca Landing, a distance of 100 miles. F. Deggendorfer, Engr. in charge.

Oklahoma, Okla. Ter.—Press reports state that Johnson Bros. & Faught, of St. Elmo, Ill., will construct a railroad from Oklahoma City to Acme, Tex., 202 miles, on the survey made for the Oklahoma City & Western Ry.

Topeka, Kan.—The Choctaw Northern R. R. Co., of Keary, Okla., has applied to the Kansas Charter Board for permission to build and operate a line of railroad in this State. The company has a capital stock of $4,000,000.

Boulder, Colo.—Press reports state that the Colorado & Northwestern R. R. has increased its capital stock from $500,000 to $12,000,000 and that the road is to be extended to Eldora. Col. S. B. Dick, of Meadville, Pa., is said to be president.

Cleveland, O.—A resolution is before the Council which provides for abolishing the Pennsylvania & Erie R. R. grade crossings on Union St., by the elevation of the street and the construction of a bridge carrying a 36-ft. roadway and one 6-ft. walk. Estimated cost of work, $130,000.

Tampa, Fla.—Press reports state that Col. Jno. P. Martin has been granted a franchise to build a road from Tampa to St. Petersburg, Fla.; work to begin this fall; total cost, about $1,000,000.

Guthrie, Okla. Ter.—The Atchison, Topeka & Santa Fe Ry., according to reports, has secured a charter to build 14 separate lines of railroad with a total length of 815 miles, to be operated as the Eastern Oklahoma lines.

Vancouver, B. C.—John Hendry is reported to have received a letter of credit from the Morgan-Hill interests for $2,000,000 for the construction of the Vancouver, Westminster & Yukon Ry. and the establishment of a terminus for the Great Northern Ry. in Vancouver.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

King's Park, N. Y.—Bids are wanted Sept. 18 for the construction of a Nurse's Home at L. I. State Hospital, as advertised in The Engineering Record.

Denver, Colo.—Bids are wanted Sept. 10 for heating, ventilating and electric wiring the hospital building now being erected on the grounds of the County Hospital. Julius Aichele, County Clk.

Green Bay, Wis.—Local press reports state that the State Board of Control, Madison, Wis., will receive bids Sept. 17 for the construction of the north wing of the reformatory at Green Bay. Available appropriation, $112,800.

Guthrie, Okla. Ter.—The Public Improvement Committee, F. B. Lillie, Chmn., will receive plans until Sept. 14 for a $20,000 city hall.

Rochester, N. Y.—J. Foster Warner, Granite Bldg., has prepared plans for Hahnemann Hospital to be built on Rockingham St. Estimated cost, $15,000.

Edmonton, Alberta, N. W. Ter.—F. Deggendorfer is preparing plans for St. Albert Cathedral, stone and brick, with steel columns. Cost, $35,000 to $40,000. Work to be done by day labor.

Allentown, Pa.—Plans are being prepared by Jacoby, Weishampel & Biggin for brick fire houses for the Franklin and Allen fire companies. The former is to be a 3-story structure, 32 x 105 ft.; the latter, 30 x 136, 3 stories in the front and 2 in the rear.

Santa Ana, Cal.—The city is said to be contemplating the erection of a city hall and fire hall.

Moline, Ill.—Andrew Carnegie has given $37,000 to this city for a public library.

Philippi, W. Va.—Plans prepared by J. C. Fulton, of Uniontown, Pa., have been selected for the Barbour County Court House. Cost, about $50,000, including heating, lighting and plumbing.

New Haven, Conn.—The Aldermen have decided in favor of the construction of a contagious disease hospital at Springside. Appropriation, $50,000.

Jacksonville, Fla.—Local press reports state that the Board of County Commissioners will receive until Sept. 15 preliminary sketches of ground plans and elevations for a 2-story court house, 145 x 50 ft., to be erected in Jacksonville. Cost not to exceed $70,000. R. B. Archibald, Chmn. Bd.

Washington, D. C.—The District Commissioners have, according to local press reports, extended the time for submitting plans for the municipal hospital from Oct. 15 to Oct. 25.

Jacksonville, Fla.—Plans and specifications are wanted by the Board of Public Works until Sept. 30 for the erection of a modern municipal building. Philip Prioleau, City Engr.

At the election held Aug. 27 it was voted to issue $100,000 bonds for a city hall and other city buildings.

York, Pa.—Repairs and additions will be made to the York County jail; cost not to exceed $100,000.

Ortonville, Minn.—Fremont D. Orff, of Minneapolis, is said to be preparing plans for a $30,000 court house.

Escanaba, Mich.—Charlton, Gilbert & Demay, of Marquette, have submitted plans for a $25,000 city hall.

Nashville, Ga.—It is stated that bids will be received until Oct. 15 for erecting a 2-story brick fireproof jail. Plans on file with the Clerk of Superior Court.

Ozona, Tex.—Charles Schumm, San Antonio, Tex., is stated to have received the contract at $27,000 for building Crockett County courthouse, according to plans by Oscar Ruffini, San Angelo, Tex. Charles E. Davidson, County Judge.

Milwaukee, Wis.—An ordinance is before the Council which provides for the issue of $60,000 bonds for a police station.

Lawrenceville, Pa.—J. H. Campbell, of Pittsburg, is stated to have prepared plans for a $30,000 Baptist church to be erected on 34th St.

Cambridge, Mass.—Hartwell, Richardson & Driver, of Boston, have prepared preliminary plans for an armory, which it is proposed to build at an estimated cost of from $100,000 to $125,000.

Beloit, Wis.—Andrew Carnegie has given $25,000 to this city for a public library.

Jacksonville, Fla.—Snelling & Potter, of New York City, are preparing plans for the St. John's Episcopal Church. Estimated cost, $50,000.

BUSINESS BUILDINGS.

Utica, N. Y.—The Utica Belt Line Street Railroad Co. is preparing to erect a barn 250 ft. long and 70 ft. wide, at Utica Park. Power stations are to be erected in Oneida, Rome and Little Falls.

Denver, Colo.—The Woman's Club of Denver has decided to build a $25,000 club house.

Victor, Colo.—A. G. Higgins, of Victor, is stated to have been engaged to prepare plans for a $100,000 hotel.

New York, N. Y.—Plans have been filed for a 15-story office building to be erected at 68 William St. Goldwin Starrett, 51 Wall St., is the architect. Chas. A. Barker, Pres. of the corporation. Cost, $785,000.

Marion, O.—Bids are wanted by the Marion Masonic Temple Co., until Sept. 12, for erecting a temple, to cost $42,000. Wilbur T. Mills, Archt., Columbus.

Galveston, Tex.—The Rosenberg Library Association, A. J. Walker, Pres. of the Bd. of Directors, has invited plans for a modern $100,000 building.

Dayton, O.—Press reports state that the Dayton, Springfield & Urbana Electric Ry. Co. is about to build a passenger and freight depot.

Connellsville, Pa.—It is stated that plans have been completed for the Pennsylvania R. R. depot, with office and express equipment, which will replace present structure.

Jacksonville, Fla.—R. W. Simms will build a 3-story brick hotel at Maine and Adams Sts. Estimated cost, $30,000.

Minnequa, Colo.—Press reports state that the Minnequa Town Co. has in contemplation the building of a 2-story block 50 x 100 ft. on Evans and Bay State Aves.

Topeka, Kan.—It is stated that members of the St. Ananias Club contemplate erecting a temple in Topeka.

Camden, N. J.—A site has been selected at Lake Garden, near Camden, for the proposed building to be erected at a cost of $37,000, for the Eastern Home of the Benevolent & Protective Order of Elks.

Bristol, Va.—Press reports state that the Virginia & Southwestern Ry. is about to build a freight depot and freight yards at Lee and Water Sts.

Monteagle, Tenn.—Press reports state that C. A. Asmus, of Nashville, is drawing plans for the large addition to be built to the Assembly Inn this fall.

Shreveport, La.—The contract for the superstructure of the First National Bank is stated to have been let to Sonnenfield & Emmons, at $108,000, exclusive of fixtures, elevators, fittings, etc.

Decatur, Ala.—The Alabama R. R. Commission has ordered the construction of a new union passenger station at Decatur.

Redlands, Cal.—The Southern California Sanatorium Co. has been incorporated, with a capital stock of $250,000, for the purpose of building a sanatorium, according to plans prepared by Hugh Todd, of Los Angeles.

Livingston, Mont.—Manager A. O. Newton, of the New Albemarle, has received plans of his proposed new hotel, which will probably cost $75,000. An elevator and all other modern conveniences will be added.

Toledo, O.—Wachter, Hudson & Co., "The Nasby," have completed plans for a stable and business building for P. McGlynn, to be located on Jackson St.

Fort Worth, Tex.—Queen City Lodge No. 21 and Red Cross Lodge No. 14, Knights of Pythias, have arranged to erect a new 3-story temple at Third and Main Sts.

Newark, N. J.—Plans, prepared by Chas. Alling Gifford, 763 Broad St., for the Y. M. C. A. building to be erected on Halsey St., call for a 6-story structure 85 x 180 ft., the framework to be of steel with brick walls and fireproof partitions.

Cleveland, O.—The White Sewing Machine Co. proposes to erect, next year, a 7-story building which will contain 90,000 sq. ft. of floor space.

Kansas City, Mo.—Root & Siemens, Postal Tel. Bldg., have prepared plans for a $50,000 manufacturing plant to be built for W. J. Smith.

The Heim Brewing Co. is about to erect bottling works at Rochester Ave. and the M. P. Ry. Cost, $30,000.

A $25,000 addition is about to be made to the building at 8th and Delaware Sts., owned by Wm. Ried.

Jennings, La.—Bids are wanted Sept. 25 for the erection of a 2-story-bank building. W. L. Stevens, of Crowley, La., Archt.

St. Paul, Minn.—Plans have been filed for a boiler shop, to be erected by the Omaha road at Randolph and Duke Sts. The building is to be of steel and brick, and cost $50,000.

Chicago, Ill.—Permits have been issued for the construction of the following buildings: Freight-house for Chicago, Rock Island & Pacific R. R. Co., cost $60,000; brick car storage barn for Chicago City Ry. Co., cost $75,000; addition to Auditorium Annex, Congress Hotel Co., cost $750,000.

Architects Adler and Treat are stated to have let the contract to the Falkenau Construction Co. for a 6-story addition to the Stand Club House, to cost $100,000.

San Antonio, Tex.—Press reports state that the International & Great Northern Railway will build a depot to cost $100,000 or more. Leroy Trice, Vice-Pres. and Gen. Mgr.

Columbus, O.—The Pythian Castle Association has been incorporated to construct a $50,000 lodge building. Incorporators: Andrew G. Davis, P. W. Stewart, E. B. Kinkead and others.

Denver, Colo.—E. R. Rice, Kittredge Bldg., has prepared plans for a $35,000 brick and stone 3-story office building to be erected at 1800 Stout St. Owner, J. S. Flower.

Louisville, Ky.—The Louisville Home Telephone Co., recently incorporated, has purchased property on Fifth St., between Walnut and Chestnut, upon which a modern 3-story building will be erected to be used entirely by the telephone company.

Philadelphia, Pa.—Press reports state that Architect Jas. H. Windrim has invited bids from a number of firms for the construction of a 15-story banking and office building for the Commonwealth Title, Insurance & Trust Co. Bids will be submitted to Vice-President Andrew J. Maloney on September 10.

Philadelphia, Pa.—It is stated that Hales & Ballinger are preparing plans and specifications for additions to the German Home, Old York Road and Hunting Park Ave.

DWELLINGS.

Milwaukee, Mis.—A permit has been issued for the erection of a $25,000 dwelling at Prospect Ave. and Albion St. Owner, Miss E. M. Black.

Syracuse, N. Y.—Local press reports state that E. B. Curtis, of this city, has purchased property on So. Warren St. and will build thereon a 7-story brick flat at a cost of $100,000.

Salt Lake City, Utah.—S. C. Falkenberg, of Detroit, is said to be preparing plans for an apartment house, estimated to cost $175,000. J. S. Bransford, of Detroit, agent for the owner, is said to be receiving bids for construction.

Gettysburg, Pa.—According to press reports, Mrs. M. Edwards, of Philadelphia, will erect a $25,000 residence at this place. J. H. Hunter, architect.

Cincinnati, O.—Press reports state that Lida Meacham will erect a $20,000 residence on the north side of Reading road, between Mitchell Ave. and Paddock road.

Philadelphia, Pa.—Local press reports state that Architects Morris & Vaux will soon let contracts for a 3-story stone residence to be erected on School Lane, Germantown, for J. Snowdon Rhoads.

New York, N. Y.—Plans have been filed for two 6-story brick tenement houses, to be built by Robert Friedman and Joseph Feinberg, owners, at 2 to 12 Hancock St. Michael Bernstein, of 111 Broadway, is the architect. Estimated cost, $70,000.

F. De R. Wissman and the City Real Property Investing Co. have filed plans for two 5-story brick dwellings to be built at 9 and 11 E. 84th St. Warren, Wetmore & Morgan are the architects. Total cost, $210,000.

Chicago, Ill.—A permit has been taken out by E. M. Willoughby for the erection of a 3-story apartment building at 5450-56 Michigan Ave. Cost, $110,000.

Frost & Granger, "The Temple," have completed plans for a residence to be built on Drexel Boulevard, near 50th St., for Simon Mandel. Cost, $50,000.

Henry P. Harned, 218 La Salle St.. has made plans for a 4-story apartment building, to be erected at 4369-71 Oakenwald Ave. for Edward B. Andrews; cost, $50,000.

SCHOOLS.

Washington, D. C.—Bids are wanted Sept. 21 for constructing two 4-room schools, one on Lot 6, Bunker Hill Road, the other on Grant Road. Wm. Tindall, Sec'y Bd. of Commrs., D. C.

Muskegon, Mich.—The J. J. Howden Co., of this city has, it is stated, closed a contract with the Muskegon Board of Education for installing a steam heating system at the Hackley Manual Training School, at a cost of $15,000.

San Bernardino, Cal.—T. H. Goff has been selected by the Board of Education to prepare plans for 2 schools.

Philadelphia, Pa.—Charles O'Neill has received a permit to erect a $27,000 two-story stone addition, 43 x 100 ft., to the school at Ridge Ave. and Kolas St.

Waltham, Mass.—The Board of Aldermen on Aug. 27 adopted a resolution authorizing Mayor Leonard to engage a consulting architect to examine the original plans for a high school, prepared by Superintendent of Public Buildings and Grounds Patch, and to proceed immediately with the construction of the building according to these plans with some modifications.

Rockville (L. I.), N. Y.—Morrell Smith, of Far Rockaway, has been engaged by the Board of Education to prepare plans for a school, to cost about $16,000.

New York, N. Y.—Bids are wanted Sept. 16 for installing a ventilating and heating apparatus in school No. 184 and for sanitary work in addition to and alterations in school No. 22, Boro. of Manhattan; and for installing electric light wiring fixtures and electric bell systems; also ventilating and heating apparatus in schools No. 136 and 137, Boro. of Brooklyn. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ.

South Omaha, Neb.—Bids are wanted Sept. 16 for erecting a high school at 23d and K Sts. Address Chmn. of the Com. on Bldgs. & Grounds, Bd. Educ.

Somerville, Mass.—The contract for the erection of a 12-room school at Maple and Poplar Sts. has been awarded to Geo. M. Davis, Son & Co., for $38,225.

New Haven, Conn.—The contract for erecting the new high school on York Sq. has been awarded to The Geo. M. Grant Co., of New Haven, at $204,194.

Pittsburg, Pa.—The members of control have decided to erect a 12-room school in the Second Ward west of N. Main Ave.

La Crosse, Wis.—Press reports state that Fred. C. Easton, will give $100,000 toward the erection of a new Presbyterian college in La Crosse.

Santa Fe, N. Mex.—Bids are wanted by Commr. W. A. Jones, at Washington, D. C., until Sept. 24, for constructing at the Indian School near Santa Fe, one brick industrial building and one brick employees' quarters with plumbing, electric light, etc.

Denver, Colo.—An 8-room school is about to be built in District No. 2, contract not yet let.

Macomb, Ill.—Press reports state that new bids will be opened Sept. 20 for the heating plant and for the plumbing and sewering of the Ill. Normal school. C. J. Searle, Pres. Western Ill. Normal School Bd.

Boise City, Idaho.—Plans and specifications are wanted for the high school. Geo. H. Stewart, Vice-Pres. of the Bd. of Trustees, Independent School District.

Allegheny, Pa.—The lowest bids received for heating and ventilating the new and the old high school buildings were from James Hay Co., of Allegheny, at $41,300, and the McGinness-Smith Co., at $42,377.

STREET CLEANING AND GARBAGE DISPOSAL.

Brooklyn, N. Y.—Bids are wanted Sept. 18 for the removal of snow and ice from the streets of this borough during the coming winter. P. E. Nagle, Commr. of Street Cleaning, N. Y. City.

New York, N. Y.—Bids are wanted Sept. 20 for the removal of snow and ice from the streets of the Boro. of Bronx, also until Sept. 23 for the removal of snow and ice from the streets of the Boro. of Manhattan, during the coming winter. P. E. Nagle, Commr. of Street Cleaning.

Topeka, Kan.—Local press reports state that this city will probably let a garbage crematory franchise before next spring.

Ellis Island, N. Y. Harbor.—The following bids were opened at the Treasury Dept., Washington, D. C., Sept. 3, for the construction of a garbage and refuse crematory. Bidders, all of New York City: Louis Wechsler, $6,750; Benj. Boulger, $5,280; Williams & Gerstle, $7,684.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted at the Dept. of Interior, Office of Indian Affairs, Washington, until Sept. 20, for furnishing materials and constructing a sewer system and an addition to the hospital at the Lac du Flambeau School, Wis. W. A. Jones, Commr.

Ft. Grant, Ariz.—See "Water."

Tompkinsville, N. Y.—Bids are wanted Sept. 12 for furnishing and delivering riprap stone at light stations on Long Island Sound. Bids will also be received at the same time for rebuilding Black Ledge Beacon, New London entrance, Conn., and repairing Sea Flower Reef Beacon, Fisher's Island Sound, N. Y. Col. D. P. Heap, Corps of Engrs., U. S. A.

Sullivan's Island, S. C.—Bids are wanted Sept. 28 for constructing one barrack and one administration building. David Price, Q. M.

Seattle, Wash.—The second contract on the Lake Washington Canal has been awarded to Smyth & Howard, of Seattle, at 27 cts. per cu. yd.; total, $25,920.

Ft. Strong, L. I.—Bids are wanted Sept. 19 for constructing one brick guard house at Ft. Strong. A. M. Palmer, Depot Q. M., Boston, Mass.

Ft. Yates, N. D.—See "Water."

Ft. Mansfield, R. I.—Bids are wanted by the Constructing Quartermaster, New London, Conn., until Sept. 17, for sinking a tubular deep well at Ft. Mansfield.

Salem, Ore.—Bids are wanted Sept. 26 for furnishing materials and labor required to construct at the Indian school, Chemawa, Ore., a dormitory, an industrial school and a laundry, all of brick with plumbing, and an extension of the electric light and steam heating plant. W. A. Jones, Commr. of Indian Affairs, Washington, D. C.

New York, N. Y.—Bids are wanted Sept. 28 for constructing a 3-story and basement brick and steel fireproof building about 80 x 200 ft. at the N. Y. Navy Yard. Mordecai T. Endicott, Ch. of the Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Boston, Mass.—Bids are wanted Sept. 28 for constructing an extension of a rolling mill, including new roof for building, at Boston Navy Yard. Appropriation, $98,000. Mordecai T. Endicott, Ch. of the Bureau of Yards & Docks, Navy Dept., Washington, D. C.

St. Cloud, Minn.—The following bids were opened Sept. 4 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post-Office at St. Cloud: Angus & Gindele, Chicago, $45,939; Carl Krupp, St. Cloud, $46,721; Butler-Ryan Co.. St. Paul, $55,994; P. M. Hennessy, St. Paul, $52,490.

Algiers, La.—The following bids were opened Aug. 31 at the Navy Dept., Washington, D. C., for constructing four buildings at the Naval Station, Algiers: Muir & Trombey, New Orleans, $140,100; J. H. Gardner, New Orleans, $148,208; R. H. Griefen, Chicago, $123,000; Snare & Triest, New York, $143,800.

Philadelphia, Pa.—Local press reports state that the following bids were opened Aug. 30 for the new storehouse at Schuylkill Arsenal: G. Goodfellow, $88,775; Cramp & Co., $89,900; the Wade-Gilpin Co., $92,600; Henderson & Co., Ltd., $92,876; J. A. Bradin, $98,000, and T. Gannon, $114,500.

Manila, P. I.—Commander A. B. Speyer has reported to the Navy Department upon the necessity of establishing a refrigerating plant at Manila; cost, $200,000.

Ft. Caswell, N. C.—Bids are wanted Sept. 30 for erecting, plumbing and electric wiring several buildings at Ft. Caswell. Address T. W. Hollyday, Q. M.

Brunswick, Ga.—The following bids were opened Aug. 29 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Custom House and Post-Office, Brunswick: C. L. Rounds, Augusta, $99,846; W. H. Bowers, Brunswick, $100,000; Miles & Bradt, Atlanta, $109,000; A. B. Stanand, N. Y. City, $97,878; Angus & Gindele, Chicago, Ill., $105,837.

Boise, Idaho.—The following bids were opened Aug. 29 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the superstructure of the U. S. Public Building at Boise: W. S. Campbell, Boise, $174,367; Hastie & Doregan, Tacoma, Wash., $199,975; Congress Construction Co., Chicago, $208,000.

Detroit, Mich.—Bids were opened Aug. 31 by Col. G. J. Lydecker, Corps of Engrs., U. S. A., for dredging Hay Lake Channel, St. Mary's River, Mich. The approximate amount of material to be removed being as follows: Section 1, 204,100 cu. yds. above the depth of 21 ft. and 65,000 cu. yds. between the depths of 21 and 22 ft.; distance to the dumping ground will average about 1 mile. Section 2, 1,538,250 cu. yds. above the depth of 21 ft. and 63,000 cu. yds. between the depths of 21 and 22 ft.; distance to the dumping ground will average about 3 miles. Section 3, 926,400 cu. yds. above the depth of 21 ft. and 110,000 cu. yds. between the depths of 21 and 22 ft.; distance to the dumping grounds will average about 3 miles. Bids given below are for Sections 1, 2 and 3 respectively; James Rooney, Toledo, O., 65, 14, 18 cts.; Lydon & Drews Co., Chicago, Ill., 95, 11.9, 17.9 cts.; Samuel O. Dixon, Milwaukee, Wis., 68, 11.4, 15.9 cts.; The Buffalo Dredging Co., Buffalo, N. Y., 75, 14⅛, 16¼ cts.; Henry Hickler, Sault Ste. Marie, Mich., 56, 16, 18 cts.; Duluth Dredge & Dock Co., Duluth, Minn., 65, 13½, 16½ cts.; Hingston & Woods, Buffalo, N. Y., 63, 13⅞, 15⅝ cts.; The L. P. & J. A. Smith Co., Cleveland, O., 80, 15, 16½ cts.; James B. Donnelly, Buffalo, N. Y., 78, 15, 17 cts.; G. H. Breymann & Bros., Toledo, O., 74, 14, 16 cts.; H. W. Hubbell & Co., Saginaw, Mich., 57 cts.

San Francisco, Cal.—The following bids were opened Sept. 3 at the Treasury Dept., Washington, D. C., for the completion of the interior finish of the U. S. Post-Office at San Francisco: Richardson & Burgess, Washington, $1,304,820; Davison Bros. Marble Co., Chicago, $995,000, $1,015,000 and $1,037,000.

Bids as follows were received at the same time for mechanical equipment, including plumbing, boilers, engines and generators, switchboard, electric wiring and conduits, heating and ventilating, and elevators for said building: J. F. Buchanan, Philadelphia, $283,970; S. Faith, Philadelphia, $269,721; Ford Elec. Co., Boston, $279,820; G. H. Tay Co., San Francisco, $264,700; Gas Comm'l Asso. of U. S., San Rrancisco, $276,469; C. B. Kruse Htg. Co., Milwaukee, Wis., $227,200; Byron Jackson Machine Wks., San Francisco, $329,465; Risdon Iron & Locomotive Wks., San Francisco, $304,744; C. C. Moore & Co., San Francisco, $280,032; Jos. McWilliams & Co., Louisville, Ky., $220,517.

Combined bids on interior finish and mechanical equipment were as follows: Richardson & Burgess, Washington, $1,580,353; Jno. Peirce, N. Y. City, $1,499,000.

Governor's Island, N. Y. Harbor.—The following bids were opened Aug. 28 by S. R. Jones, Q. M., for sinking an artesian well:

	Sinking and casing well, per lin. ft.			
Bidders.	1 to 400.	400 to 800 ft.	800 to 1,200 ft.	Per day of 24 hours.*
P. H. & J. Conlan, Newark, N. J.	$4.25	$4.50	$4.75	$24.00
Phillips & Worthington, N. Y.	5.50	6.00	6.50	25.00
Joseph P. Hoadley, Middletown Springs, Vt.	6.00	8.00	10.00	50.00
Nassau Coustruction Co., Brooklyn, N. Y.......................,	30.00	6.10	6.10	25.00
Elisha Gregory, N. Y. City......	8.00	8.00	9.00	24.00

*Bids in this column are for making tests of the capacity of the well beyond the period required by the specifications.

San Juan, Porto Rico.—The following bids were opened by the Bureau of Yards & Docks, Washington, D. C., on Aug. 31, for the construction of two coal hoist towers for Naval Station at San Juan: *a*, The two steel towers and steam machinery, erected on the naval station wharf in Porto Rico: *b*, the two steel towers and steam machinery complete, delivered f. o. b. New York Harbor: Ellington Mfg. Co., Quincy, Ill., *a* $32,594; *b* $24,194; C. W. Hunt Co., New Brighton, N. Y., *b* $20,262; Snare & Triest, New York City, *a* $30,626; *b* $22,070.

Philadelphia, Pa.—The following bids were opened Aug. 31 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of a brick and steel building 65 x 350 at the League Island Navy Yard: R. A. Griefen, Chicago, $109,980 and $101,280; Cramp & Co., Bridgeton, N. J., $109,885; Henderson & Co., Philadelphia, $107,206 and $98,619; R. H. Hood, N. Y. City, $108,740; L. S. Leach & Son, Chicago, $115,000 and $103,000; G. H. Dieterich, Philadelphia, $108,880 and $99,888; Chas. McCaul, Philadelphia, $108,998.

MISCELLANEOUS.

Philadelphia, Pa.—Bids are wanted Sept. 11 for dredging dock and driving fender piles, House of Correction Wharf, Holmesburg Junction. Wm. C. Haddock, Dir. Dept. of Pub. Wks.

Alexandria, La.—Bids for digging a drainage canal from Alexandria to Chatlans Lake were opened Aug. 28 by the Commissioners of the Red River, Atchalaya & Bayou Boeuf Levee Board, and the contract was awarded to the R. N. Andrews Co., of Hamilton, O., for $61,556.

Brockton, Mass.—The Harbor & Land Commissioners through their engineers have completed the survey of the proposed Brockton & Taunton ship canal, extending from Boston Harbor through the Weymouth Fore River to Narragansett Bay, by Brockton and Taunton. A rough estimate places the cost of construction at $8,000,000.

Terminal Island, Cal.—Local press reports state that it is proposed to build a $50,000 bulkhead.

Boston, Mass.—Bids are wanted about Sept. 10 for excavating about 70,000 cu. yds. of mud, earth and gravel at or near an arm of Lake Cochituate, known as Snake Brook Meadow. Harry H. Sprague, Ch. Engr. Met. Water & Sewerage Bd.

NEW INDUSTRIAL PLANTS.

The Vulcanite Portland Cement Co., Real Estate Trust Bldg., Philadelphia, Pa., is erecting a new mill having a daily capacity of 2,000 bbls., at Vulcanite, Warren Co., N. J., which will double the capacity of its works.

The Union Traction Co. of Indiana, Anderson, Ind., may increase its shop building or build a new shop. Geo. F. McCulloch, Gen. Mgr.

The St. Joseph, Mo., Stock Yards Co. expects to be in the market for wheel and engine lathes, planers, drill presses, water grinders, blacksmith's forge, etc.

The Herrick Refrigerator & Cold Storage Co., Waterloo, Ia., will erect a 2-story building 100 ft. square, to be used for storage until next August, when additions 100 ft. square and 60 x 200 ft. will be built and the company will want a Corliss engine, a boiler, shafting, etc.

The Riter-Conley Mfg. Co., Pittsburg, Pa., contemplates building a new plant next spring.

The Reynolds & Davie Lumber Co., Reynolds, Wash., is rebuilding its mill. The building will be 40 x 220 ft. and have three engines, 16 x 24, 14 x 20 and 12 x 16 inches.

The L. S. Starrett Co., Athol, Mass., toolmakers, will erect two 4-story additions, 162½ x 50 ft. and 160 x 50 ft., and a 75 x 80-ft. steam plant, including coal pocket, etc., which will be provided with three 110-H.-P. tubular boilers.

The Great Northern Paper Co., Millinocket, Me., will erect a ground wood pulp mill at Madison, Me., with a development of about 8,000 H.-P.

The Blacksher-Miller Lumber Co., Brewton, Ala., will rebuild its plant, recently burned, and will want a 100-H.-P. engine, a 60-H.-P. boiler and five machines.

The Korn-Krisp Co., Ltd., Battle Creek, Mich., expects to build a 2-story, 60 x 150-ft. factory, and its power plant will probably consist of two 100-H.-P. tubular boilers and a 100-H.-P. automatic, balanced-valve engine, medium speed.

The Peninsula Foundry Co., Newport News, Va., has contracted for the erection of a 200 x 75-ft. foundry, and will need some fittings.

The Portland Cement Co., Portland, Colo., has been incorporated by C. Leonardt, Aman Moore, James A. McCandless and Lyman Robinson with a capital stock of $500,000 and will erect a 100 x 500-ft. factory, of structural iron with concrete walls and roof. An electric power house with two 500-H.-P. units with direct-driven generators and water-tube boilers will be constructed.

The Friend Mfg. Co., Gasport, N. Y., maker of spray pumps, has begun work on a 2-story, 30 x 130-factory and will soon erect a foundry.

The Continental Glass Co., Richmond, Va., will be chartered with a capital of about $25,000, and is in the market for machinery for a new plant. J. E. Fowler, Sec'y.

BUSINESS NOTES.

The Girard Boiler & Mfg. Co., Girard, O., is increasing its floor space 10,000 sq. ft. and adding punches, air compressors, cranes, 14-ft. 2-in. bending rolls for 1¼-in. plate, and an equipment for field work, including a 50-H.-P. hoisting engine, air compressor and tools. The company has just received an order from the La Belle Furnaces, Steubenville, to build four stoves and a furnace from the plans of G. A. McClure, Son & Co., Pittsburg.

The Hawkins Iron Construction Co., capital stock $50,000, has been incorporated by Geo. E. Hawkins, Astoria, N. Y., Robert T. Brooks, Brooklyn, N. Y., and Henry S. Starr, Jr., Hempstead, N. Y.

The Connecticut Hospital for the Insane at Middletown has contracted for a Green economizer to be applied to its locomotive boilers.

The Independent Asphalt Co., principal office, 243 Washington St., Jersey City, N. J., has been incorporated with a capital of $300,000 by William Smith, Ralph B. Corbin and George S. Hobarts.

The Billings, Mont., Water Power Co. has recently purchased a 250-H.-P. engine from the Ball Engine Co., Erie, Pa., which company has also furnished the engine for the electrical plant of the Craddock-Terry shoe factory at Lynchburg, Va.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Sept. 9.	Elmore, Minn	Sept 7
Sept. 10.	National Home, Wis	Sept. 7
Sept. 11.	Pump house, Auburn, N. Y.	Sept. 7
Sept. 11.	St. Paul, Minn	Sept. 7
Sept. 11.	Garretson, S. D.	Aug. 24
Sept. 13.	Fremont, O	Aug. 31
Sept. 14.	Fonda, Ia	Sept. 7
Sept. 16.	Ft. Grant, Ariz	Sept. 7
Sept. 16.	Melrose Park, Ill	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Sept. 17.	Ft. Mansfield, R. I	Sept. 7
Sept. 17.	Glenwood, Minn	Sept. 7
Sept. 17.	Hendricks, Minn	Sept. 7
Sept 17.	Conduit, Cleveland, O	Aug. 31
Sept. 18.	Socrabaya, Java	July 20
Sept. 18.	Tullahoma, Tenn	Sept. 7
Sept. 20.	Longmont, Colo	Aug 24
Sept. 21.	Washington, D. C	Aug. 17
Sept. 21.	Washington, Pa	Sept. 7
Sept. 30.	Ft. Yates, N. D	Sept. 7
Oct. 1.	Burlington, Ia	June 29
	Adv., Eng. Record June 29	
Oct. 5.	Water Gates, Washington, D. C	Aug. 3
	Adv., Eng. Record, Aug. 3.	

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close		See Eng. Record.
Sept. 9.	White Plains N. Y	Sept. 7
Sept. 9.	Edgewood Pa	Sept. 7
Sept. 9.	St. Paul, Minn	Sept. 7
Sept. 10.	Milwaukee, Wis	Sept. 7
Sept. 10.	New Brunswick, N. J	Sept. 7
Sept. 12.	St. Paul, Minn	Sept. 7
Sept. 13.	Omaha, Neb	Sept. 7
Sept. 14.	Evansville, Ind	Aug. 31
Sept. 15.	Hartford, Conn	Sept. 7
Sept. 16.	Oshkosh, Wis	Aug 31
Sept. 16.	Oelwein, Ia	Sept. 7
Sept. 16.	New York, N. Y	Sept. 7
Sept. 16.	Cincinnati, O	Sept. 7
Sept. 18.	Kings Park, N. Y	Aug 31
	Adv., Eng. Record, Aug. 31.	
Sept. 18.	Birmingham, Ala	Sept. 7
Sept. 20.	Washington, D. C	Sept. 7
Sept. 23.	Austin, Tex	Sept. 7
Sept. 23.	Oshkosh, Wis	Sept. 7
Sept. 23.	Greenville, Pa	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Sept. 23.	Toledo, O	Sept. 7
Sept. 23.	Yonkers, N. Y	Sept. 7
Sept. 25.	Havana Cuba	June 29
	Adv., Eng. Record, June 29 to July 20, Aug. 17, 21.	
Sept. 27.	Boston, Mass	Aug. 31
	Adv., Eng. Record, Aug. 31, Sept. 7.	
Oct. 1.	Canyon City, Colo	Aug. 24
Oct. 1.	Leicester, England	Sept. 7
Oct. 1.	Hartford, Conn	Sept. 7

BRIDGES.

Bids Close		See Eng. Record.
Sept. 10.	Pratt City, Fla	Sept. 7
Sept. 11.	Chicago, Ill	Sept. 7
Sept. 11.	Atlantic County, N. J	Aug. 31
	Adv., Eng. Record, Aug. 31.	
Sept. 12.	Paulding, O	Aug. 31
Sept. 13.	Tipton, Ind	Aug. 31
Sept. 13.	Hamilton, O	Aug. 31
Sept. 13.	Bemidji Minn	Sept. 7
Sept. 16.	Rutland, Vt	Sept. 7
Sept. 17.	Willows, Cal	Aug. 31
Sept. 23.	Ogden, Utah	Aug. 31
Sept. 30.	Fredericton, N. B	Aug. 17
	Adv., Eng. Record, Aug. 17 to Sept. 7.	
Nov. 1	Milwaukee, Wis	Sept 7
Feb. 28.	Sidney, N. S. W	June 22
	Adv., Eng. Record, June 22 to July 13.	

PAVING AND ROADMAKING.

Bids Close		See Eng. Record.
Sept. 9.	Union, N. J	Sept. 7
Sept. 9.	Edgewood, Pa	Sept. 7
Sept. 10.	Hancock, Mich	Sept 7
Sept. 11.	Buffalo, N. Y	Aug. 31
Sept. 11.	Pittsburg, Pa	Aug. 31
Sept. 13.	Lima, O	Sept. 7
Sept. 13.	Chillicothe, O	Sept 7
Sept. 13.	Indianapolis, Ind	Sept. 7
Sept. 14.	Alliance, O	Aug. 24
Sept. 14.	Youngstown, O	Aug. 24
Sept. 14.	Shelby, O	Aug. 31
	Adv., Eng. Record, Aug. 31, Sept. 7.	
Sept. 14.	Marion, O	Aug. 31
Sept. 15.	Marion, Ia	Aug. 10
Sept. 16.	Cincinnati, O	Aug. 31
Sept. 16.	Erie, Pa	Sept. 7
Sept. 16.	East Chicago, Ind	Sept. 7
Sept. 16.	Chester, N. Y	Sept. 7
Sept. 16.	Indianapolis, Ind	Sept. 7
Sept. 17.	Oberlin, O	Aug. 31
Sept. 17.	Marinette, Wis	Aug. 31
Sept. 18.	Salem, N. J	Aug. 31
Sept. 18	Glenville, O	Aug. 31
Sept. 18.	Birmingham, Ala	Sept. 7
Sept 19.	Des Moines, Ia	Sept. 7
Sept. 19.	New Brunswick, N. J	Sept. 7
Sept. 20.	Chagrin Falls, O	Aug. 24
Sept. 21.	Conneaut, O	Aug. 31
Sept. 21.	Youngstown, O	Sept. 7
Sept. 21.	Savannah, Ga	Sept. 7
Sept. 23.	Muncie, Ind	Sept. 7
Sept. 25.	Havana, Cuba	June 29
	Adv., Eng. Record, June 29 to July 20, Aug. 17, 24.	

POWER, GAS AND ELECTRICITY.

Bids Close		See Eng. Record.
Sept 11.	Tacoma, Wash	Sept. 7
Sept 11.	Pittsfield, Mass	Sept. 7
Sept. 16.	Mascoutah, Ill	Aug. 31
Sept. 18.	Tullahoma, Tenn	Sept. 7
Sept. 19.	Norway, Mich	Aug. 31
Sept. 20.	El Paso, Tex	Aug. 10
Sept. 21.	Steam generating equipment, Washington, D. C	Aug. 3
	Adv., Eng. Record, Aug. 3.	
Sept. 21.	Pipe line franchise, Los Angeles, Cal.	Sept. 7
Oct. 8.	London, England	Aug. 31
Oct. 8.	London, England	Sept. 7
——	Providence, R. I	Sept. 7
——	Abbeville, La	Sept. 7

GOVERNMENT WORK.

Bids Close		See Eng. Record.
Sept. 9.	Washington, D. C	Aug 10
	Adv., Eng Record, Aug. 10 to 24, Sept. 7.	
Sept. 10.	Ash handling apparatus in P. O. bldg., St Louis, Mo	Aug. 24
	Adv., Eng. Record, Aug. 24, 31.	
Sept. 10.	Boiler, Washington, D. C	Aug. 31
Sept. 11.	Officers' quarters, Ft. Rodman, Mass	Aug. 24
Sept. 12.	Barracks, Ft. H. G. Wright, N. Y	Aug. 24
Sept. 12.	Tompkinsville, N. Y.	Sept. 7
Sept. 14.	Bldg., htg., etc., Ft. MacKenzie, Wyo.	Aug. 24
Sept. 16.	Dredging, Savannah, Ga.	Aug. 17
	Adv., Eng. Record, Aug. 17, 24.	
Sept. 16.	Butte, Mont	Aug. 17
	Adv., Eng. Record, Aug. 17, 24.	
Sept. 16.	Water system, Ft. Grant, Ariz	Sept. 7
Sept. 17.	Well, Ft. Mansfield, R. I	Sept. 7
Sept. 17.	Fort DuPont, Del	Aug. 24
Sept. 19.	El. light plant, Ft. Washington, Md	Aug. 24
	Adv., Eng. Record, Aug. 24 to Sept. 7.	
Sept. 19.	Ft. Strong, L. I	Sept. 7
Sept. 20.	Washington, D. C	Sept. 7
Sept. 20.	Stone wall, San Francisco, Cal	Aug 31
Sept. 20.	Boston, Mass	Aug. 31
Sept. 23.	Pumps, etc., for bldg., Washington, D. C.	Aug. 24
	Adv., Eng. Record, Aug. 24, 31.	
Sept. 23.	Bldg., West Point, N. Y	Aug. 24
	Adv., Eng. Record, Aug. 24, 31.	
Sept. 23.	Seattle, Wash	Aug. 31
Sept. 24.	Carrollton, Ky.	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Sept. 26.	Salem, Ore	Sept. 7
Sept. 28.	Boston, Mass	Sept. 7
Sept. 28.	Sullivans Island, S. C	Sept. 7
Sept. 28	New York, N. Y	Sept. 7
Sept. 30.	Ft. Yates, N. D	Sept. 7
Sept. 30.	Louisville, Ky	Sept. 7
	Adv., Eng. Record, Sept. 7	
Sept. 30.	Governor's Island, N. Y. Harbor	Aug. 31
	Adv. Eng. Record, Aug. 31, Sept. 7.	
Sept. 30.	Ft. Caswell, N. C	Sept. 7
Oct. 1.	Galveston, Tex	Aug. 10
	Adv., Eng Record, Aug 10 to Sept. 7.	
Oct. 2.	Gas and elec. fixtures, Portland, Ore	Aug. 24
Oct. 3.	Creston, Ia	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Oct. 12.	New York, N. Y	Aug. 31
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15

BUILDINGS.

Bids Close		See Eng. Record.
Sept. 10.	Office bldg., Philadelphia, Pa.	Sept. 7
Sept. 10.	Htg., etc., hospital, Denver, Colo.	Sept. 7
Sept. 11.	Jail, Jackson, Minn	Aug. 17
Sept. 12.	School, Guilderland, N. Y	Aug. 31
Sept. 12.	Heating hospital, Bedford, N. Y	Aug. 31
Sept. 12.	Pub bldg. repairs, Dayton, O	Aug. 24
Sept. 12.	Temple, Marion, O	Sept. 7
Sept. 14.	City hall plans, Guthrie, Okla. Ter	Sept. 7
Sept. 15.	School, Mauch Chunk, Pa	Aug. 24
Sept. 15.	Courthouse plans, Jacksonville, Fla	Sept. 7
Sept. 16.	Htg., etc., in schools, New York, N. Y.	Sept. 7
Sept. 16.	School, South Omaha, Neb	Sept. 7
Sept. 17.	Boilers in pub. bldg., National Military Home, Ind	Aug. 24
Sept. 17.	Court house, Cartersville, Ga	Aug. 3
Sept. 17.	Reformatory, Green Bay, Wis	Sept. 7
Sept. 18.	Kings Park, N. Y	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Sept. 20.	School, Macomb, Ill	Sept. 7
Sept. 21.	Schools, Washington, D. C	Sept. 7
Sept. 24.	Power house, etc., for Capitol, St. Paul, Minn	Aug. 10
	Adv., Eng. Record, Aug. 10, 17.	
Sept. 24.	Pub. bldg., Mansfield, O	Aug. 31
Sept 24.	School, Santa Fe, N. Mex	Sept. 7
Sept. 25.	Bank bldg., Jennings, La	Sept. 7
Sept. 30.	Municipal bldg. plans, Jacksonville, Fla	Sept. 7
Oct. 1.	Bank plans, San Antonio Tex	Aug. 24
Oct. 2.	Hospital, Huntington, W. Va	Aug. 31
Oct. 15.	Jail, Nashville, Ga.	Sept. 7
Oct. 25.	Hospital plans, Washington, D. C	Sept. 7
Nov 4.	Jail, Meridian, Miss	Aug. 31
Nov. 30.	Capital plans, Harrisburg, Pa	Aug. 31
——	School plans, Boise City, Idaho	Sept. 7

MISCELLANEOUS.

Bids Close		See Eng. Record.
Sept. 10.	Excavating, Boston, Mass	Sept. 7
Sept. 11.	Philadelphia, Pa.	Sept. 7
Sept. 12.	R. R. work, Pittsburg, Pa	Aug. 31
	Adv., Eng. Record, Aug 31.	
Sept. 15.	R. R. work, Harrison, Ark	Sept. 7
Sept. 16.	Dam, Roswell, Ga	Aug. 31
	Adv., Eng. Record, Aug. 31.	
Sept. 17.	Garbage crematory, Allentown, Pa	Aug. 31
Sept. 17.	El. Ry. franchise, Tontogany, O	Sept. 7
Sept. 18.	Rem. of snow, Brooklyn, N. Y	Sept. 7
Sept. 20.	Rem. of snow, New York, N. Y	Sept. 7
Sept 23.	Rem. of snow, New York, N. Y	Sept. 7
Sept. 24.	El. Ry. franchise, San Bernardino, Cal.	Sept. 7
Dec. 31.	Incinerators, Calcutta, India	Aug. 3

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

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Architects and Engineers in Building Construction.

The extent to which engineering in one branch or another has entered modern building construction is scarcely realized until one considers in detail a great modern office or other building, with its heating, lighting, ventilating and elevator machinery and the motive power required to operate it. The same observation is applicable even with greater force to a considerable class of buildings in which the development, transmission and application of power are elements of materially greater relative importance. This complicated combination of purely structural work and machinery installation has inevitably raised important questions both as to the amount of fees for the design and supervision of the entire work and the division of them between the architect and engineer. These questions are comparatively new, as it is but a few years since the design of a building involved so little outside of strictly architectural work that nothing beyond the services of the architect were needed, although in the older practice of the architect his field was considered a rather broad one. Indeed, nearly two thousand years ago Vitruvius wrote: "An architect should be ingenious and apt in the acquisition of knowledge. . . . He should be a good writer, a skilful draughtsman, versed in geometry and optics, expert at figures, acquainted with history, informed in the principles of natural and moral philosophy, somewhat of a musician, not ignorant of the sciences both of law and physic, nor of the motions, laws, and relations to each other of the heavenly bodies." And then, as if to confirm or justify the professional character of the architect, and possibly to indicate the propriety of joining the expert services of other professional men to his own, he further wrote: "Moral philosophy will teach the architect to be above meanness in his dealings and to avoid arrogance . . . and, what is of the highest importance, it will prevent avarice gaining an ascendancy over him: for he should not be occupied with the thoughts of filling his coffers, nor with the desire of grasping everything in the shape of gain, but, by the gravity of his manners, and a good character, should be careful to preserve his dignity."

The overlapping of the professional work of architects and engineers has already received serious consideration, and a committee report touching the matter, printed in The Engineering Record of December 22, 1900, was made to the last annual convention of the American Institute of Architects held at Washington, D. C. The committee made its report after a conference with a committee of the American Society of Heating and Ventilating Engineers, with many engineers of various specialties and with architects representing all sections of the country. The committee recommended in substance that the Institute's schedule charges be so amended that the minimum fee of the architect for those portions of his work involving electrical, mechanical and sanitary engineering, heating and ventilation, be made 10 per cent. of the cost of the corresponding parts of the work; that the architect select engineering experts and that the latter render their services under the supervision of the architect. On the whole, the terms of the report of the committee, when reasonably interpreted, may be considered satisfactory, and yet there would appear to be something further to be said.

The Institute has not devoted serious attention to this matter any too soon, and it probably would be wise for the American Society of Civil Engineers, or for other engineering bodies, to devote to the same subject equally serious consideration. In this region of professional work architects and engineers ought to co-operate both cordially and comprehensively. Both professions are deeply concerned and the most satisfactory results can only be obtained by mutual effort. As a matter of fact, general principles of co-operation could be at least outlined which would be of material benefit in other work than building construction. It is well enough that the architect should be the responsible head in the design and construction of buildings, but it would be equally suitable and essential that if an architect co-operated with an engineer in the design and construction of a bridge, the engineer should be the responsible head. Again, it is in the highest degree essential that in work where engineers and architects co-operate both should act from the initiation of the design work. This may not be essential from all points of view, but it certainly is essential from the point of view of estimated cost, and that is a point of view which does not always receive sufficient consideration. A client has a right to know what the cost of the work will be within a narrow margin, whereas the estimated costs of buildings with the plant involved are often grossly in error. Such a result will almost certainly occur if the services of the auxiliary expert do not begin with the inception of the design. His preliminary work ought to be performed coincidently with that of the professional principal, in order that all the elements of cost may be developed suitably to the purposes of the complete design, and, so far as their principal features are concerned, in final shape.

The report of the committee of the American Institute seems to bear entirely on the matter of machinery plants or parts of the work other than those of a structural character. As a matter of fact, there may frequently arise structural questions requiring auxiliary expert services. In most cases such expert service would be rendered in connection with the design of steelwork or foundations. Obviously these features should receive the same treatment as the others of the same class—that is, those beyond the limits of a purely architectural character. Apparently it was the opinion of the committee that all such structural matters should, so far as the fees are concerned, be considered architectural only. It may reasonably be doubted whether that is the proper conclusion. Certainly some foundation work and occasionally special structural design may properly be classed in the same category as the special lines of installation named by the committee and covered by the 10 per cent. fee. It is full time that these and possibly other fields of professional co-operation should be carefully considered by both engineers and architects, to the end that they may in actual practice be suitably recognized and that an adequate distribution of responsibility and fees may be reached.

Improvements in the Garbage Reduction Process.

Elsewhere in this issue there will be found the first account ever made public of an important experiment to improve the reduction process of garbage disposal. The primary object in garbage disposal must always remain its conversion by some process unobjectionable from a sanitary standpoint into products which are likewise unobjectionable. This primary object must ever be in mind. The secondary objects may include the generation of steam for power purposes by means of the gases of combustion from refuse incinerators, or the recovery of grease and fertilizing materials by the various methods of reduction. These secondary aims all have for their purpose the diminution of the cost of disposal, which is a praiseworthy aim so long as it never interferes with the primary object of such plants.

In the garbage reduction process the products are grease, used in making soap, and tankage, employed as a base for fertilizer. The tankage derives its value from its nitrogen content. There is a marked tendency everywhere to regard organic refuse as a fertilizing medium. The long striving of engineers to regard sewage as a fertilizing liquid is a matter of history, and even more recent was the endeavor to utilize as a fertilizer the ground clinker of garbage furnaces. In these attempts proper study was not made of the possibility of utilizing the nitrogen and phosphates as plant food, by first ascertaining that they occurred in the proper form for assimilation. It is only within a very few years that this subject has received more than casual investigation, and while much still remains to be learned, it seems fairly certain that tankage, sewage and the like contain their nitrogen in such combinations with other elements that little of it has any real immediate fertilizing use.

The experiment described elsewhere was intended to make commercial use of a far larger part than usual of the nitrogen of the tankage by changing the portion of it which has trifling fertilizing value into sulphate of ammonia, fertilizer base, gas and tar. The plant was not operated for sufficient time to furnish very definite results. The mixture of charred tankage and stick probably had about as much usefulness for agricultural purposes as the raw material from which it was made, but its cost must have been unnecessarily high by reason of the large percentage of water to be evaporated in the tankage fed into the coke ovens. This percentage must be reduced, or the cost of coking will be prohibitively high, but fortunately plants are in regular operation to-day where the proportion of water is much less. If any further experiments are made in this interesting matter, it is evident that the first step must be the study of tankage pressing. It is to be hoped that this step will be taken soon, for the garbage reduction process as generally conducted is by no means perfect yet.

The Pennsylvania Railroad Train-Shed at Camden.

The recent improvements of the Pennsylvania Railroad Company's terminal at Camden, N. J., include the concentration of all their Philadelphia passenger ferries at one point and the construction there of a new train-shed, headhouse and slip-sheds.

The train-shed is a 292 x 570-foot rectangular steel structure 75 feet high to the top of the lantern. It encloses a 252 x 570-foot space obstructed only by a center longitudinal row of columns, and has a cantilever roof 20 feet wide, projecting from each long side to shelter the yard tracks and street entrances. The shed accommodates twelve lines of tracks, which are arranged in four pairs and four single tracks on both sides of seven longitudinal platforms, in one of which the center columns are located. The building is lighted entirely by fixed-sash windows in the vertical walls of the gable ends, in the upper parts of the side walls, and in the clere-story sides of nine transverse lanterns built across the main roof. The shed has about the same length, width and train capacity as that at Jersey City, but differs radically in design from it and from the similar arched-roof train-sheds at the Philadelphia and Pittsburg terminals of the company.

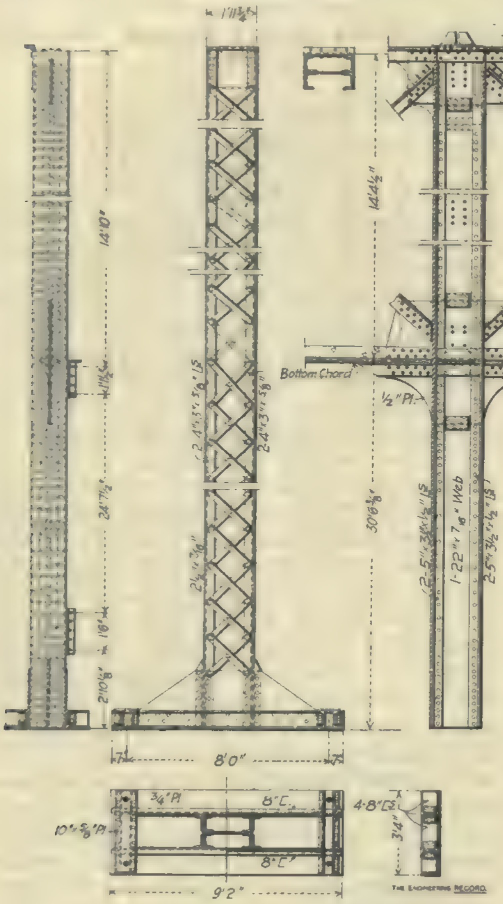
The framework of the shed is composed entirely of soft open-hearth steel with riveted main connections and weighs about 3,000,000 pounds. The flat roof slopes 1 : 4 on each side of the longitudinal axis, and the rafters and purlins of the center part are carried by vertical posts from the panel points of the horizontal top chords of twenty main roof trusses 15 feet deep and 252 feet long. These trusses have a clearance of about 28 feet above the track, and each is supported by a column in the center and one at each end, over which it forms a continuous truss, practically equivalent to a balanced cantilever supported in the middle and anchored at both ends. The center columns are designed to receive all wind strains, and the trusses develop maximum efficiency with a moderate depth and have proved to be very light and stiff.

The trusses are proportioned for a dead load of 11,200 pounds per panel of top chord and 1,600 pounds per panel of bottom chord; for a snow load of 20 pounds per square foot, which is equivalent to 9,400 pounds per panel; and for a wind pressure of 30 pounds per square foot on vertical surfaces and 10 pounds per square foot normal to the inclined roof surfaces. For dead and snow loads the unit tensile stress allowed is 15,000 pounds per square inch of net section, which is reduced in the usual way for compression. The values for stresses from dead load, snow and wind combined, are 20 per cent. greater. The maximum stresses are 164,000 pounds in the center panels of the top chord, 105,900 pounds compression in the end columns, 244,700 pounds compression and 27,100 pounds horizontal wind strain in the center column.

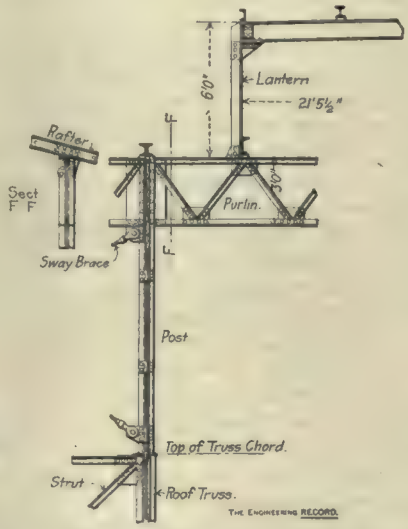
Nearly all the truss members have T-shaped cross-sections and are composed of pairs of angles riveted together back to back and connected at panel points with gusset plates 7/16 inch thick. The top chord has a uniform cross-section composed of two 6 x 4 x ⅜-inch angles and one 14 x ½-inch cover plate. The bottom chord has the same section except in the two middle panels, which have an additional 14 x 7/16-inch cover plate. The diagonal web members are two 6 x 4 x ½-inch angles in the center panels and decrease to two 4 x 3 x 5/16-inch angles in the second panels from the ends.

All the vertical truss members are pairs of 4 x 3 x 5/16-inch angles, riveted together with tie plates and having their flanges in the same planes at right angles to each other, but on opposite sides of the center line. At each end of the truss a pair of 6 x 8-inch angles are riveted to the under side of the bottom chord to form jaws engaging the 4-inch pin through the top of the vertical column, which has an I-shaped cross-section made up of four 5 x 3½ x 5/16-inch angles and a 10 x ¼-inch web plate. The lower end of the column also has a pin bearing in a shoe which is bolted to the masonry; it serves as a rocker bent and to receive either upward or downward reaction.

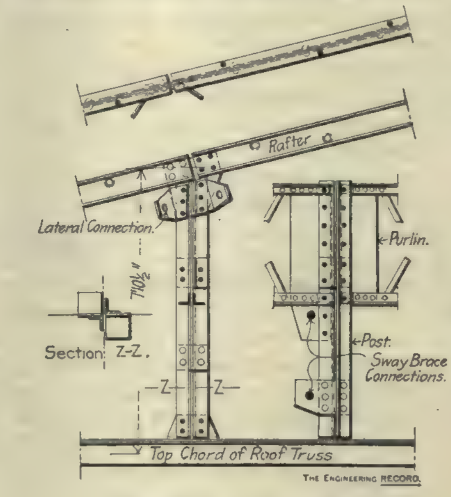
The diagonals and chords at the ends of the semi-trusses are thoroughly field riveted to the web of the center column. This column is continuous through the truss from bottom to top chord, and essentially forms the center vertical post of the continuous truss. It projects nearly



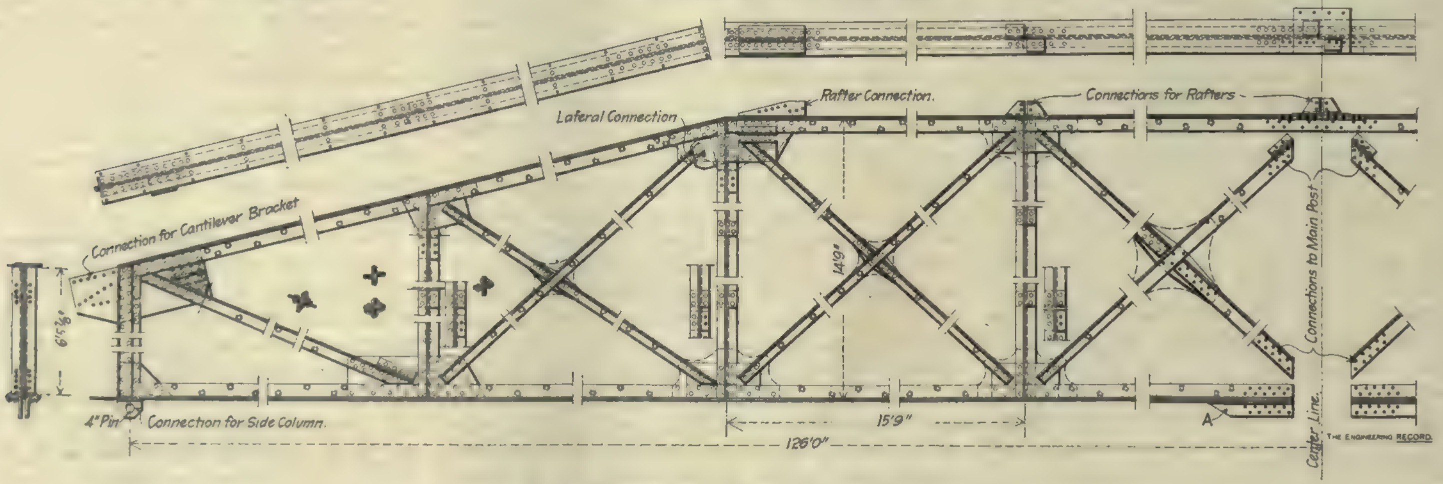
Details of Center Column.



Longitudinal Section above Main Truss.



Rafter on Main Truss Post.



Half Elevation of Main Roof Truss.

THE PENNSYLVANIA RAILROAD TRAIN-SHED AT CAMDEN.

WM. H. BROWN, CHIEF ENGINEER; W. A. PRATT, ENGINEER OF BRIDGES; AMERICAN BRIDGE CO., STEEL CONTRACTORS.

30 feet beyond the bottom chord of the truss, and is riveted with gusset plates to a horizontal transverse girder, 9 feet long at the bottom, which forms a stable pedestal and is anchored to the masonry with four 2¾-inch bolts about 10 feet long, calculated to resist any upward pull from wind pressure. At each end of the truss the last two panels of the top chord are sloped to correspond with the pitch of the roof, but the intermediate panels are horizontal and have a pair of angle clips at right angles to each other, riveted to the upper side to receive the vertical posts at panel points, which carry rafters composed of two 6-inch channels riveted together back to back. The tops of these vertical posts are connected together by lattice-girder purlins, and under every other purlin the panel between the purlin and the truss is braced by intersecting diagonal rods in the vertical longitudinal plane, with clevis ends pin-connected to web plates in the posts.

There are nine lines of longitudinal lattice girder struts connecting the trusses together at every other point and having the full depth of the truss at each point. These girders serve as purlins in the two end panels of the truss and support in each panel six intermediate 6-inch I-beam rafters. The trusses have double sets of lateral X-bracing in alternate bays. The upper set is composed of 1-inch square rods in the plane of the rafters under the sheathing. The lower set is in the horizontal plane of the top chords and is composed of 1-inch and 1¼-inch square rods. All rods in both systems are upset, cross two panels of purlins, and are pin-connected with clevis ends.

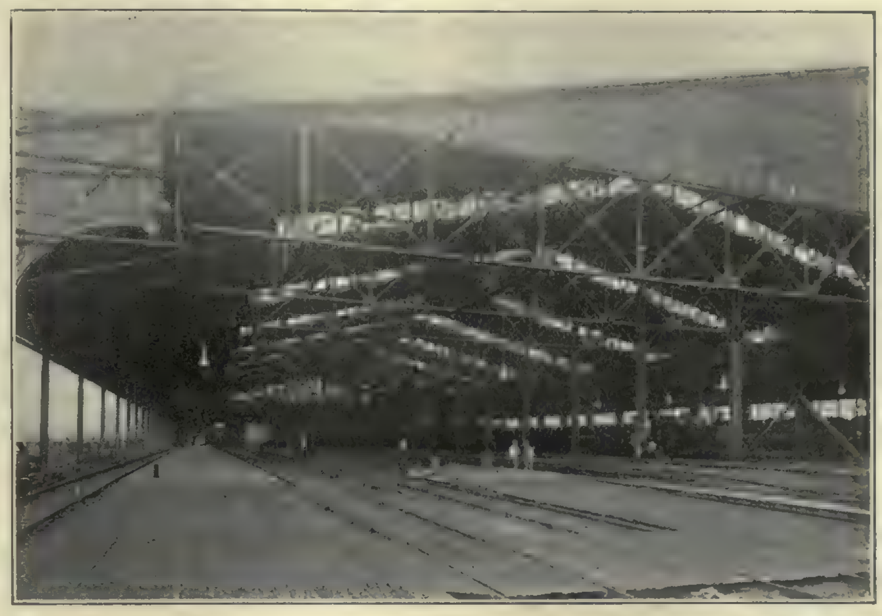
River Front of Ferry Slips and Camden Terminal.

In the center of each alternate roof panel there is a rectangular transverse lantern about 190 feet long, 22 feet wide and 8 feet high. Its pitched flat roof is parallel and similar to the main roof and its sides are glazed with fixed sash. The lantern framework consists of light vertical bents supported on each purlin. The bents have knee-braces in the upper corners, and carry the six intermediate rafters for that panel. The wall columns are braced together longitudinally by the eaves purlins and by a light framework of angles and channels to which the window casings and the corrugated sheathing are attached. The lower panels of this framing are X-braced in alternate panels.

All parts of the roof surface are sheathed with tongue-and-groove boards and covered with slag roofing which was laid at a cost of only 4½ cents per square foot. This detail, together with the difference in weight of the trusses and the greater economy of erection, resulted in a saving of about $100,000 in the cost of this train-shed over the cost of a shed covering the same ground space and of the Jersey City type. Owing to the absence of skylights, the roof is perfectly watertight and the arrangement of windows is such that they are all easily accessible for cleaning. On other sheds the outside of the glass has been found to become most soiled and is usually cleaned with dilute muriatic acid, which restores it to its original transparency. Live steam has the same effect but is more difficult to apply. Ventilation is accomplished entirely by means of 162 24-inch Star ventilators set in the main and lantern roofs. These produce a positive circulation whenever there is any perceptible breeze and are considered more efficient than louvres, especially in high roofs.

Side View of Camden Train-Shed.

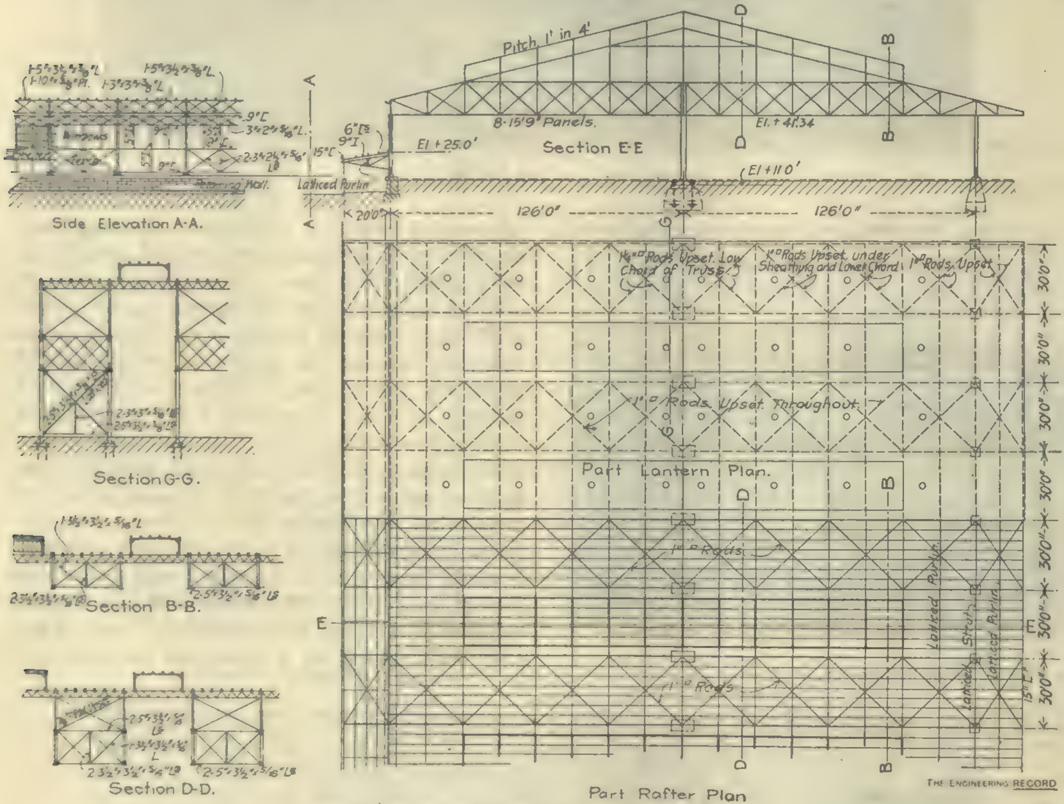
The building was erected by two tower travelers, one on each side of the center columns, with two 50-foot booms on the front corners of each traveler. They first set the center columns and the two end columns for each truss, and then erected, piece by piece, on the center column, the middle third of the truss, which had been shipped knocked down. The outer ends of this section were temporarily supported on wooden bents. The outer sections, each about 85 feet long and shop-riveted, were then raised bodily into place. After all main trusses and columns were in place, the lighter upper work was raised by means of two lighter tower travelers moving on timber runways located above the top chords of the main trusses and moving from the river end of the shed toward the eastern gable. A part of one side of the site was not filled to grade, and several foundations supporting the wall columns were not built when the trusses were erected. The latter were riveted to the center columns and temporarily supported on timber trestle bents two panels back of the wall ends until the grading was completed and the foundations built, when they were jacked up a little and the wall columns set in place to support the outer ends. It was observed in these operations that very little weight was imposed on either the temporary bent or on the wall columns.



End View of Train-Shed.

The slip-sheds and head-house are adjacent and at right angles to each other and their axes are oblique with the axis of the train-shed, so that there is a 190 x 120-foot triangular space enclosed between the end walls of these three buildings. This is covered with a flat roof supported on steel columns about 37 feet high and arranged in rows 25 feet apart longitudinally and 50 feet apart transversely. They carry lattice girders 4 feet deep, on which 6-inch longitudinal I-beams 5 feet apart support the roof sheathing and several pitched skylight frames. The roof surface is slightly pitched, with ridges parallel to the train-shed trusses so as to form several drainage valleys from which the rainwater is discharged in conductors carried down the outside of the vertical columns. To preserve the continuity of the front elevation, the main cornice at the eaves of the train-shed is continued on the same horizontal line across the front of this roof, and serves to hide the slopes and to conceal the skylights except from a long distance.

The general designs and calculations for the train-shed and other structural work were made by the Construction Department of the Pennsylvania Railroad, Mr. Wm. H. Brown, chief engineer, and Mr. W. A. Pratt, M. Am. Soc. C. E., engineer of bridges. The structural steel work was built by the Edge Moor Branch of the American Bridge Company.



PLAN AND ELEVATIONS OF CAMDEN TRAIN-SHED.

Extension of the Snoqualmie Falls Power Company's Plant.

Two years have passed since the first current from Snoqualmie Falls was carried into the cities of Seattle and Tacoma, Wash., and in this short time the initial installation has proved too small. The capacity of the plant is to be enlarged to meet the increasing demand for power in these growing western cities. At the falls, distant 44 miles in an air line from Tacoma and 32 miles from Seattle, are installed in a rock-excavated chamber four generating units, each consisting of a water-wheel direct-connected to a 2,000-horse-power Westinghouse three-phase alternator. This famous power transmission system, described fully in The Engineering Record of July 7, 1900, now generating and distributing 8,000 electrical horse-power, is to be more than doubled in capacity. At the same transmission voltage now employed, 30,000 volts, it is proposed to carry 12,000 horse-power more into the cities above mentioned, making a total output of 20,000 electrical horse-power. The electrical machinery is to be wholly furnished by the Westinghouse Electric & Manufacturing Company.

If an impact wheel is used there will be a single wheel on each end of each generator shaft and each wheel will be driven by a single jet of water 14 inches in diameter, the two jets combined being sufficient under the existing head of 270 feet to give the requisite power. The two water wheels and the generator between will be built on a single hollow shaft of oil-tempered nickel steel.

The present underground generating station, which is 200 feet long, is to be lengthened out 150 feet upstream to make room for the new installation. A new penstock is to be built which will carry 50 per cent. more water than the old one. The transmission line that is to parallel the old line will require 125 tons of aluminum wire, the order for which has already been placed. At Tacoma a large brick and stone sub-station is now being erected. The entire cost of these improvements will be in the neighborhood of $400,000. The work is to be vigorously prosecuted, and it is expected that the first of the new generators will be delivering current into Seattle and Tacoma within the next nine months. The generating machinery will consist of three 3,000-kilowatt rotating-field generators of the two-bearing type, generating a three-phase current at 1,100 volts and 7,200 alternations. The speed is to be 100 revolutions per minute. Each generator will require an exciting current of 320 amperes approximately, at 125 volts. For exciting these three generators, a 200-kilowatt, eight-pole, direct-current generator of the two-bearing type is to be used. At 175 revolutions it is to deliver under normal load a current of 1,600 amperes at 125 volts.

The current which is generated at 1,100 volts is to be raised to a line potential of 30,000 volts by nine 1,000-kilowatt, oil-insulated, water-cooled transformers. These are to be delta-connected on both the primary and secondary sides. It is estimated that each transformer will weigh 11,000 pounds and require 500 gallons of oil. The switchboard that is to be installed is to consist of fourteen panels of white marble and is to be of the special type that was furnished for the original installation. Instead of the Niagara type single-phase indicating wattmeter that is in use on the present switchboard a polyphase long scale indicating wattmeter is to be used. Where formerly a field plug switch was used a double-pole field switch is to be employed. The standard equipment of synchronizing lamps is to be replaced by a single-pole plug switch mounted on the generating panel and connected to a synchroscope, which will be mounted on the multiplying panel. The increased capacity of the generators will necessitate placing three single-pole main switches instead of one three-pole main switch. The circuit breakers, which are to be non-automatic, will be placed on an extension panel above the main instrument panel.

The Power Station for the New York Rapid Transit Railway.

Announcement has been made by the New York Rapid Transit Subway Construction Company, which is building the rapid transit system in New York City, of the letting of certain contracts for the power station that is to operate the line. Electricity is to be used, probably transmitted by means of the third rail. Contracts for the engines have been let to the Allis-Chalmers Company, of Chicago, while the boiler contract has been awarded to the Babcock & Wilcox Company, of New York City. The Engineering Record has obtained the following information concerning the plant from Mr. John Van Vleck, the mechanical engineer of the company:

The eight engines are to be of the same general type as those used in the power station of the Manhattan Railway Company of New York City. They were described in The Engineering Record, May 11, 1901. At each end of the main shaft there is a crank connected to a pair of cylinders, each pair arranged on the compound principle. The low-pressure cylinders have their axes in a vertical position, while the high-pressure cylinders are horizontal. The subway engines differ from those used in the Manhattan power station in that the high-pressure cylinders are provided with poppet valves in order that superheated steam may be used. These cylinders are jacketed by steam, which passes from the throttle through jackets surrounding the barrel before entering the admission valves. The high-pressure cylinders are to be 42 inches in diameter; the low-pressure 86 inches, and all will have a stroke of 60 inches. The rotative speed will be 75 revolutions per minute, giving a piston speed of 750 feet. The engines will develop 7,500 horse power each, when running at their best efficiency, while the maximum requirement is that 11,000 horse power will be generated. The steam pressure is to be from 175 to 200 pounds and the engines are guaranteed "to operate satisfactorily and without excessive use of oil with steam at temperatures of from 500 to 550 degrees Fahrenheit," and also that "they are to be superior to any engine machinery ever constructed for electric service." The type of condensers has not yet been decided upon.

There will be 48 boilers of the Babcock & Wilcox make, provided with wrought-steel headers. Each boiler will contain about 6,200 square feet of heating surface and is rated at 600 horse power. The specifications require the boiler settings to be lined throughout with fire brick. A minor detail is that each boiler will have two water columns, which is in accordance with the European practice, Mr. Van Vleck having made this provision on account of the impossibility of determining the water level by means of guage cocks, when a guage glass breaks, when high steam pressure is carried.

The preliminary plans which have been prepared for the power house contemplate the installation of eight entirely independent units, six boilers being provided for each engine with direct piping connections between them. The piping of the different units is to be connected by means of three tie pipes, running horizontally so that they can be readily drained, and connected opposite each engine to a vertical manifold connecting with the steam pipe of the engine. Frequent use is to be made of a new type of steam valve, which can be closed quickly by steam or air pressure controlled from convenient points.

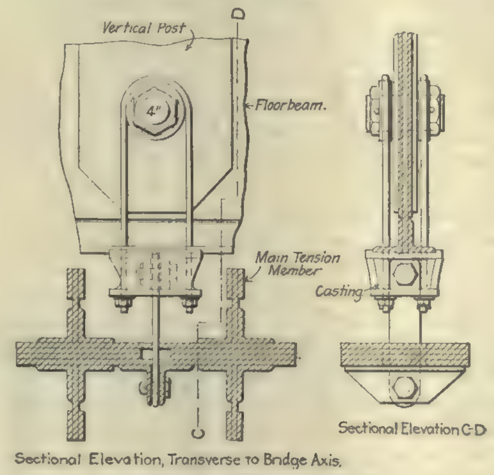
Unlike other large stations located in New York City, all of the boilers are to be located upon one floor, and this arrangement has been made possible by supporting the base of the four contemplated chimneys upon steel structures carried up from suitable foundations, so that the only space needed for the chimneys in the boiler room is that occupied by their supporting columns. Coal handling machinery will, of course, be used, and the boilers are to be equipped with mechanical stokers. To accommodate men engaged in cleaning the fires and boiler tubes and also the water tenders, men who will be employed solely for this purpose, there will be a platform elevated some feet above the floor and carried around the boiler fronts, leaving an open space in the middle to give light and ventilation to the boiler-room floor. Sufficient space has been provided back of the boilers so that a vertical cylindrical smoke flue can be used to connect the boilers with the main flue instead of the broad and shallow flues that have usually been employed, shutting off light to the boiler-room from adjacent windows. The circular flue will be lined with fire brick. Provision has been made in the preliminary plans for the use of economizers.

The Railway Bridge Across the Rhine at Worms.

There was finished last November at Worms, Germany, a double-track bridge across the Rhine which is about 3,054 feet long, and shows striking differences in several respects from the standard practice in the United States. The river is crossed by a 383.2-foot channel span and two 335.3-foot side spans, and at one end there is an approach with seventeen deck-truss spans of about 115½ feet. The abutment piers at the ends of the side spans are very massive, with heavy masonry arches and superstructures rising considerably above the tops of the trusses so as to form impressive portals which afford an opportunity for architectural embellishment. The main spans have deep trusses with curved chords resembling those of the great spans at Bonn and Dusseldorf. These trusses, although constructed like hingeless arch ribs, are considered as plain trusses because the curved lower chords are united at the first panel points from the ends by horizontal longitudinal tension members which take up all the thrust, like the lower member of a bowstring truss, so that only vertical reactions are developed at the abutments and piers.

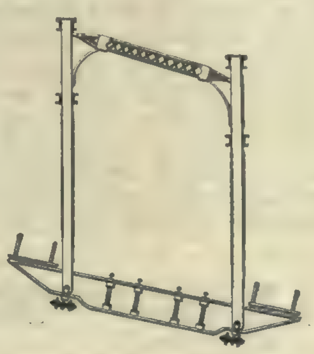
It is one of the marked features of the design that the horizontal tension members are made independent as much as possible of both the floor system and the trusses, and particular care has been exercised by the designers to make the roadway platform, the main trusses and the wind bracing all act independently. The designers have laid great stress on the unsymmetrical loading of the two trusses by the irregular position of trains on the double tracks, and to avoid the distortion in the transverse planes at panel points they have scrupulously avoided rigid connections between the trusses and the top lateral or bottom lateral systems and floor system and between the floor system and the horizontal tension members, except at the ends of the spans. The floor and lateral systems are rigidly connected to the trusses where the horizontal tension member intersects them one panel from the ends, and there is a deep plate-girder portal strut and stiff transverse bracing below the floor there; elsewhere transverse sway bracing is entirely omitted and the connections are made flexible for the express purpose of allowing the cross-section of the span to assume the shape of an oblique parallelogram, as shown in the exaggerated diagram, and thus prevent the transmission of strains in transverse planes which would occur if the trusses were braced together so as to preserve a rectangular cross-section for the span.

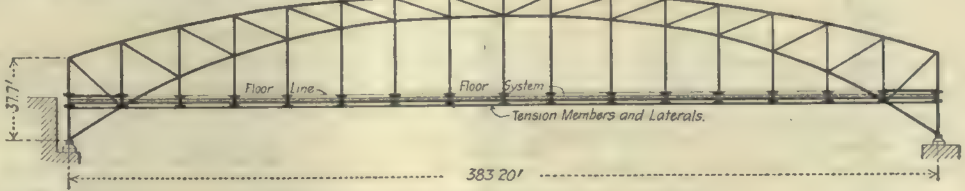
The trusses, although less than 30 feet apart on centers, have end bearings, with provision for transverse as well as longitudinal expansion and contraction, and elaborate provision is made to give permanent access to different parts of the bridge for repairs and inspection, by means of a movable transverse platform which rolls from end to end of each span under the roadway platform, and by permanent footwalks attached to the curved upper and lower chords, as shown in the general cross-section diagram, where the outlines of a car are dotted to show its small margin of clearance with the bridge members and with another car.



Sectional Elevation, Transverse to Bridge Axis.

Suspension of Horizontal Tie.


Distortion Diagram.



General Elevation, Worms Railway Bridge.

The upper and lower chords are rigidly spliced with field-riveted connections at all panel points, and each of them forms the chord of a parabolic arc between panel points. The top chords are of the usual inverted trough shape with two webs and a top cover plate. Each web plate is apparently made of two or more full width plates riveted together with narrower reinforcement plates riveted to them between the flange angles; the lower flange angles have reinforcement plates on their horizontal flanges and the cover plates appear to be riveted together in two or more thicknesses.

The bottom chord consists of two built channels latticed together on the top and bottom flanges, and having reinforced webs. The trusses are divided into panels of equal length by vertical posts, which are continued down through the curved bottom chords to act as suspenders for the floorbeams. They are made with an I-shaped cross-section and have a solid web in the transverse plane and four flange angles. There is in each panel a single diagonal which is made of two rolled or built channels latticed together with their webs in vertical planes.

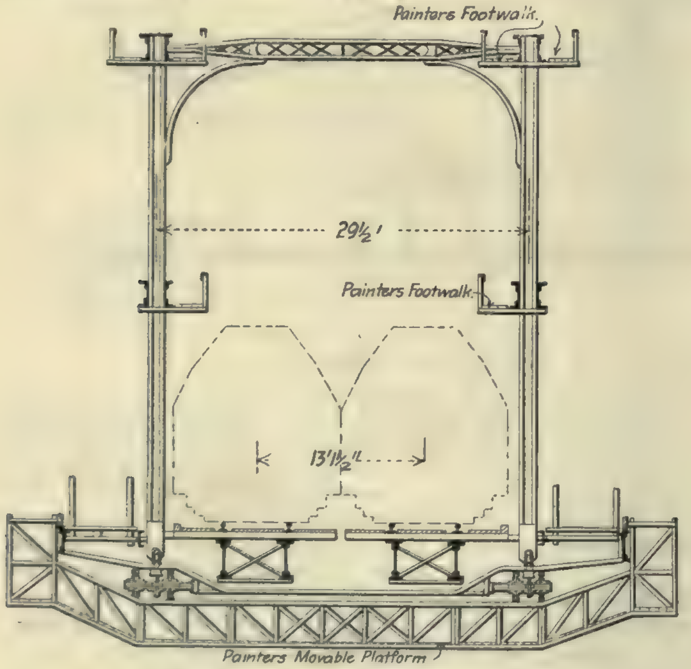
The top lateral system consists of transverse struts and X-braces, apparently made of pairs of channels latticed together with their webs horizontal and connected to the inner webs of the top chords by single thin horizontal plates which are rigid longitudinally and very flexible vertically. The ends of the transverse struts are also connected to the vertical posts below the top chords by knee-braces made of single curved channels with their flanges in vertical transverse planes. The centers of the transverse struts are braced together by a longitudinal strut which terminates one panel point from each end of the span. The end vertical posts of the main trusses are connected at the top by an arched plate-girder portal strut, which receives at its middle point the diagonals of the end panel of top lateral bracing.

The lower lateral system consists of X-braces riveted to horizontal connection plates on the lower tension members and independent of the floor system. There is no lateral or transverse bracing between the lower chords of the trusses except at the two points where they intersect the horizontal tension members. There is no sway bracing in the span except in the transverse planes of the end vertical posts, where there are the rigid connections of a deep portal strut at the top, a deep floorbeam in the middle and a transverse strut at the bottom. Between the two latter there are X-braces made of pairs of channels latticed, with their webs in vertical planes. These struts and all the others which have their details shown, have the channel webs converging at the ends so that they are almost in contact and act as jaw plates riveted directly to the connection or gusset plate.

The floorbeams are suspended from the vertical posts by pairs of U-bolts parallel to their webs. These U-bolts engage pins through the vertical posts and have bottom nuts bearing on saddle castings under the lower flanges of the floorbeams. A vertical suspension link in the center of this casting engages the web of the horizontal tension member and affords a flexible support for it. At the center of the span this connection is replaced by a diaphragm in the plane of the floorbeam web, which is riveted to the bottom flange of the floorbeam and to the web of the horizontal tie, and makes a connection which is rigid transversely and flexible longitudinally. The floorbeams have their lower flanges curved to clear the horizontal ties, and have shoulders riveted to them with grooved vertical plates to engage the edges of the lateral connection plates and thus keep the floor system from transverse displacement.

The floorbeams are extended beyond the trusses to carry a cantilever sidewalk on each side of the bridge, and their ends are connected by light fascia girders with solid webs. The upper flanges of these girders serve as tracks on which rolls a service platform with two light lattice girders which clear the under side of the span. Permanent sidewalks with hand rails are also cantilevered from the insides of the lower chords and from both sides of the upper chords, for convenience in inspecting, painting and repairing the bridge.

The vertical end posts take bearings at their lower ends on castings which have concave seats on the spherical upper portions of cast pedestals. At the fixed end of the span one of these pedestals is stationary on the masonry and the other is set on segmental rollers which make a rocker bearing allowing it to move transversely. At the expansion end one of the bearings is like the rocker bearing at the fixed end except that the rollers are set to allow longitudinal instead of transverse displacement, and the other bearing has two sets of segmental rollers at right angles to each other, one on top of the other, so as to allow both longitudinal and transverse displacement. The single roller pedestals are similar to the fixed pedestals except that they are shorter, so that when seated on the rollers the top is in the same horizontal plane. The double roller pedestal also has its upper surface at the same height, and in order to allow for the extra set of rollers is made so short that the webs of the pedestal disappear and it becomes simply a solid rectangular cast block. Each nest of rollers has a pair of cross bars tap-bolted to both ends of each roller, and in the center of the upper side of each roller there is a tap bolt with a round head which enters a hole recessed in the bottom of the bed plate or pedestal above. There is also a tap bolt at each end of the under side of each roller, but these are screwed into the bed plate and their heads project into recesses cut in the rollers, thus locking the rollers securely against all but a very small angular displacement and preventing their longitudinal or transverse movement.

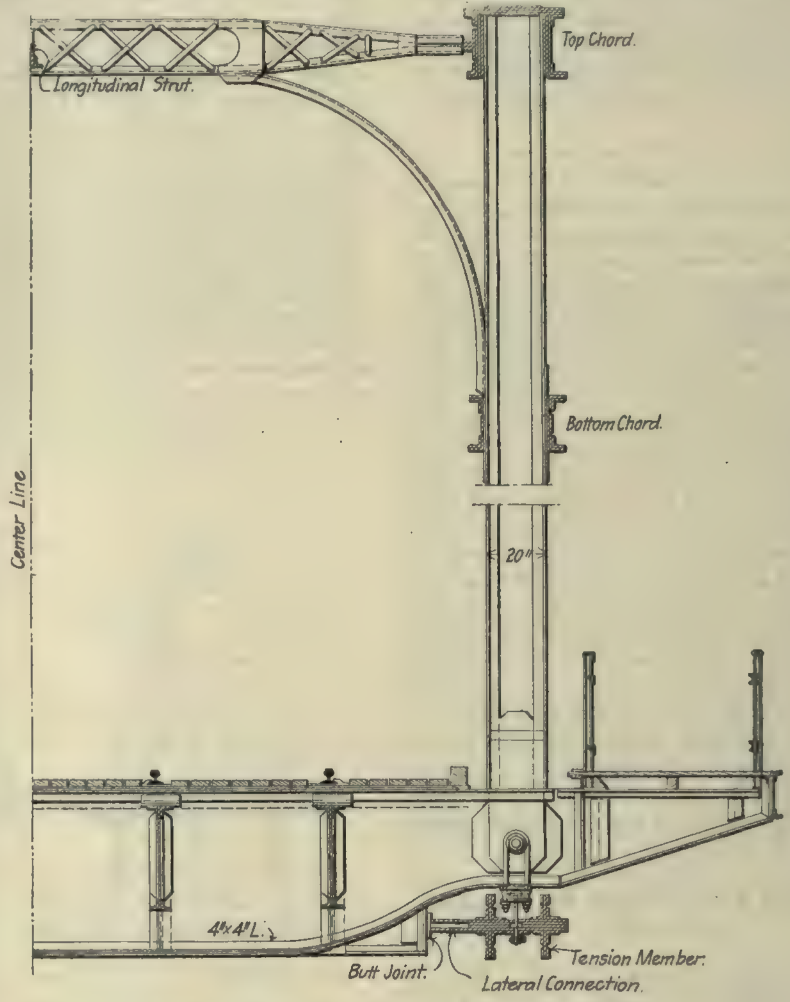


Typical Cross-Section.

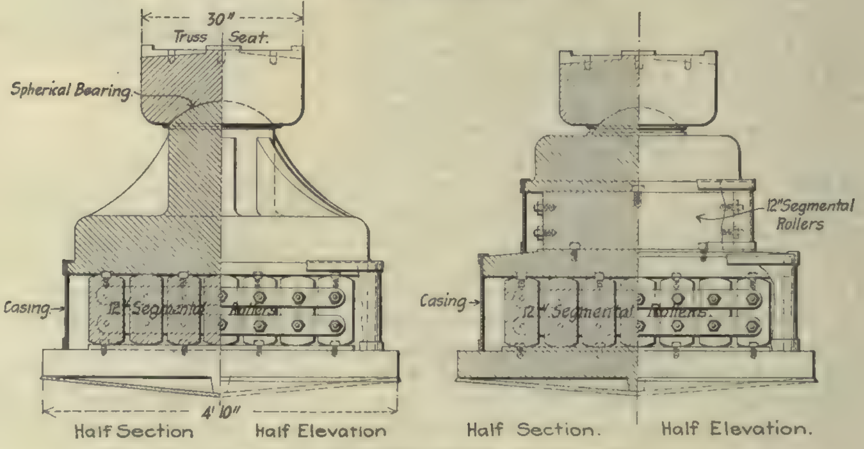
The deck spans of the approach viaduct are single-track structures, placed side by side in pairs, as close together as possible, the two inside trusses being supported on the same pedestal on top of the pier, and the floor systems and other parts of the structures being apparently entirely independent. The top and bottom chords are horizontal and the web members consist of vertical posts and single diagonals, all with riveted connections. There are sway-brace frames in transverse planes and the floorbeams are seated on top of the top chords and have their top and bottom flange angles extended beyond the outside trusses to form cantilever brackets for the sidewalks. The plate-girder stringers are web-connected to the floorbeams as in the main spans.

The main spans were erected on ordinary pile and trestle falsework, braced to make alternate towers and open panels and having one floor at the roadway level and another at the level of the center of the curved lower chord. A four-bent gantry, similar to an American erecting traveler, moved on the top of the falsework above and outside the trusses and assembled their members.

The deck approach spans were erected on trestle falsework, one story high, set on piles cut off at the surface of the ground. Each bent had three vertical posts, one in the center line of the bridge and one in the center line of each truss of one of the two single-track spans. The trusses were erected by a gantry with long legs on one side and short legs on the other; the short legs traveled on a rail on top of the falsework, in the center line of the bridge, and the long ones traveled on a rail on the surface of the ground, between which and the falsework there was a material track. A hand windlass was placed on a platform bracketed to the outside of the gantry, near the ground level, and operated a trolley hoist which traversed the bridge span.



Floor-Beam and Portal Connections.



Single and Double Expansion Pedestal.

The river piers rise about 28 feet above mean water level, are of concrete with stone facing, and were built on 28 x 75-feet pneumatic caissons sunk about 33 feet below water level. The abutment piers were built in cofferdams, for one of which the sheet piles were timber and for the other steel I-beams. The masonry and concrete were handled by a girder crane which traveled from end to end of the abutment. The bridge is described by M. Seurat in a recent issue of the "Genie Civil," from which these notes were prepared.

Notes on Electric Transmission of Power From Niagara Falls.

One of the most interesting papers presented before the American Institute of Electrical Engineers at its recent convention at Buffalo is that of Mr. Lewis B. Stillwell on the electric transmission of power from Niagara Falls. In its entirety it is a well-sustained thesis that, as the author puts it, progress in alternating-current methods since 1893, the date when the original contract for electrical machinery for the Niagara Falls Power Company was closed, has been in no sense revolutionary and that the time has long since passed when capital might reasonably hesitate to embark in well-considered enterprises depending for success on a correct application of electrical engineering skill. It is a significant fact, he said, that the electrical machinery to be installed in the second power-house now under construction will differ from that now in the first power-house only in relatively unimportant details of construction, while nearly every constituent part of the hydraulic equipment of the new plant will be materially and even radically different from its predecessor. In short, the paper may be styled a refutation of the common statement. "Electricity is in its infancy."

The paper takes up the engineering history of the plant under the following heads in order: the problem presented, system adopted, the first three alternators as planned and constructed, and under test and in service, alternators Nos. 4 to 10, the exciters, switching apparatus and measuring instruments, transmission and distribution, electrical equipment of the terminal house and the equipment of Power House No. 2. While it will be out of the question to take up even in brief the interesting conditions and solutions of problems leading to the final design and installation, the general features of which are doubtless more or less familiar to the readers of this article, there are a number of statements of the author and descriptions of details which it was desired to abstract or reprint, as the case may be, in this connection.

The system chosen to meet the complex requirements, unprecedented up to that time, was the alternating-current system, using two-phase alternators wound for 25 cycles per second and 2,200 volts. The adoption of the system was made, notwithstanding much advice in favor of the use of direct current. The author thought the rejection of the three-phase system a mistake from present knowledge, but even with Scott's subsequent invention of the method of securing three-phase currents from a two-phase source, he believed that were the Niagara problem presented at the present time, he would incline to the use of two-phase alternators which provide for three-phase long distance transmission and single or two-phase circuits for local distribution, with its accompanying convenience in load balancing. He considered the frequency was wisely chosen; that it was more generally used in America for electrical distribution for power purposes than any other. A frequency of 30 cycles per second he thought preferable, because 110-volt lamps of 16-candle-power or more supplied at that frequency are free from any suspicion of fluctuation in candle-power due to reversal of current, while at 25 cycles such is not the case, unless the conditions are assisted, as at Niagara, by a comparatively flat potential curve.

The method employed in balancing the revolving element of the alternators, which was devised by Mr. Albert Schmid, is described by Mr. Stillwell as follows: A special shaft is placed in the bearings of the machine, and supported at its lower end by a thrust bearing into which oil is pumped at a pressure of about 1,000 pounds per square inch. This pressure is sufficient to lift the weight of the revolving parts, and the collars on the shaft are separated from the grooves of the thrust bearing by a thin layer or film of oil. A small piece of tool steel is set into the upper end of the shaft, a half sphere or cup being cut in the upper surface of this tool steel, in which is placed a tempered steel ball ⅝ inch in diameter. A large eye-bolt with a similar piece of tool steel, having in its lower surface a cup bearing similar to that at the top of the shaft, is secured in the taper bearing of the umbrella-shaped driver, to the periphery of which the field ring is bolted. The entire weight of the driver and the ring is thus supported upon the small steel ball. A casting secured to the shaft serves to rotate the driver and ring with the shaft. The steel ball is placed a very short distance above the center of gravity of the field and driver, and under these conditions, the driver and ring being free to rock while rotated, a defect in balance is quickly shown.

Another interesting point of the paper, though treating of generator design, may well be mentioned, and that is the damage to armature windings caused by short circuits. The magnetic force exerted momentarily by the enormous currents flowing through the armatures and external circuits when a failure of cable insulation resulted in a short-circuit can be realized from the statement that lead-covered insulated conductors of 1,000,000 circular mils section, weighing upward of 4 pounds per linear foot, have been thrown off from their supporting brackets to a distance of 5 or 6 feet. In one instance the cable was thrown a horizontal distance of approximately 5 feet while falling not more than 2½ feet. The difficulty has been overcome by inserting wooden spacing-strips between the projecting ends of the armature bars.

With regard to the distribution of power in underground ducts, it was found that there was little information obtainable as to the relative temperature of different ducts in a conduit, and a test was made for the purpose, the result of which shows the importance of taking into account the dissipation of heat in cases where cables conveying large amounts of power are used. The power losses are two-fold: those due to resistance of the copper conductors and those due to currents induced in the lead sheaths. For the test 24 ducts of 36-duct conduit were used, between two manholes 140 feet apart. No. 6 drawing wire was drawn through the ducts and these were connected at ends in such a way as to put eight wires electrically in series, the 24 wires constituting three groups of eight wires each. Current was passed through these in sufficient quantity to cause a loss of energy of 5.5 to 6 watts per linear foot. The test was continued for about ten days and nights, with hourly readings. It was found that the rise of temperature of the air in the duct above the temperature of the earth surrounding the conduit was as much as 20 degrees Centigrade, where the ducts are separated on all sides from the surrounding earth by at least one other duct, and that the rise of temperature in the case of ducts next to earth was about 60 degrees Centigrade, or 108 degrees Fahrenheit. If the temperature of the earth surrounding the conduit is assumed to rise in summer to 79 degrees Fahrenheit, it follows that the temperature of the air in the inner duct may go as high as 114 degrees Fahrenheit, while the temperature of the air in the outside ducts would be 188 degrees under the same conditions. To convey 15,000 horse-power using 24 500,000-circular-mil cables, the author calculated that if the temperature of the ground surrounding the conduit be 70 degrees Fahrenheit, the temperature of the copper conductor will approximate 215 degrees Fahrenheit. The practical result was that instead of local transmission to points exceeding two miles through the conduits at 2,200 volts, three-conductor cables working at 10,000 volts supplied through step-up transformers were adopted.

Concerning the new long-distance power transmission pole line, the author, among other things, said that the length of span is doubled, that is, about 140 feet as against 70 in the old line, and every third pole is guyed. In the case of the old line it had been assumed that during sleet storms ice might cover the conductors to a radial depth of half an inch and the increased pressure would tend to assist the severe wind storms of that locality in overthrowing the line. It has been demonstrated, however, that ice never adheres to the power circuits while they are traversed by the working circuits, due in part, the author presumed, to the heating effect of the current and in part perhaps to static repulsion It is certain, he said, that dry snow is statically repelled by the charged conductors. Experience has shown, he continued, that mechanically the weak point in the construction of the old line was the junction of pin and insulator, and the new pin at the top is 1½ inches in diameter against ⅞ inch in the case of the old pin. From tests made to determine the horizontal stress which would break pin or insulator, or both, if exerted at the top of the insulator, it was found that a pin will break at the point where it enters the cross arm under a pressure of about 2,100 pounds, which is about six times the calculated maximum pressure to which it will be subjected in service. The shoulder of the insulator, the tests showed, will break under a horizontal stress of about 1,300 pounds in service.

Aluminum conductors are used for the line and where they pass near large chemical industries, they are protected by a braided cover treated with asphaltum. The joints are spliced and wrapped, but not soldered. It has been found that when the wind is blowing at high velocity, the tightly strung copper conductors swing or vibrate irregularly, but rapidly, and the vibration is transmitted to the pole, the trembling of which can be detected by placing the hand against it at a point near the ground. The aluminum conductors under similar circumstances tend to assume a fixed position, which is sometimes apparently as much as 45 degrees from the vertical plane in which they hang when the air is quiet, and there is practically no vibration at the pole. The author thought the elimination of vibrating stresses on insulator and pin gratifying, as in the old line there was a tendency for the insulators to work loose, which he had no doubt was caused by the vibration of the conductors during heavy wind storms.

The New England Water-Works Association will hold its twentieth annual convention at Portland, Me., September 18-20, at the New Falmouth Hotel. The following papers are announced: "Bacteriological Analysis of Water and Its Interpretation," Chas. E. A. Winslow; "Work of Sanitary Inspection on the Metropolitan Water-Works," William A. Locke; "Water Supplies of the State of Vermont," Chas. P. Moat; "Swamp Drainage for Watershed Improvement," Edward S. Larned; "What an Engineer Saw in Venice," Desmond FitzGerald; "Pollution of Streams by Manufactural Wastes —Methods of Prevention" and "Investigations in Regard to Coloring Matter in Waters and Methods of Removal," H. W. Clark. Reports are also to be made from the committees on uniform statistics, standard specifications for cast iron, and the apportionment of charges for private fire protection.

Testing Hydraulic Cements.—I.

Report of Major William L. Marshall, Major Smith S. Leach and Capt. Spencer Cosby, Corps of Engineers, U. S. A., being Professional Paper 28 of the Corps.

The constructing engineer is confronted by no problem more difficult than to decide whether a certain cement, when placed in a work, will behave in a predetermined way. This is especially true of Portlands. Other cements are much more reliable under conditions of exposure for which they are suited.

The difficulties arise from the fact that tests for acceptance or rejection must be made on a product not in its final stage. A cement, when incorporated in masonry, undergoes for months chemical changes in the process of setting, so that the material subjected to strains in the work is not the material tested, but a derivative of it. The object of tests is to establish two probabilities: First, that the product of the given cement will develop the desired strength and hardness soon enough to enable it to bear the stresses designed for it; second, that it will never thereafter fall below that strength and hardness. Up to the present time it appears that the relation between the chemical and physical properties of raw cement and of its partially indurated derivatives, determined by tests, and the physical properties of the same cement or its derivatives, after complete hydration and induration in the work, can be stated only within rather wide limits.

The most useful tests of cements are those, first, which connect themselves definitely with some serious defect to which cements are subject, or with some merit which they should possess; second, which can be made with the least apparatus and manipulation, and which give their indications in the shortest time; and, third, which are freest from personal equation and from influences of local surroundings. These criteria, applied to the customary tests of cements, give indications as to their relative value and the best methods of making them.

Test of grinding.—This test derives importance from the fact, apparently well established, that, other things being equal, the finer the cement the greater will be its sand-carrying capacity; that is, it will show greater strength with the same charge of sand, or equal strength with a greater charge. According to the best information the Board can obtain, the cementitious value of this material is believed to reside principally, if not wholly, in the very fine part. It follows that a grinding test should be directed to determining the proportion which is very fine rather than the residue above a certain size. The Board does not propose any change in the accepted grinding test of Portland cement, but favors for natural cement the use of the same size screen as for Portland, No. 100, with the requirement that 80 per cent. shall pass through it. The screen should be frequently examined, magnified, if practicable, to see that no wires are displaced, leaving apertures larger than the normal.

Test for specific gravity.— This test is made with simple appliances, and its result is immediately known. It appears to connect itself quite definitely with the degree of calcination which the cement has received. The higher the burning, short of vitrification, the better the cement and the higher the specific gravity.

This test has another value, in that the adulterations of Portland cement most likely to be practiced and most to be feared are made with materials which reduce the specific gravity. The test is therefore of value in determining a properly burned, nonadulterated Portland. If underburned, the specific gravity may fall below 3; it may reach 3.5 if the cement has been overburned. No other hydraulic cement is so heavy in proportion to volume, natural cement having a specific gravity of about 2.5 to 2.8 and puzzolan (slag) of about 2.7 to 2.8. Properly burned Portland, adulterated with slag, will fall below 3.1.

Test of activity.—This test, made by gauging the cement with water and observing the times of initial and permanent set, is partly direct and partly indirect. It is direct in so far as its limits relate to the time necessary to get the cement in place after mixing, which must not be greater than the time of initial set, and to the time within which the cement product must take its load, which must not be less than the time of permanent set. It is indirect in so far as its limits relate to the probable final strength, elasticity, and hardness of the cement mixtures. In the latter respect it appears to be reasonably well established that cements exhibiting great activity give, after long periods, results inferior to those with action less rapid.

The test for activity is easily made with simple appliances, and its results are known in a few hours at most. Variable results in the test are caused by different local conditions of moisture and temperature and by the different judgments of observers as to whether the needles penetrate or not. Generally speaking, both periods of set are lengthened by increase of moisture and shortened by increase of temperature. Some manufacturers claim that their cements show their best results when gauged with particular percentages of water. It is not considered good policy to encourage these peculiarities at the expense of the uniformity of tests which is so greatly desired. It is better to adopt a definite proportion of water for gauging and require all cements of the same class to stand or fall on their showing when so gauged. Such a percentage, adopted and known, will probably be used by manufacturers in testing goods sold to the Engineer Department, and a greater harmony between mill and field tests of the same cement will result.

In gauging Portland cement in damp weather the samples should be thoroughly dried before adding water. This precaution is not deemed necessary with natural cement. Sufficient uniformity of temperature will result if the testing room be comfortably warmed in winter and the specimens be kept out of the sun in a cool room in summer, and under a damp cloth until set.

Test for constancy of volume.—This test results from observations made on the pats or cakes used in the setting test. It derives its value from its connection with the quantity of expansives in the cement.

The test is easy to make, and its results are relatively free from personal error, though there is room for a difference of judgment as to the appearance of the cakes. As they may be preserved and the decision reviewed at any time on the original data, such differences are immaterial.

Tests of strength.—These may be subdivided into compressive and tensile tests, the latter including the transverse test made by breaking a beam of the cement. The compressive test need not be further considered, as it is less easily made than the tensile test and gives no surer indications. The ratio of compressive to tensile strength of the same class of cements is quite uniform.

Of the tensile tests the direct pull is preferable to the flexure test.

The tensile test is theoretically a perfect index of the quality of the cement at the periods of test, and a comparison at different periods gives the best obtainable indication of what its subsequent conduct will be. In the opinion of the Board the two periods most generally adopted, 7 and 28 days after mixing, are, on the whole, the best. The one-day test, though of some value in a discriminating sense, should not be placed in the same category as the other periods named.

The apparatus for tensile tests is somewhat elaborate and delicate, but is of standard manufacture and readily obtainable at relatively small cost.

In respect of uncertainties due to the personal equation of the tester and to the influence of local conditions this test presents greater difficulties than any of the others considered. The most scrupulous care must be observed in the manipulations, and the tester should possess natural aptitude for such work. The object is to determine the greatest stress per square inch which the cement can be made to stand under given conditions without rupture. If the conditions have been carefully observed and several discrepant results are obtained, the highest may be right, but the others are certainly wrong. No averaging should be done.

The remarks made above under the activity test as to the relation between early hydraulic intensity and the final excellence of a cement product are equally applicable to the indications from tensile tests. A cement which tests moderately high at 7 days and shows a substantial increase to 28 days is more likely to reach the maximum strength slowly and retain it indefinitely with a low modulus of elasticity than a cement which tests abnormally high at 7 days with little or no increase at 28 days.

Accelerated tests.—The rules recommended by the committee of the American Society of Civil Engineers in 1885 have been substantially accepted here and abroad as to tests of setting qualities and soundness; more rapid tests for soundness are, however, proposed and practiced, though no accelerated test has been generally accepted.

Accelerated tests proposed for the speedy detection of the presence of expansives in cement usually consist in the application, after gauging, of dry heat or of immersion in warm or boiling water or steam. The immersion tests are most in vogue. They vary from immersing freshly gauged pats on glass plates in water at 115 degrees Fahr. for 24 hours, or at higher temperatures for various periods, to steaming or boiling cakes or cylinders of the material to be tested at 212 degrees Fahr. for varying times.

In France and Germany the swelling or expansion of boiled cylinders is measured directly by calibration. Usually change of volume not accompanied by visible evidences of it—i. e., distortion or disruption—is not observed in American tests prescribed in specifications for the reception of cements. Of all these tests the boiling test is the simplest, requires only apparatus everywhere available, and is recommended by the Board. It has been the experience that this test detects material that is unsound by reason of the presence of active expansives; but in some cases it rejects material that would give satisfactory results in actual work and will reject material that would stand this test after air slaking.

The great value of the test lies in its short-time indications and in at once directing attention to weak points in the cement to be further observed or guarded against. Of two or more cements offered for use or on hand, the cements that stand the boiling tests are to be taken preferably; it should be constantly applied on the work among other simple tests to be noted, for although the boiling test sometimes rejects suitable material, it is believed that it will always reject a material unsound by reason of the existence of active expansives. Sulphate of lime, while enabling cements to pass the boiling tests, introduces an element of danger.

This test is proposed as suggestive or discriminative only. Except for works of unusual importance it is not recommended that a cement passing the other tests proposed shall be rejected on the boiling test.

Tests to be made.—For selecting Portland and puzzolan cement from among the brands offered, the Board recommends that the following tests be made: 1, For fineness of grinding; 2, for specific gravity; 3, for soundness, or constancy of volume in setting; 4, for time of setting; 5, for tensile strength.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXIII, PRAGUE, CARLS BRIDGE.
A view of the archway, with flanking towers, that terminates the bridge on the Kleinseite bank of the Moldau. The most noted of the statues is that of St. John Nepomuk, patron saint of the bridge, which is still visited by thousands of people on his anniversary day.

For natural cement we recommend the omission of the specific-gravity and soundness tests.

On the works the Board recommends simple tests when the more elaborate tests cannot well be made.

In determining the minimum requirements for cements given in the subjoined specifications we recognize that many cements that attain only fair strength neat and with sand in a short time and show marked gains of strength on further time will fulfil the requirements of the service, and that unusually high tensile strength attained in a few days after gauging is often coupled with a small or negative increase in strength in further short intervals. Unusually high tests in a short time after gauging should be regarded with suspicion, although some well-known brands of American cements show great strength in short-time tests and, so far as observed, are reliable in air and fresh water. Cements offered under such known brands should show their characteristic strength and other qualities or be suspected as spurious or adulterated, if not rejected, even though the minimum requirements of the specifications are met. The practice of offering a bonus or free gift of money in addition to the contract price for cement testing above a fixed high point should be prohibited as unnecessary, for cements so obtained are likely to be unsound in a manner not easily detected in the time usually available in testing.

It is believed that most of the very high testing Portland cements have lime in excess, the effect of which is temporarily masked by the use of sulphate of lime. Overlimed cements so treated are unfit for use in sea water. For such uses a chemical analysis should be required, and the quantity of sulphuric acid, as well as magnesia, be limited to a low percentage. It is not yet known that sulphate of lime in quantity less than 2 per cent. is injurious to cements to be used in fresh water or in air. It masks expansives that might ultimately cause the destruction of the work, but it is not known whether this effect is permanent. Its addition is now deemed necessary to control time of setting. It makes a quick-setting cement slow setting, at the same time increasing tensile strength acquired in short time.

Manipulation of cements for tests.—I, Fineness.

—Place 100 parts (denominations determined by subdivisions of the weighing machine used) by weight on a sieve with 100 holes to the linear inch, woven from brass wire No. 40, Stubb's wire gauge; sift by hand or mechanical shaker until cement ceases to pass through.

The weight of the material passing the sieve plus the weight of the dust lost in air, expressed in hundredths of the original weight, will express the percentage of fineness. In order to determine this percentage the residue on the sieve should be weighed.

It is only the impalpable dust that possesses cementitious value. Fineness of grinding is therefore an essential quality in cements to be mixed with sand. The residue on a sieve of 100 meshes to the inch is of no cementitious value, and even the grit retained on a sieve of 40,000 openings to the square inch is of small value. The degree of fineness prescribed in these specifications (92 per cent.) for Portland through a sieve of 10,000 meshes to the square inch is quite commonly attained in high-grade American cements, but rarely in imported brands. On the Pacific coast, where foreign cements only are in the market, this requirement may be lowered for the present to 87 per cent. on No. 100 sieve.

II, Specific gravity.—The standard temperature for specific gravity determinations is 62 degrees Fahr., but for cement testing temperatures may vary between 60 and 80 degrees Fahr. without affecting results more than the probable error in the observation.

Use any approved form of volumenometer or specific gravity bottle, graduated to cubic centimeters with decimal subdivisions. Fill instrument to zero of the scale with benzine, turpentine, or some other liquid having no action upon cements.

Take 100 grams of sifted cement that has been previously dried by exposure on a metal plate for twenty minutes to a dry heat of 212 degrees Fahr., and allow it to pass slowly into the fluid of the volumenometer, taking care that the powder does not stick to the sides of the graduated tube above the fluid and that the funnel through which it is introduced does not touch the fluid.

Read carefully the volume of the displaced fluid to the nearest fraction of a cubic centimeter. Then the approximate specific gravity will be represented by 100 divided by the displacement in cubic centimeters.

The operation requires care.

III, Setting qualities and soundness.—The quantity of water and the temperature of water and air affect the time of setting. The specifications contemplate a temperature varying not more than 10 from 62 degrees Fahr., and quantities of water given herein:

For Portland cements use 20 per cent. of water.

For puzzolan cements use 18 per cent. of water.

For natural cements use 30 per cent. of water.

Mix thoroughly for five minutes, vigorously rubbing the mixture under pressure; time to be estimated from moment of adding water and to be considered of importance.

Make on glass plates two cakes from the mixture about 3 inches in diameter, ½ inch thick at middle, and drawn to thin edges, and cover them with a damp cloth or place them in a tight box not exposed to currents of dry air. At the end of the time specified for initial set apply the needle one-twelfth of an inch diameter weighted to ¼ pound to one of the cakes. If an indentation is made the cement passes the requirement for initial setting, if no indentation is made by the needle it is too quick setting. At the end of the time specified for "final set" apply the needle one twenty-fourth of an inch diameter loaded to one pound. The cement cake should not be indented.

Expose the two cakes to air under damp cloth for 24 hours. Place one of the cakes, still attached to its plate, in water for 28 days; the other cake immerse in water at about 70 degrees temperature supported in a rack above the bottom of the receptacle; raise the water gradually to the boiling point and maintain this temperature for six hours and then let the water with cake immersed cool. Examine the cakes at the proper time for evidences of expansion and distortion. Should the boiled cake become detached from the plate by twisting and warping or show expansion cracks the cement may be rejected, or it may await the result of 28 days in water. If the fresh-water cake shows no evidences of swelling, the cement may be used in ordinary work in air or fresh water for lean mixtures. If distortion or expansion cracks are shown on the fresh-water cake, the cement should be rejected.

Of two or more cements offered, all of which will stand the fresh-water cake test for soundness, the cements that will stand the boiling tests also are to be preferred.

IV, Tensile strength.—Neat tests. Use unsifted cements. Place the amount to be mixed on a smooth, non-absorbent slab; make a crater in the middle sufficient to hold the water; add nearly all the water at once, the remainder as needed; mix thoroughly by turning with the trowel, and vigorously rub or work the cement for five minutes.

Place the mold on a glass or slate slab. Fill the mold with consecutive layers of cement, each when rammed to be ¼ inch thick. Tap each layer 30 taps with a soft brass or copper rammer weighing 1 pound and having a face ¾ inch diameter or 0.7 inch square with rounded corners. The tapping or ramming is to be done as follows: while holding the forearm and wrist at a constant level, raise the rammer with the thumb and forefinger about half an inch and then let it fall freely, repeating the operation until the layer is uniformly compacted by 30 taps.

This method is intended to compact the material in a manner similar to actual practice in construction, when a metal rammer is used weighing 30 pounds, with circular head 5 inches in diameter falling about 8 inches upon layers of mortar or concrete 3 inches thick. The method permits comparable results to be obtained by different observers.

After filling the mold and ramming the last layer, strike smooth with the trowel, tap the mold lightly in a direction parallel to the base plate to prevent adhesion to the plate, and cover for 24 hours with a damp cloth. Then remove the briquette from the mold and immerse it in fresh water, which should be renewed twice a week for the specified time if running water is not available for a slow current. If molds are not available for 24 hours, remove from the molds after final set, replacing the damp cloth over the briquettes. In removing briquettes before hard-set, great care should be exercised. Hold the mold in the left hand and, after loosening the latch, tap gently the sides of the mold until they fall apart. Place the briquettes face down in the water trough.

For neat tests of Portland cement use 20 per cent. of water by weight.

For neat tests of puzzolan cement use 18 per cent. of water by weight.

For neat tests of natural cement use 30 per cent. of water by weight.

Nearly all this water is retained by Portland cement, whereas only about one-third of the gauging water is retained by puzzolan or natural cements; from this it follows that an apparent condition of plasticity or fluidity that ultimately little injures Portland paste, very seriously injures puzzolan or natural mortars and concretes by leaving a porous texture on the evaporation of the surplus water.

Sand tests. The proportions 1 cement to 3 sand are to be used in tests of puzzolan and Portland, and 1 cement to 1 sand in tests of natural or Rosendale cements. Crushed quartz sand, sifted to pass a standard sieve with 20 meshes per linear inch and to be retained on a standard sieve with 30 meshes to the inch, is to be used.

After weighing carefully, mix dry the cement and sand until the mixture is uniform, add the water as in neat mixtures, and mix for five minutes by triturating or rubbing together the constituents of the mortar. This may be done under pressure with a trowel or by rubbing between the fingers, using rubber gloves. The rubbing together seems necessary to coat thoroughly the facets of the sand with the cement paste.

It is found that prolonged rubbing, when not carried beyond the time of initial set, results in higher tests. Five minutes is the time of mixing quite generally adopted in European specifications. The briquettes are to be made as prescribed for neat mixtures.

Portland cements require water from 11 to 12½ per cent. by weight of constituent sand and cement for maximum strength in tested briquettes.

Puzzolan, about 9 to 10 per cent.

Natural, about 15 to 17 per cent.

Mixtures that at first appear too dry for testing purposes often become more plastic under the prolonged working required herein.

In general, about four briquettes constitute the maximum number that may be made well within the time required for initial setting of moderately slow setting cements.

Three such batches of sand mixtures should be made, and one briquette of each batch may be broken at 7 and 28 days, giving three tests at each period. At least one batch of neat cement briquettes should be made.

If the first briquette broken at each date fulfils the minimum requirement of these specifications it is not necessary to break others, which may be reserved for long-time tests.

If the first briquette does not pass the test for tensile strength, then briquettes may be broken until six briquettes, two from each batch, have been broken at 7 days, and the remaining six reserved for 28-day tests. The highest result from any sample is to be taken as the strength of the sample when the break is at the least section of briquette.

If, on the 28-day tests, the cement not only more than fulfils the minimum requirements of these specifications, but also shows unusual gain in strength, it may still be accepted if the other tests are satisfactory, notwithstanding a low seven-day test, if early strength is not a matter of importance. Such cements are likely to be permanent.

For a batch of four briquettes, the following quantities are suggested as in accord with these specifications. Water is measured by fluid-ounce volumes, not by weight, temperature varying not more than 10 from 62 degrees Fahr.

Portland cement: Neat: 20 ounces of cement, 4 ounces of water. Mix wet five minutes.

Sand: 15 ounces sand, 5 ounces cement, 2½ ounces water. Mix thoroughly dry; then mix wet five minutes.

Puzzolan cement: Neat: 20 ounces cement, 3¾ ounces water. Mix wet five minutes.

Sand: 15 ounces sand, 5 ounces cement, 2 ounces water. Mix thoroughly dry; then mix wet five minutes.

Natural cement: Neat: 20 ounces cement, 6 ounces water. Mix wet five minutes.

Sand: 10 ounces cement, 10 ounces sand, 3½ ounces water. Mix dry; then wet for five minutes.

For measuring tensile strength, a machine that applies the stress automatically at a uniform rate is preferable to one controlled entirely by hand.

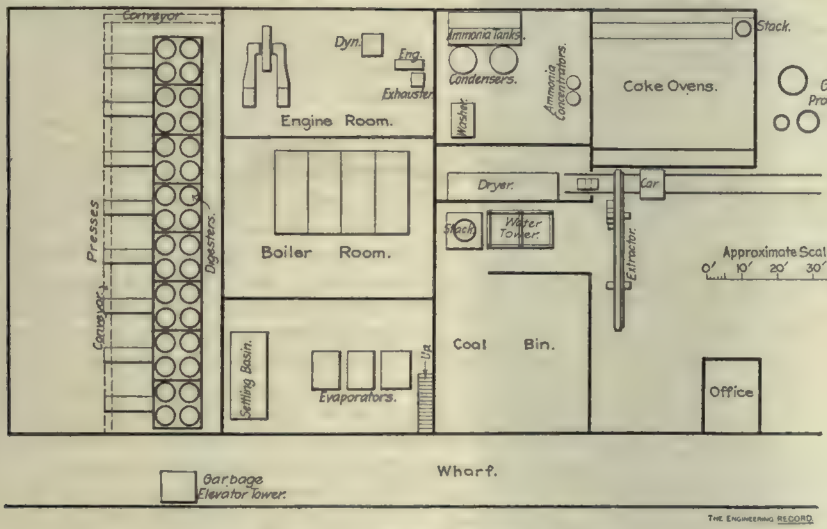
These specifications for tensile strength contemplate the application of stress at the rate of 400 pounds per minute to briquettes made as prescribed herein. A rate so rapid as to approximate a blow or so slow as to approximate a continued stress will give very different results.

The tests for tensile strength are to be made immediately after taking from the water or while the briquettes are still wet. The temperature of the water during immersion should be maintained as nearly constant as practicable; not less than 50 nor more than 70 degrees Fahr.

The tests are to be made upon briquettes 1 inch square at place of rupture. The specifications contemplate the use of the form of briquette recommended by the committee of the American Society of Civil Engineers, held when tested by close-fitting metal clips, without rubber or other yielding contacts. The breaks considered in the tests are to be those occurring at the smallest section, 1 inch square.

Simple tests.—Tests of cement received upon a work in progress must often be of much simpler character than prescribed herein.

Tests on the work are mainly to ascertain whether the article supplied is genuine cement, of a brand previously tested and accepted, and whether it is a reasonably sound and active cement that will set hard in the desired time, and give a good, hard mortar. Simple tests may give this information, and such should be multiplied whether or not more elaborate tests be made. Pats and balls of cement and mortar from the storehouse and mixing platform or machine should be frequently made. The setting or hardening qualities, as determined roughly by estimating time and by pressure of the thumb nail, should be observed; the hardness of the set and strength, by cracking the hardened pats or cakes between the fingers, and by dropping the balls from the height of the arm upon a pavement or stone and observing the result of the impact.



Plan of Garbage Reduction Works.

By placing the pats in water as soon as hardened sufficiently and raising the temperature to the boiling point for a few hours and observing the character and color of the fracture after sufficient immersion, information as to the character of the material, whether hydraulic or Portland or puzzolan, whether too fresh or possibly "blowy," may be speedily and quite well ascertained without measuring instruments.

Many engineers and users of cements regard such simple tests, taken in connection with the weight and fineness of the cement and the apparent texture and hardness of the mortars and concretes in the work, sufficient field tests of a material of known repute. The more elaborate tests, described above, should be made in well-equipped laboratories by skilled cement testers.

(To be Continued.)

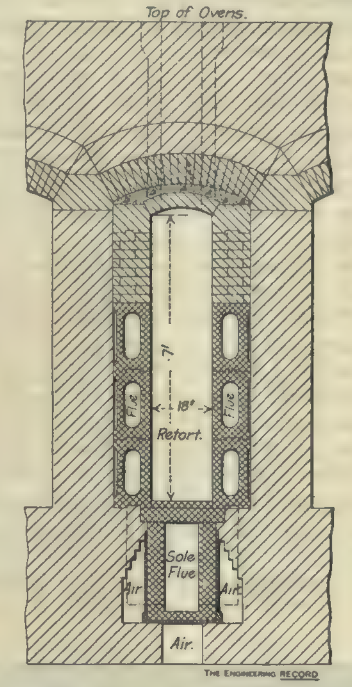
The Garbage Reduction Plant at Boston, Mass.

A system of garbage disposal was installed and operated in 1898-99 in Boston, Mass., which combined the Arnold reduction process with a method of ammonia recovery involving the use of by-product coke ovens. The system was in full operation only about six weeks before the plant was partly destroyed by fire, and a complication of circumstances prevented its reconstruction in its original form, but the process itself and the apparatus provided to carry it out was of a nature unusual enough to warrant description. The garbage reduction plant now in operation is essentially the same as that described.

The plant at Boston was built by the New England Sanitary Product Company to take care of the garbage of Boston, for the disposal of which they had a contract for a term of years. The members of this company control the garbage reduction plants at Philadelphia and New York; the latter works, at Barren Island, were described in The Engineering Record of August 27, 1898, and other issues.

The use of by-product coke ovens as a means of recovering ammonia from garbage was the idea of Dr. Bruno Terne, and is the subject of United States patent 619,056 granted to him. Dr. Terne, as the chemist of the above-mentioned companies, has made a study of the subject at their different plants, and saw in the coking process an opportunity to utilize the solid and liquid residues to better advantage than previously possible, while obtaining from them a large part of their nitrogen in the more available form of ammonium sulphate or crude liquor. The project was brought to the notice of the Semet-Solvay Company, of Syracuse, N. Y., and tests were made by them of some 20 tons of pressed tankage in their coke ovens at Syracuse. These tests showed that from 1 ton of tankage containing 40 per cent. of water there were obtained approximately 163 pounds of ammonia reckoned as sulphate, 488 pounds of carbonized tankage and 4,000 cubic feet of gas of about 300 British thermal units, together with a small quantity of tar. On the basis of these results the construction of a coke oven plant to work in connection with the garbage reduction plant at Boston was undertaken. The engineer for the construction of the portion involving the Arnold process was Mr. Charles Edgerton, of Philadelphia. The coke ovens and the apparatus pertaining to them were built by the Semet-Solvay Company.

A site was obtained near the extremity of Old Harbor Point in Dorchester Bay, adjoining the city sewage pumping station, this location affording convenient wharfage for the garbage in scows and coal boats and being presumably remote enough to keep unpleasant odors from causing annoyance. To accommodate the reduction plant a brick building about 120 x 120 feet and 35 feet high to the eaves was erected. This was divided longitudinally by a brick partition into two equal parts, each having a steel-trussed roof covered with tar and gravel. One portion, containing the digesters and presses, was open from the floor to the roof, while the other portion had a second story, the ground floor being divided into rooms for the evaporators, the boilers and the engines. The coke oven, condensing and washing plant, the ammonia concentrator and the drying apparatus were placed in an ell of wooden mill construction about 45 x 54 feet, and in a continuation of this ell were the by-product coke ovens, having a separate steel smokestack 80 feet high and 4 feet in internal diameter, located at one corner of the oven brickwork, the whole being enclosed in a steel framed structure 46 x 40 feet, covered with galvanized iron, having a storage bin for pressed tankage in the upper portion.



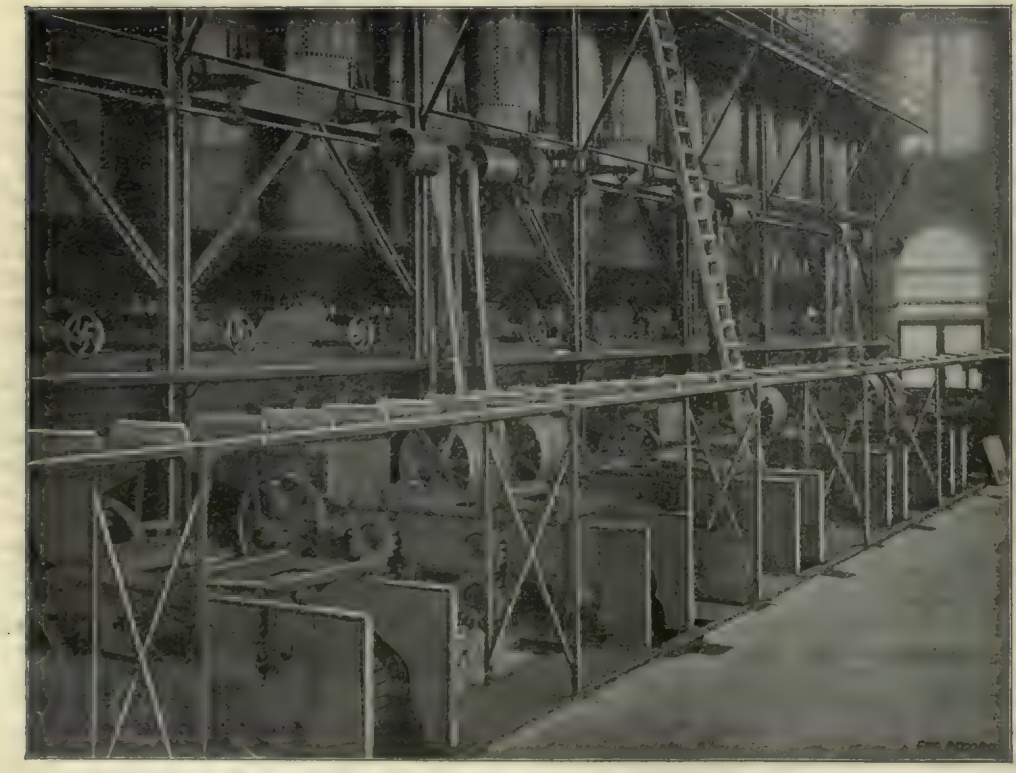
Cross-Section of Garbage Oven.

The power plant consisted of four return tubular boilers carrying about 80 pounds steam pressure, and of about 600 aggregate horse-power, with two 125-horse-power Corliss engines, run condensing, the excess of steam capacity being needed to run the digesters. There was also a belt-driven electric generator which supplied the current for lighting the plant and for a number of motors in different parts of the building. Adjoining the boiler-room door was a 150-foot steel smokestack, and beside it was a steel-framed water tower about 75 feet high, carrying two wooden water tanks which served as a reserve water supply in case of fire, and could be filled with salt water by a large duplex pump housed in below them. Fresh water was supplied from the city service. The coal was brought by water and was stored in a bin adjoining the boiler-room door.

The garbage was brought in scows towed from the city dumps to the wharf alongside the building, and was shovelled by hand into the trough of a Jeffrey scraper conveyor projecting from the wharf, and so constructed as to be adjustable vertically to suit the stage of the tide. From this conveyor the garbage was elevated to the top of the main building and conveyed along above the filling holes of the digesters. There were 32 of these, about 6 feet in diameter and 15 feet high, supported in a double row in a steel framework high enough above the floor level to allow room for a steel receiving hopper placed under each four digesters. The cooked garbage was dumped into this hopper, and was fed from there into the presses, of which there were eight, one for each group of four digesters. These presses were made by the Link Belt Engineering Company, from designs by Mr. Edgerton. In them the garbage was carried on an endless apron of perforated steel slats between two pair of crushing rolls, by which the liquid portion was expressed, the solid residue being scraped off the slats by a revolving brush into a conveyor beneath the floor level and discharged as pressed tankage to the apparatus belonging to the coking process. The operations so far were practically identical with those practised at the other reduction plants of the same type, except that a different form of press was generally used. The tankage at this stage contained about 50 per cent. of water. The liquid effluent was drained away from the machine by concrete channels in the floor to the settling basin, where the grease was skimmed off and the remaining liquor was put through triple-effect evaporators furnished by R. D. Wood & Company, to make the stick, as the gummy product is called.

The pressed tankage was transferred to the storage hopper before mentioned, being further dried on the way there by the following means: The first portion of the conveyor was of the rotary type, built by the Link Belt Engineering Company, and consisted of a horizontal steel cylinder about 40 inches in diameter and considerably over 100 feet long, revolving in one piece on bearings at rather wide intervals, and furnished with an internal helix so arranged that the material fed into one end was discharged at the other, occupying several minutes in transit, according to the speed of rotation. Through this cylinder the waste heat from the coke oven and boiler smokestacks was drawn, in order to absorb as much as possible of the moisture remaining in the tankage. The exhaust fan used for this purpose was of the Sturtevant make, and was placed next the partition wall of the press room, and discharged into an apparatus known as a dasher-washer, the object of which was to remove all odor from the exit gases before allowing them to escape into the atmosphere. This consisted of a water-tight steel box about 5 feet square and 60 feet long, lying parallel with and immediately below the rotary conveyor. The bottom of this box was kept covered with several inches of water, which was violently dashed into the space above by rapidly revolving paddles, driven by belts from the outside. The exit gases passed from this apparatus by a vertical pipe to the roof.

View of Garbage Reduction Plant during Erection.



View Showing Digesters and Presses.

The ovens, as has already been stated, were of the Semet-Solvay type, seven in number, built side by side, and were 18 inches wide, 7 feet high and 30 feet long inside. The characteristic of these ovens is that each consists of a separate arched brick chamber, the walls and covering arch of which support the super-imposed weight, lined with refractory tile, the sides and top of the lining being built independent of the middle walls in order to allow for expansion. The side lining tiles are hollow, forming three or more horizontal flues, one over the other, communicating at the ends, through which the flame from the gas burners entering the two upper flues is drawn, passes through the remaining flue on its way downward and unites with the flame from the other side of the oven to pass through a common flue beneath the oven floor, and so to the flue communicating with the smokestack. The ovens in this case were 20 inches (one course of tile) higher than those generally in use for coking coal, because the pressed tankage shrank over 50 per cent. during the coking process, thus making it advisable to increase the height to get the benefit of the heated walls during the latter part of the coking time. The air supplied to the gas burners was heated by being passed through narrow flues built in the foundation brickwork parallel and close to the sole flue, thus absorbing heat from the waste gases. The doors at either end of the ovens were of cast-iron lined with fire-brick, closing into a cast-iron frame, and on the end of the oven entered by the extracting machine they were arranged to lift by hydraulic power. The doors on the other end, which were seldom opened, were swung on hinges.

The ovens thus formed a tightly closed retort, the contents of which were heated by transmission through the side walls, the gases evolved from the coked material being drawn off through an opening in the top of the oven to the condensing and washing apparatus. The gas evolved in the operation of coking in the Syracuse test before mentioned was about sufficient in calorific power to heat the ovens, but to heat them in starting and to bridge over any irregularities in the operation of an untried plant, a pair of Taylor gas producers, made by R. D. Wood & Company, were installed adjoining one end of the ovens. The gas from these producers was passed through a gravity dust catcher, and delivered to the oven flues through the same piping system as supplied the oven gas. The dry tankage was charged into the ovens by removing the lids covering the three charging holes in the roof of each oven and opening the gates of the hoppers in the storage bin about 6 feet above and immediately over each hole, using a sheet iron funnel to keep the material from scattering. The charge of tankage was levelled to an even height in the oven by long-handled hoes worked from each end through small openings in the doors.

The residue from the carbonization or coking process was a light granular substance, somewhat resembling ground coffee, only darker in color. It was withdrawn from the ovens by a mechanical extractor consisting of an ordinary scraper bucket conveyor, independently driven, and traveling longitudinally on a rigid horizontal steel beam about 40 feet long around wheels placed one at either end. This beam was supported on a steel framework level with the oven floor and was provided with wheels at the sides on which it could be forced into the oven end on. The motion of the conveyor being inward on the top of the beam and outward on the bottom, when the conveyor buckets were pressed by the forward motion of the beam into the material in the oven they would convey the material out of the oven and deposit it in a car placed just outside the oven door. This conveyor was actuated by an electric motor mounted on the beam, receiving current from a trolley wire supported from the main carriage. The forward and backward motion of the beam was accomplished by a wire rope passing over sheaves and attached to a drum operated by a second electric motor, carried on the main frame supporting the beam and receiving current from a second trolley wire. To admit of lateral motion the supporting frame was provided with two trucks running on rails about 16 feet apart, the truck wheels carrying gears driven by the last-mentioned motor. The machine was built by the Link Belt Engineering Company, and was provided with C. & C. motors and a General Electric street car controller.

The carbonized tankage was received and quenched in an iron car and dumped into the boot of an elevator which raised it to the floor above, where it was screened and mixed with the requisite portion of stick before passing through a steam-heated Anderson dryer, emerging in its final form as a fertilizer base.

The gas from the retorts was passed through a water-sealed hydraulic main placed on top of the ovens, and then through a pair of tubular surface condensers cooled with sea-water, to the exhauster, which forced it through a compartment washer, where the ammonia was removed by absorption in water. The exit gas from the washer was led to the oven burners directly, and the ammoniacal liquor, after passing through a gravity tar separator, was collected in storage tanks, together with that from the hydraulic main and the condensers. From these it was pumped up to the concentrator feeding tank as required. The ammonia concentrator was of the tower pattern, consisting of a dozen or more flanged cylindrical cast-iron sections about 40 inches in diameter, bolted one on top of another, each containing a baffle plate of the mushroom type covering an inlet in the middle so as to form a water seal. The live steam admitted at the bottom of the column forced its way up through these seals, which were maintained by the weak liquor fed into the top of the column, and passing from section to section by outside by-passes, the ammonia being driven off as the liquor passed down. The gaseous ammonia and steam passing up from the column were cooled by contact with a system of cooling tubes enclosed in a continuation of the tower, at the same time heating the incoming weak liquor, and passed over to the final condensing worm, where they were condensed, passing thence to the storage tanks in the form of crude strong liquor. As the preliminary tests showed that only a very small proportion of the ammonia in the weak liquor was in the form of fixed salts, re-distillation of the waste from the column with lime was not thought necessary.

Apparatus for the manufacture of sulphate of ammonia was also provided on the upper floor of the condensing house, consisting of lead-lined saturating tanks, acid tank, drainage bins and piping. Storage tanks for the acid required were placed on the ground level near the water front, so as to receive acid by boat, and a small auxiliary tank and a Westinghouse air compressor were provided to elevate the acid to the saturators.

The plant was started in November, 1898, and continued in operation until its partial destruction by fire in February, 1899. The difficulties unavoidably attendant upon the working out of a new process prevented the immediate realization of the results obtained in the preliminary experiments, but there is no doubt that they would have been fully equaled had not the disaster intervened.

Open and Covered Service Reservoirs.

Extracts from a paper read before the British Association of Water-works Engineers by William Ingham, Water Engineer, Torquay.

The chief points to be considered in connection with the design of service reservoirs are: (1) The greatest daily variation in the supply. (2) The length of time necessary to repair any defect, either in the trunk main, pumping engine or other machinery between the storage reservoir or well and the service reservoir. (3) The maximum requirements in case of fire, or of the bursting of water pipes. (4) Utilizing the reservoir to equalize the variation due to intermittent pumping.

Where there is only a single main from the storage to the service reservoir, the latter should be large enough to supply the district for from three to four days—if in duplicate, from one to two days' supply will be found sufficient; but the capacity of the reservoir must depend somewhat on the length and accessibility of the main. If the distance from the storage to the service reservoir be short, it may be more economical to lay a second main rather than to build a larger service reservoir. For pumping schemes where the machinery is duplicated, a two days' supply is generally sufficient. If the supply is delivered to the town direct from the trunk mains a larger pipe will be required, as it will have to discharge at a rate sufficient to meet the greatest demand, but with a service reservoir this will be avoided. If the district supplied is very hilly, it can be worked in zones by separate reservoirs, the sites being fixed to give a head of not less than 60 feet, or more than about 150 feet above the pavement level.

If the reservoir only supplies water to property around the hill upon which it is built, the pressure can be reduced by a reducing valve, but where the pipes run across a valley to supply property on another hill, it is not advisable to lower the pressure. The depth of service reservoirs is generally between 9 and 18 feet, the most economical depth, considering all things, probably being within the limits of 12 and 14 feet. Low walls are much cheaper per foot in height than high ones, and this should be carefully considered when designing a reservoir.

For covered reservoirs the economical depth to be excavated under the original surface of the ground may be taken at 50 to 60 per cent., and for open ones at from about 45 to 50 per cent., of the height of the wall. If the soil can be excavated by machinery, it will pay to do it if the quantity exceeds 30,000 cubic yards; the cost then being from 18 to 24 cents per yard. The filling behind the walls should be of selected earth, brought up in 9-inch layers, slightly watered and well rammed. The embankment should be consolidated in the same way and finished with a slope of from 2 to 1 to 3 to 1, according to the character of the material, but should in no case exceed its natural slope. Embankments settle about 1 inch per foot of depth, and enough soil should be left on the ground to bring them up to their full height after settlement. On completion, the embankment should be turfed or sown with grass seeds, but on no account should trees be planted immediately behind or near the reservoir walls.

The inlet pipe may be below, but is better above, the water-level in the reservoir. If it is desirable to shut off the water when the reservoir is full, rather than let it run to waste, it can be done by fixing a float valve in the reservoir; and if in connection with a pumping engine the increase of pressure in the pipe due to the float valve closing can be made to shut off the steam, or other motive power, and thus stop the machinery.

The outlet supply pipe can be controlled by a valve, either within the reservoir or behind the walls. The best practice is to place the valves in a well behind the walls, so that they can be examined and repaired without interfering with the supply. All pipes under water should have flanges cast on them to prevent creeping, and be laid in fine concrete or grout. The weakest place in a reservoir is, as a rule, along the line of outlet pipes, and unless they are carefully laid in cement grout, leakage will occur. A screen of some kind, of sufficient fineness to stop fish, newts, eels, and dirt from entering the pipe, should be fixed on the entrance to the outlet pipe. The pipe should also be fixed from 3 to 9 inches above the floor of the reservoir, to avoid drawing off the dirt which settles on the bottom. If it is desired to draw off the top water a floating draw-off pipe can be used. An apron should be fixed in the reservoir immediately under the inlet pipe.

The same remarks as to laying the pipe through the wall apply equally to the wash-out pipes. In many cases standing overflows are connected to the wash-out pipes, but this necessitates a valve being placed between the overflow and the inlet to the wash-out pipe, and will probably require a platform to enable the valve spindle to be reached.

Under certain conditions the inlet or delivery main to, and the supply pipes from, the reservoir, may be connected with a by-pass outside the reservoir, so that when the reservoir is being repaired or cleaned out the supply to the district can be maintained. This, however, is not advisable where the pressure in the delivery mains is high, as the fittings in most towns might be unable to stand it. On the other hand, any excessive pressure could be lowered to meet the exigencies of each individual case by means of a reducing valve. Otherwise, a dwarf wall could be built in the reservoir, separating it into two compartments having an outlet pipe from each, so that either compartment could be cleaned out without varying the pressure on the fittings to any great extent.

Steps or ladders to facilitate the examination of the inside, and for removing dirt, should be provided.

A gauge, or, in covered reservoirs, a water-level indicator, for showing the depth of water, should be fixed. For large reservoirs, engineers are now adopting electrical recorders, by means of which the level of the water is shown on a diagram in the office. If it be necessary to measure the water entering the reservoir, this may be done in a gauge well, or by meter or piezometer.

Ventilators should always be fixed in the roof of covered reservoirs, to aid circulation and control the air pressure, which would otherwise vary with the water-level.

Before designing the reservoir, it is absolutely necessary that the engineer should make himself acquainted with the class of material he is going to build upon by making trial pits; for unless this is done failure may occur on the one hand, or, on the other hand, a costly reservoir may be constructed where a much cheaper form would be quite as efficient. In this country we are, luckily, not troubled with earthquakes, but in districts where coal, salt, or other mines are worked special attention should be directed to possible disturbances due to their presence.

The materials chiefly used in constructing service reservoirs are concrete, brick, puddle, asphalt and bituminous sheeting. Asphalt, as a waterproof material, in the form of mortar and concrete, was used about 4,000 years ago at Babylon and Nineveh, while at Memphis, in Egypt, it was also used for keeping basements dry. Sometimes the above materials are used in conjunction one with another, but the author is of the opinion that puddle is used in many cases when there is absolutely no necessity for it. For instance, to place 2 feet of puddle behind a reservoir wall with a mean thickness of 4 feet, and to then make the floor with concrete 15 inches thick without puddle, is bad engineering, especially where the land is subject to settlement. Where it is practically impossible to obtain good workmanship, one can understand puddle being used, but to use it in any and every place is an exhibition of bad designing. Of late years concrete has been largely used for water-works purposes, and if properly made is a very desirable material. The thickness required in a reservoir floor will, to some extent, depend upon the depth of water, the geological nature of the ground, and the class of concrete used. A rough-and-ready rule for a fairly good floor of concrete alone is to make the thickness of concrete equal to one-twelfth of the depth of water, with a minimum thickness of 6 inches, the concrete being 6 to 1, and rendered with cement and sand in equal parts. This thickness can be reduced if either asphalt, puddle or bitumen sheeting is used in conjunction with the concrete.

Asphalt, asphalt concrete and concrete slabs are now being used for covering the floors of reservoirs, the joints being filled up with asphalt or cement mortar respectively. To avoid cracks in concrete due to expansion and contraction, it would be an improvement if the joints were run with asphalt. York stone, brick and cobble stones are also used; but the first is expensive, and the two last are dirty. If strength is required with a minimum thickness, concrete slabs with expanded metal embedded in them, as at Cardiff and at Warrington, can be used. All rendering should be done before the concrete sets, or if that is impossible, the surface should be roughed and washed before the coating is put on. The concrete commonly used in reservoir construction varies from 5 to 1 to 7 to 1, and should be made of clean materials, with a large percentage of small stuff and sand, and if crushed by machine the fine dust should always be retained. How to lay concrete is a subject which is frequently discussed, and the author favors a rather but not too wet concrete, so as to obtain a mass which, when slightly rammed, moves like an ordinary table jelly, and brings the liquid cement to the surface.

Puddle varies considerably in different localities, and where for a certain head 1 foot would be sufficient in one case, in another 2 feet would be required. The best puddle for water-works construction is the bluish-gray clay common in the carboniferous formation of the mining districts. The worst kind known to the author is the Devonshire potters' clay, known as kaolin, it being the disintegrated felspar of granite rock; some of the yellow clays, however, are very good. To test clay for water-works purposes, a piece about 1 inch diameter should be rolled to about 1 foot long, and if it will support itself without breaking when held by one end, it may be classed as good. The weight which can be put on good clay varies from 1½ to 4 tons per square foot. An admixture of cinders with puddle will stop rats from making passages through it. Puddle and concrete can be used together with advantage when the reservoir is constructed on a permeable foundation or jointed rock; but when there is a probability of unequal settlement, it is advisable to use puddle, with asphalt or bituminous sheeting laid on the top of bricks driven into the puddle, as this gives a considerable amount of elasticity.

The thickness of puddle generally varies between 9 and 24 inches, according to the class of material and the head of water to be resisted, but when it is used for reservoir floors it ought to be well selected and placed in situ in thin layers, well worked by cutting, cross cutting and ramming; dirty joints must be avoided, and if a little gravel is added to the puddle, it will increase its weight-carrying capacity and prevent it shrinking or cracking so quickly. When there is a good natural bed of clay in the bottom of a reservoir a thin layer of cement concrete, or concrete slabs, will be sufficient to protect it and facilitate cleaning out. Good clay beds or solid rock make the best foundations, but the rock should be stepped if there is a considerable dip in the strata, and in clay beds the puddle core of the embankment should be sunk 2 to 4 feet into the natural clay.

Gravel and coarse sand make good foundations if kept from spreading, whereas silt and fine sand give much trouble, and, as a rule, require piling. If the bottom of the reservoir is founded on book-leaf clay, care must be taken to see that it is stable and not inclined to slide on its beds; this clay is very treacherous, and great care is required to make a successful job of work founded upon it.

Reservoirs should never be constructed on made ground unless it has been thoroughly consolidated, and even then it may be advisable to increase the footings, or carry piers down to the original ground level, so as to act as bearing pillars.

Where the bottom of a reservoir is waterlogged, or of very absorbent material, and there is any difficulty in getting the concrete to set, the construction applied at the Charlottenberg reservoir of the Berlin water-works can be adopted. In this work bitumenized paper was first spread over the bottom, and then covered with 15 inches of concrete; the same thickness of puddle was next laid, then 6 inches of concrete and finally a cement rendering on the top.

There is greater difficulty in dealing with the floors of covered reservoirs than with open ones, because the weight of the piers, walls and floor gives rise to unequal pressures on the foundations.

Where springs are met with, the water should be led away from the site, or if, owing to the contour of the surrounding land, that is impossible, a valve may be placed in the bottom to allow the water, if pure, to enter the reservoir. Air gives trouble in some cases, as at the Devonport works, where Mr. Francis had much difficulty in completing the Belliver reservoir, but it can be dealt with in a similar manner to water.

An example of building a covered reservoir, holding 660,000 gallons, in bad ground at Bordeaux may be referred to here. The site was one which with the ordinary methods of construction would have required piling all over, the foundation being peat and black mud. This would have been very costly, so it was decided to erect an iron reservoir having sides 0.15 inch thick, and the bottom 0.20 inch thick, supported on a grillage of 8-inch girders, the only piles put in being immediately under the columns supporting the roof. Eighty tons of cast iron and 320 tons of wrought iron were used in the construction, the cost being $39,000.

Walls built of heavy material need not be quite as thick as those of lighter weight. The length of a wall also has a considerable influence on its strength, and it is advisable to construct long walls with a heavier section than short ones. Counterforts, no doubt, effect a slight saving in material, but the total cost of construction is about the same. In deep reservoirs, or where the bottom is compressible, it is best to build the wall first, and thus obtain the advantage of shoring up the earth at the rear of the wall during construction. Unequal settlement, and consequent breaking of the concrete used for the floor of a reservoir, is also thereby avoided.

In deciding the kind of roof to adopt, consideration must be given to the durability and weight of the material it is intended to use. The life of ironwork has been placed by Sir R. Rawlinson at 50 years. If, however, the roof be properly designed, there is no reason why its durability should be less than any other kind of structure, provided that the ironwork be embedded in concrete. Groined brick arches make a good and durable covering, but concrete is much cheaper to construct, and is lighter per square foot of covering, owing to the reduction in the quantity of material required. A light and strong concrete roof can be obtained with a span of 12 feet, rise 2½ feet, and thickness at crown 6 inches; or if granolithic concrete be used, the weight can be somewhat reduced.

Groined elliptical arches require a small amount of material, and give clear headroom in each direction, which facilitates ventilation. Semi-circular arches are expensive, owing to the loss of space, as the water-level should never be higher than about 3 inches below the line of springing.

The roof should be well ventilated, and have inspection manholes fixed in suitable positions, so that direct light may never be admitted except when cleaning out the reservoir. For this purpose a 15 x 15-inch manhole cover to every 300 square feet of roof is sufficient.

If the roof is carried from the side walls, which in covered reservoirs are usually built with vertical faces, so as to reduce the roof area, they must be designed accordingly, bearing in mind the fact that any outward pressure resists the overturning effect of the earth backing. In America it is a common practice to take the outward pressure of the roof upon a metallic ring fixed near and around the top of the wall. If the roof rises above the surrounding ground level, the effect of the wind pressure transferred to the walls must also be borne in mind.

Occasionally, to avoid the turning movement on the wall, the roof is supported from a point some distance behind the side walls. This method can be adopted when it is found necessary to cover an existing open reservoir. When the roof is entirely underground, it is usual to cover it with from 12 to 24 inches of earth.

To prevent rain-water entering the reservoir, it is necessary to cover the roof with some impervious material, such as concrete, puddle, asphalt or bitumen sheeting, the last being the cheapest and lightest. All spandrels should be drained away from the reservoir.

The whole weight of the roof is seldom carried by the walls, excepting in small reservoirs, some portion being, as a rule, carried on concrete or brick piers, or on steel or iron columns. The piers must be designed according to the weight they have to carry and their length. It is cheaper, owing to their small section, to build piers of brick than of concrete, and from one-fifth to one-sixth of the height is the usual width for the side of a square pier. To distribute the pressure over a greater area of footings with the same quantity of material in the piers, a cruciform section is sometimes adopted. Pier footings should never penetrate through the full thickness of the floor, or they will form lines of weakness and leakage, and where there is trouble from upward pressure inverted arches should be built at the bottom of the reservoir, and the pressure transmitted through the piers or columns to the roof, which can be weighted accordingly.

With regard to the question of rectangular as compared with circular reservoirs, the author thinks that engineers are not fully alive to the advantages to be gained by making reservoirs circular in plan. As to wall length, in a reservoir having an area of 10,000 square feet, if square, the wall length will be 400 feet; if rectangular, 80 x 125 feet, 410 feet; and if circular, and approximately 113 feet in diameter, 355 feet. There is thus an average difference of 50 feet between the length of the circular walls and the straight ones, and the narrower the rectangular reservoir is, the greater will be the difference.

The cost of a properly-designed open reservoir to hold 12 feet depth of water may be anything between \$15 and \$25 per foot run of wall, and taking a mean cost of \$20 with the above lengths the relative costs will be, if square, \$8,000; if rectangular, \$8,200; and if circular, \$7,100, representing a saving of about 12½ per cent. on a comparatively small reservoir of 750,000 gallons capacity.

Besides this, in circular reservoirs the walls need not be designed as thick as in rectangular ones, and there will consequently be a large saving in cost. The thickness of straight walls for rectangular service reservoirs varies between a quarter and two-fifths of the depth, while those of circular reservoirs or gasholder tanks have been found strong enough where the thickness has been between the limits of one-sixth and one-tenth of the depth.

After careful consideration it must be concluded that circular reservoirs are from 20 to 40 per cent. cheaper than rectangular ones, although it must be borne in mind that the former are not so economical in ground space as the latter.

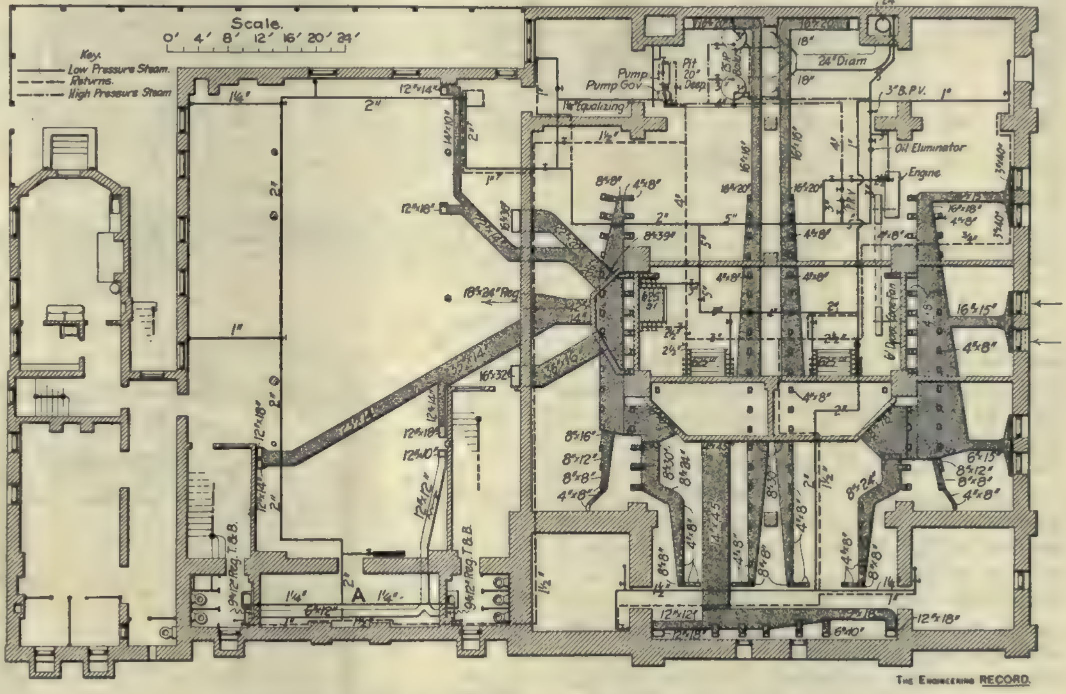
The Water Shortage in Manchester, England, was so serious in the middle of last month that the supply was shut off each evening. At the time this practice was begun the storage was equal to 47 days' supply, while in August, 1900, it was equal to 76 days' supply.

The Value of a Water Tower is well shown by the experience of La Salle, Ill., which formerly had a direct-pumping system of waterworks. Mr. D. W. Mead stated at the last convention of the Illinois Engineering Society that the boiler house of the works caught fire, but as the house was independent of the pumping station, the pumps could be run after the firemen were unable to enter the burning building. The falling of the roof, however, soon broke the steam pipes, and the pumps were disabled. The boiler house and pumping station is located perhaps 75 or 80 feet below the city, so that fortunately the mains themselves furnished sufficient water and the fire was just controlled and practically extinguished when the last drop of water came out of the mains and the mains were left empty. The boilers weren't destroyed and by getting a large number of steam fitters there the city was without water about eight hours only.

Ventilating and Heating St. Mark's Church, Baltimore.

St. Mark's Lutheran Church, at St. Paul and Twentieth Streets, Baltimore, Md., is warmed by hot air distributed under a plenum system which is assisted by aspiration near the exits of the vent passages. The system of ventilation is an upward one, with air delivery through a large number of small openings in the ends of the various pews. The outflow of the air takes place at the ceiling of the nave, passing in ducts in the roof space to two shafts at the rear of the building. A feature of the apparatus is the large distribution ducts in the basement supplied from a large plenum chamber and divided into three systems, one for each half of the church proper and one for the sunday-school building. Direct radiators are used in corridors and in some of the rooms where ventilation is of secondary importance. The plant is a very interesting one, and plans are shown herewith of the basement, the main floor and the third floor.

The edifice is in two portions, the church and the sunday-school building. Altogether they occupy about 89 x 116 feet ground space. The church proper has two corner entrances at the front end and there is an aisle down the center of the nave and two side aisles. The choir is located at one side of the chancel. The nave extends through three stories, while the aisles, speaking of the architectural term, extend to about the third-floor level. There is a gallery at the second floor above the foot of the nave. The sunday-school building has an elaborate entrance, and each end of the portico opens into a stair hall. It is reached from the church from one of the church entrances and the gallery above it, both opening upon one of the stair halls. The first floor of the sunday-school building is given up principally to parlors. The second floor is the main sunday-school floor, arranged with a large open space in the center with a number of class rooms partitioned off and surrounding the main space. Over the circle of the class rooms is located a gallery of class rooms as shown in the third-floor plan.



Basement Plan of the Church and Sunday-School Building.

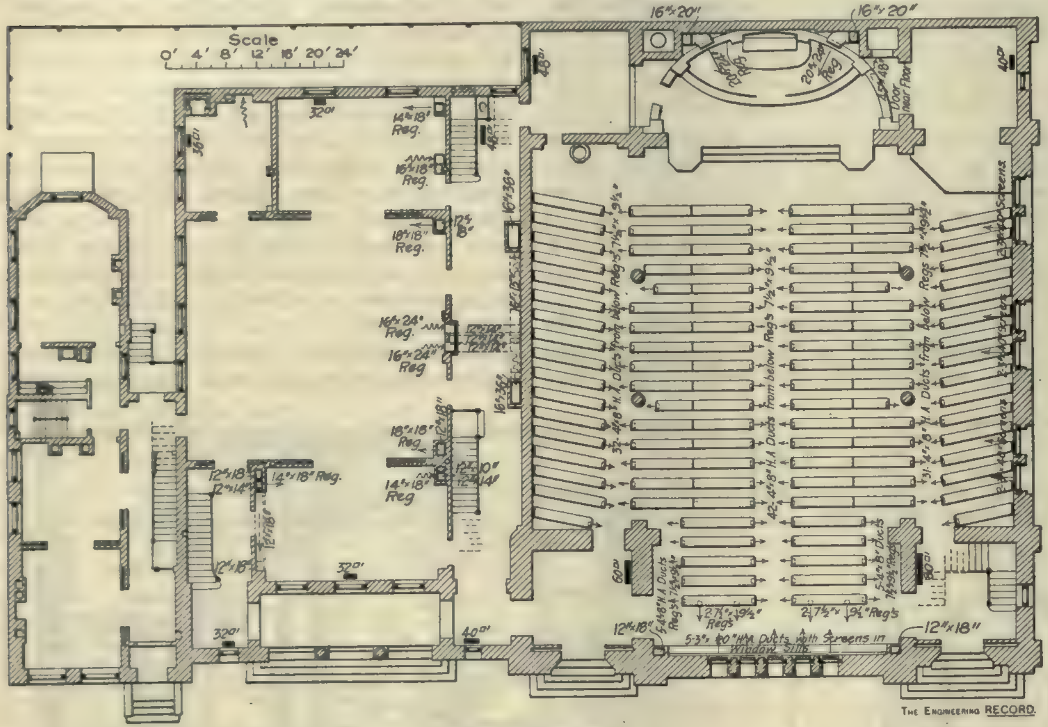
The air for the building is received through two basement windows, provided with the usual protecting screens, and enters a brick chamber about 15 feet square in plan. In the inner wall of this room the fan inlet is located, and the air is drawn into a large brick plenum chamber, the fan being mounted in the plenum chamber against the opening. It is of the cone type, made by the Buffalo Forge Company, and 6 feet in diameter. It is driven by belt from an 8 x 10-inch Buffalo Forge Company steam engine, outside of the chamber. This chamber is 15 feet wide and 35 feet long and has three exit passages leading respectively to the three sections of the ducts already mentioned. Each exit is through an indirect heater, these standing in the room, but shut off on each side by sheet-iron. The heaters are composed of pipe coils, each in five sections, 4 pipes deep per section and 20 pipes deep in the direction of air flow, the pipes being staggered. The sections are 22 pipes long and 4 feet 3 inches high, exclusive of the base, and are supported on 8-inch brick walls, high enough to bring the heater close to the ceiling. Altogether each heater presents 625 square feet of heating surface, and each section being connected independently to supply and return, 125 square feet of surface can be turned on and cut out, at a time, as desired.

Beyond each heater there is a hot-air plenum space from which the main ducts are taken, this arrangement of large spaces and consequently comparatively slow velocities of flow contributing toward increasing the equal distribution of pressure and therefore of air flow throughout the apparatus. These chambers are all walled off independently, and as stated, one supplies the system for the sunday-school building and the others, each one-half of the church proper, the division of the latter being along the longitudinal axis through the nave.

Altogether there are 73 pews in the church and the fresh air is delivered into the auditorium through registers in the pew ends along the aisles. There are 119 of these registers all told, 7.5 x 9.5 inches in size. Fresh air is also delivered through long narrow registers at the windows, six at the six windows along the side, 3 x 40 inches in size, and five at the rear at five narrow windows, 3 x 20 inches in size. Besides these window registers and those at the pew ends, there are large registers in the gallery fed by the two 12 x 18-inch flues at the rear of the nave, as shown on the first-floor plan and two large registers, one on either side of the altar.

At a minimum speed of 185 revolutions per minute the fan is depended on to discharge

675,000 cubic feet of air per hour and is arranged to run at a maximum speed of 280 revolutions per minute. A calculation of the areas of the flues in the three different systems of the apparatus indicates that about one-third the discharge of the fan is received into each system. Similarly it is found that the area of short connections from the basement ducts to the pew registers amount to 64.5 per cent. of the total flue area of each of the two systems feeding the church. Allowing for the increase in volume due to warming, each half of the church receives nearly 250,000 cubic feet of air per hour, 160,000 cubic feet of which issues through the pew end registers. This means about 45 cubic feet per minute per pew outlet. Allowing each of these registers a free area of flow of 65 square inches, the velocity of the air passing into the aisles from the register amounts to 100 feet per minute, or less than 2 feet per second. The total length of seats is about 1,000 feet, so that allowing 2 feet per person, there is a maximum seating capacity for 500 persons. As 500,000 cubic feet of air are discharged into the room per hour, at the minimum speed of the fan, there is capacity in the apparatus to supply at least 1,000 cubic feet per occupant per hour on the basis of maximum seating capacity. The proportions of the apparatus indicate, it may be added, that about 360 cubic feet of air are passed through the indirect heaters in the plenum chamber per square foot of heating surface per hour, at minimum fan output.

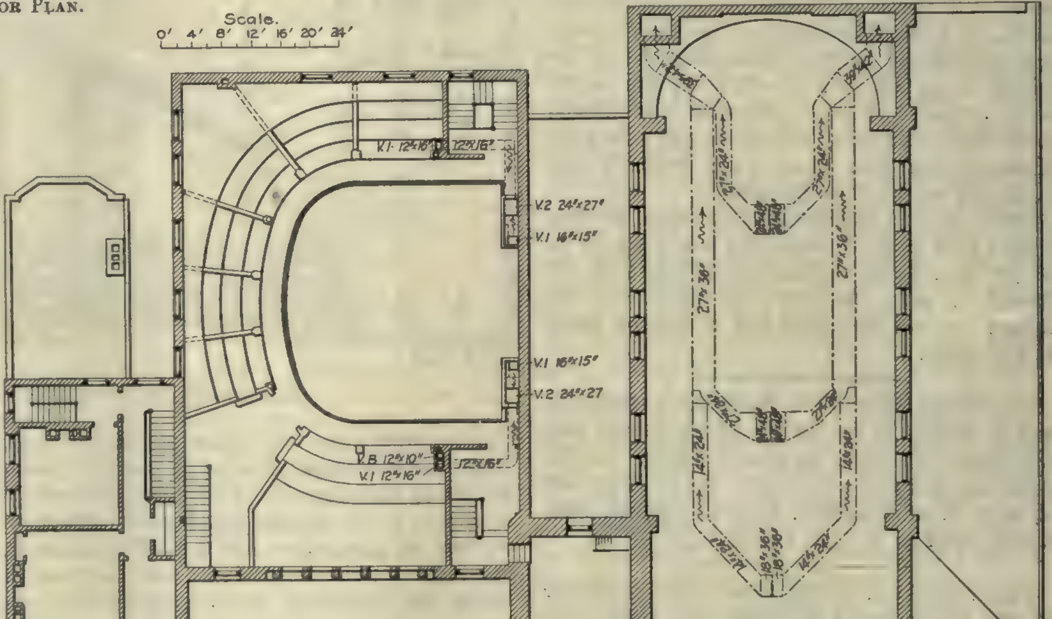


FIRST FLOOR PLAN.

The arrangement of vent outlets in the ceiling of the church is shown in the plan of the third story. There are six large registers aggregating in free area about 30 square feet. The ducts, which are located in the space above the ceiling and beneath the roof, are made of matched boards and lead to two shafts in which aspirating coils have been placed and which are capped with ventilators. Assuming that 80 per cent. of the air delivered into this part of the building will be taken care of by the vent ducts, the velocity in the main ducts at the shafts will be found to be about 5 feet per second.

The ventilation of the sunday-school building includes two fresh-air registers in the large room on the first floor and one in each of the large rooms opening from this; two large registers, 2 x 3 feet in size in the main room of the sunday school, about 8 feet above the second floor, and a fresh-air register in the largest of the rooms under the gallery. Exit registers for the more or less vitiated air are provided, in general slightly larger than the fresh-air registers with which they correspond. These connect with ducts which are carried toward, and brought to two flues in the wall between the church and sunday school, as indicated in the third-floor plan; and the air is exhausted from the shafts through ventilators above the roof.

The steam is supplied at about 30 pounds pressure for use in the fan engine and reduced in pressure for the heating system. Two boilers of the locomotive type of 25 horse-power each were adopted. Each carries a 3-inch outlet from which a 4-inch header is supplied. The steam passes in opposite directions from the end of the header to the pump and governor for returning the water to the boilers, in the one direction, and to the fan engine and the heating system, in the other direction. The reducing valve is located beyond the engine connection and feeds a 5-inch heating main. A 3-inch by-pass is provided around the reducing valve and the heating main is arranged to receive near this point a 3-inch pipe from an oil eliminator through which the fan-engine exhaust may be admitted into the heating system. In the other direction from the oil eliminator the exhaust main passes toward one of the vent shafts in which the smoke pipe rises to the atmosphere and in which the main is continued within the shaft as a free exhaust for the engine. The usual back-pressure valve is provided in the basement run of the exhaust pipe, for use in connection with the supply of the exhaust into the heating pipes, and the free-exhaust line is joined by a pipe carried from the safety valves on the boilers.



THIRD FLOOR PLAN.

The heating main first feeds a 5-inch pipe for the three indirect heaters and then continues 2 inches in diameter around the basement of the sunday-school building. The pipe to the indirect heaters is reduced to 2 inches beyond the last heater and then feeds two pipes passing in opposite directions for the few direct radiators in the church. The radiators are all connected with one pipe and in the church the base of the risers are drained into the returns.

In the basement of the sunday-school building, however, which contains a large room for public use at times, the smallest amount of visible piping only was desirable and the main was kept its full size pitched in the direction of steam flow and made to carry the water from the radiators supplied by it. Toward the end, as shown in the basement plan, it is relieved of the water, and a return pipe for this system is carried from this point at the floor. The returns all lead in short lines to the return pump and governor, located near the boilers, the pump being 4½ x 2¾ x 4 inches in size.

The building was erected from the plans of Mr. Joseph Evans Sperry, of Baltimore and the steam heating and mechanical ventilating apparatus was designed by Mr. Henry Adams, of that city and Philadelphia. The Universal Heating Company installed the apparatus. The total cost was about $5,200.

The Validity of Special Assessments was recently passed upon by the Washington Supreme Court in Smith v. City of Seattle, 65 Pac. Rep. 612, the decision being substantially as follows: The article in the State Constitution limiting the amount which cities may become indebted for establishing light, sewer and water systems to 5 per cent. of the taxable property, applies only to general indebtedness, and does not prevent a city already indebted for such purposes to the limit mentioned from bonding a local assessment district for laying water mains in it, of special benefit to the district.

Personal and Obituary Notes.

Mr. Allen F. Gill has been sworn in as city engineer of Spokane, Wash.

Mr. E. M. Scofield, Assoc. M. Am. Soc. C. E., has resigned his position as manager of the Youngstown Branch of the American Bridge Company.

Mr. George H. Davis, formerly of New Orleans, has been made general manager of the Birmingham Railway, Light & Power Company, of Birmingham, Ala.

Mr. William S. Aldrich, M. Am. Soc. M. E., M. Am. Inst. E. E., has been appointed to the Directorship of the Thomas S. Clarkson School of Technology, at Potsdam, N. Y.

Mr. E. L. Adams, Jr., supervisor of the Pennsylvania Railroad at Tyrone, has been appointed assistant engineer of the Pittsburg Division of the Baltimore & Ohio Railroad.

Mr. George Shields has resigned his position as superintendent of the Astoria Water Commission and accepted another with the Contra Costa Water Company, of Oakland, Cal.

Mr. W. A. Booker, who has been acting as city engineer of Rawlins, Wyo., during the construction of the Rawlins sewer system, has resigned and gone to his home in Jackson, Tenn.

Charles H. Ball, chief engineer of the United States Revenue Cutter Service, died Sept. 10, of heart disease, at Baltimore. He was born in New York in 1837, served in the navy during the Civil War as first assistant engineer and was appointed to the revenue service in 1865.

Electric Traction at 125 Miles per Hour has now reached the experimental stage with equipment suitable for long-distance operation. An association of German manufacturers has secured the royal military road between Marienfelde and Zossen, about 14¼ miles in length, and two cars have been built, each to seat 50 persons and containing two six-wheel trucks, capable all told of supporting 96 tons. The road is of the overhead trolley type, with three-phase 45 to 50-cycle current at 10,000 volts, the trolley poles of the triple-fork type pressing against the wires, which are supported one vertically above the other. Transformers are carried on the cars, and besides a star and delta connection for the transformers, the motors are provided with rheostat control for starting and speed regulation, all apparatus operated by compressed air. Air brakes are provided, with means also of working the motors as generators on a liquid resistance or storage battery. The motors are mounted directly on the axle, one for each truck; the wheels are about 48.2 inches in diameter and make 960 revolutions per minute. Experiments were made to get approximate values of the magnitude of air resistance, existing formulas failing under the high speeds in question, and it was decided that 900 kilograms draw-bar pull represented the force to overcome wind pressure and 450 kilograms the draw-bar pull to overcome sliding and rolling friction, requiring in each car 1,000 horse-power at the speed and maximum load mentioned.

The Steel Columns on Section No. 3 of the New York Rapid Transit Railway, for which Holbrook, Cabot & Daly are the sub-contractors, must be anchor-bolted to their base stones by two 1-inch bolts. At first these bolt holes were drilled before the stones were set, but as it proved difficult to make any adjustments afterward in the positions of the holes, they are now drilled through the base plates after the columns are set on the stones. For this work a short-stroke Q & C pneumatic hammer is used, which is fitted with a 1 1/16-inch drill bit having a +-shaped cutting edge. A 20-pound collar is slipped over the upper part of the drill to give it additional weight for feeding. One man runs the machine, holding it vertically in one hand and with the other hand operating a wrench by which he revolves the bit through a small arc about its vertical axis. The upper end of the bit is round and twists freely in the socket of the hammer, and the lower part of the shank, above the expanded bit, is square. The horizontal wrench has at one end a square hole fitting loosely over the lower part of the drill and engaging the corners so as to turn it. After each turn the operator raises the wrench until it slips back freely on the round part of the shank and then lowers it until it engages the square part, turns it, and so on. Below the wrench a loose collar slips over the bit and carries an annular sleeve extending down into the hole. This sleeve is connected with the air pipe and through it a strong blast is constantly forced into the hole and keeps it always free from chips and dust. The holes are drilled 8 inches deep, and from twenty to forty are made by one man in a day, according to the kind of stone.

The Temporary Suspension Bridge just finished for the construction of the main cables of the New East River Bridge is about 2,800 feet in total length and consists of four narrow platforms extending from anchorage to anchorage, nearly parallel to the main cables and connected together by occasional cross walks. It was fully described in The Engineering Record of October 27, 1900. Each platform is supported by a temporary steel cable made of three 2¼-inch parallel twisted ropes 3,000 feet long, having a weight of 13 tons and a breaking strength of 208 tons. Three ropes for one cable, each coiled on a separate reel, were brought on a car float to the foot of the New York tower; the free end of one rope was hoisted to the top of the tower by a boom derrick there and carried back toward the anchorage over two sheaves, one set temporarily in the top of each of the small saddles. A clamp was attached to the end of the rope and a tackle connected to it pulled it down to the anchorage, where it was socketed and connected to the anchorage. When the three ropes had been thus secured the float was towed across the river and the ropes paid off their reels and sunk to the river bottom. As all navigation had to be restricted at this time, it was done at slack tide, when the traffic could be easily controlled, and was accomplished in about 15 minutes. About 400 feet of each cable remained on its reel and was unwound and strung out on the deck of the float. On each cable successively a clamp was attached about 60 feet from the end, and from it a cable was hoisted to the saddles by a two-part tackle suspended from shears on top of the Brooklyn tower and operated by a special engine on the float. The cable was led over two sheaves on the saddles and a three-part wire-rope tackle attached to its clamp was operated by a hoisting engine in the Brooklyn anchorage. At slack tide all navigation was again stopped, and in about three minutes the cable was hauled up to a height of 150 feet above the water in the middle of the river. The three-part tackle was then replaced by one of nine parts, and the rope, under a stress of about 25 tons, was hauled up about 20 feet higher to its required position. The surplus rope was cut off, the end cleaned, immersed in an acid and in a galvanizing bath, and then fastened to the socket and attached to the second anchorage. The John A. Roebling's Sons Company are the contractors for the cables, and their engineer, Mr. William Hildebrand, expects that they may be completed in less than five months after commencing to lay the wires, if no unforeseen delays occur.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Lynchburg, Va.—Bids are wanted for a 3,000,000 gal. pump to be run by turbine wheel, have 12-ft. head and the lift is 365 ft. Bids are wanted for pump and wheel. W. C. N. Randolph, Jr., Supt. City Water-works.

Morris, Ill.—Bids will be received by City Clerk Ridgway, according to press reports, for sinking both a 10 and 12-in. well, depth 800 ft.

Newark, N. J.—The Board of Works has approved specifications for the tunnel, through which water will be conducted from Cedar Grove reservoir into the proposed new pipe line from Montclair to Newark, and bids for construction will probably be received Oct. 3. The tunnel will be 3,000 ft. long and the estimated cost is $100,000. Morris R. Sherrerd, Engr. and Supt. Dept. of Water.

Deer River, Minn.—The Village Council of Deer River, Minn., has retained the services of Thos. F. McGilvray, consulting engineer of Duluth, to draw plans and specifications and make estimate of cost of a water plant for the village.

Moline, Ill.—City Engr. H. G. Paddock writes that the Stewartville water main, 9,487 ft. of 12-in. pipe, has been let to the Moline Heating & Construction Co. for $14,999.

New Richmond, Minn.—Press reports state that the Council contemplates the installation of a system of water-works.

Ulen, Minn.—Bonds for $4,000 have been voted for a water-works system.

Oswego, N. Y.—Mayor Hall is reported to have announced that a contract had been closed with the Oswego Water Co. for a continuance of its service for a term of 15 years, at $20,000 per year.

Baltimore, Md.—Local press reports state that the Water Department will ask for an appropriation of $400,000 for 1902. Among the improvements to be made are the erection of a new pumping plant and stand pipe in the vicinity of Roland and 4th Aves., cost $55,000, and the extension of water mains on Edmondson Ave., cost $31,000.

Laramie, Wyo.—State Engineer Fred Bond has granted to Fred A. Miller of this city a State right to divert and appropriate the water of the State at Libby Creek for the Centennial Canal, which will be 2 miles in length.

Westerly, R. I.—The Town Council has voted that the Water Committee be instructed to go ahead with the preliminary work of extending the water system to Watch Hill.

Baker City, Ore.—Water bonds to the amount of $20,000 have been sold.

Stafford, Kan.—City Clk. A. W. Hartnett writes that the city proposes to construct water-works at a cost of $15,000, and that a vote will be taken on the issue of bonds.

Clarinda, Ia.—J. P. Burrow, Chmn. of Com., writes that the city proposes to erect a water standpipe at an estimated cost of $5,000.

Goshen, N. Y.—The Village Trustees have under consideration the proposition to engage an engineer to report on the best method of increasing and purifying the water supply.

Wayland, N. Y.—The Village Trustees have granted a franchise to Jones & Co., of Pennsylvania, for the construction of water-works.

Caruthersville, Mo.—Geo. C. Morgan, of Chicago, is said to be preparing plans and estimates for the erection of a system of water-works.

Groton, Conn.—Engineers Daboll & Crandall, of New London, write that they are preparing plans for a system of water-works to be constructed by the Groton Water Co., at an estimated cost of $75,000.

Joliette, Que.—Town Engr. J. O. A. Laforest, of Montreal, writes that the following bids for constructing a sewer plant and a water intake, were opened Sept. 4. Bidders, all of Montreal: McDonald & Ouimet, $33,444; O. Martineau, $28,363; Bostieu & Voliquette, $27,500; Gillespie & Co., $26,945; J. A. Rebin, $24,300 (awarded).

Harrisburg, Ill.—The City Council has granted the Harrisburg Water, Light & Power Co. a 30-year water-works franchise.

Stanley, Wis.—A. M. Patitz, of Milwaukee, is stated to have been appointed Consulting Engineer of the new water-works and sewerage system to be installed at Stanley.

Farmington, Mo.—The proposition to issue $25,000 bonds for water-works is reported to have carried at the recent election.

Floresville, Tex.—The City Council has under consideration the question of constructing water-works.

San Francisco, Cal.—It is stated that bids are wanted Sept. 21 for furnishing hydrants with gates, bends and forgings complete. J. W. McCarthy, Sec'y Bd. Fire Commrs.

New York, N. Y.—Bids will be received by Frederick H. Schroeder, Pres. Bd. Quarantine Commrs., 11 B'way, until Oct. 1, for stand-pipe, piping to buildings and pumping machinery at the upper quarantine station, Hoffman's Island, N. Y. City. Chas. F. Bruder, Sec'y.

Philadelphia, Pa.—Bids are wanted Sept. 25 for the improvement, extension and filtration of the water supply as follows: A low service pumping station for Upper Roxbury Station and extension to testing station at Spring Garden Station. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Water.

Waterloo, Ont.—A vote has been taken in favor of the issue of $5,000 bonds for the extension of the water-works system.

Pleasantville, N. Y.—Michael Decicco, of Larchmont, is stated to have been the lowest bidder on the construction of water-works, at $23,922.

Cambridge, Wis.—A vote is reported to have been taken in favor of the construction of water-works at a cost of $7,500.

Schulenburg, Tex.—The matter of constructing water-works is said to be under consideration.

Nevadaville, Colo.—Press reports state that $20,000 bonds are to be issued at once for the construction of a reservoir and pipe lines.

Evanston, Wyo.—F. C. Kelsey, of Salt Lake City, is said to have been engaged to devise ways for the improvement of this city's water supply.

Bay City, Mich.—Mayor Peter Lind recommends the issue of $25,000 bonds for the extension of water mains.

Huntington, Ore.—The Council has granted a 30-year water and light franchise to Dr. J. B. White, O. W. Porter and others.

Schuylerville, N. Y.—Plans and specifications have been completed for a system of water-works, and the estimated cost of materials and construction is $57,263.

Basin, Wyo.—The Big Horn Canal Co. has been formed for the purpose of constructing a canal to irrigate 23,500 acres of land in this vicinity.

Kansas City, Mo.—Press reports state that the Armour Packing Co. has under consideration a plan for the construction of a complete system of water-works for its exclusive use.

Carthage, N. Y.—Village Clk. W. S. Schwartz writes that on Sept. 10 it was voted to appropriate $1,000 for preliminary surveys and estimates for a gravity system of water-works.

Ocean Springs, Miss.—The People's Waterworks Co., of Ocean Springs, has been incorporated with a capital of $10,000. Incorporators: Jos. Kotzum, F. J. Lundy, E. W. Illing, O. L. Bailey, Orey Young and others.

Ashland, Wis.—Press reports state that the Ashland Iron & Steel Co. is arranging to install a pumping plant of 4,000,000 gallons daily capacity.

Minneapolis, Minn.—Bids are wanted Sept. 27 for furnishing and delivering 45 tons of cast iron, 72 tons of structural and machine steel, 259 lbs. of brass and 7 sluice gates, 36 x 48 ft., to be used in the construction of the 37th Ave. northeast pumping station. L. A. Lydiard, City Clk.

St. Michaels, Md.—Bids are wanted Sept. 24 for $12,000 water-works bonds. G. K. Benson, Clk. Bd. of Commrs.

Jesup, Ia.—City Clk. Wm. Golden writes that it was voted Sept. 7 to construct water-works.

Dannemora, N. Y.—It was recently voted to appropriate $10,000 for the construction of water-works.

Hawkesbury, Ont.—The question of constructing water-works is said to be under consideration.

La Junta, Colo.—The Fort Lyon Ditch & Reservoir Co., of Las Animas, has voted to construct a reservoir 15 miles northeast of La Junta; cost, $50,000.

Davenport, Ia.—The Davenport Water Co. proposes to install new 600-H.-P. boilers for the steam generating plant. T. N. Hooper, Supt.

Rolfe, Ia.—At a special election it was voted to issue an additional $3,000 bonds for the improvement of the city well and the extension of water mains.

Kansas City, Mo.—Both Houses of the Council are reported to have passed the ordinance providing for additional water mains in the downtown districts. The mains are to be 6 to 10 inches in diameter, and the total cost will be $40,000.

Hennessey, Okla. Ter.—The Hennessey Water and Power Co. has been incorporated, with a capital of $15,000. Incorporators: Fred. Ehler, J. A. Ratliff and others.

Yazoo, Miss.—E. J. Pouesine, City Clk., writes that bids will be received Nov. 11 for franchises for water-works, sewerage system, electric light plant and a street railway, application having been made for same by J. Z. George, of Vicksburg; the Yazoo Improvement Co. and Capt. W. O. Pugh.

Urich, Mich.—The City Clerk writes that a vote has been taken in favor of drilling a well.

Tullahoma, Tenn.—Bids are wanted Sept. 24 (extension of date) for furnishing material and constructing a complete system of water-works and electric lights. Gordon D. Hicks, Secy. Water and Light Commrs.; Granbery Jackson, Engr., 211 Union St., Nashville.

Moline, Ill.—The City Council on Sept. 6 voted in favor of the mechanical filter system, and D. W. Mead will proceed to draw complete plans for said system; capacity, 5,000,000 gallons daily.

SEWERAGE AND SEWAGE DISPOSAL.

Washington, D. C.—Bids are wanted Oct. 5 for constructing sewers, as advertised in The Engineering Record.

Cohoes, N. Y.—Bids are wanted Sept. 20 for the completion of section No. 2 of the sewer system, as advertised in The Engineering Record.

Rochester, Ind.—Bids are wanted Sept. 30 for completing pipe sewers in various streets, as advertised in The Engineering Record.

Columbia, Mo.—Bids are wanted Oct. 1 for constructing sewers in district No. 6, as advertised in The Engineering Record.

Santiago, Cuba.—Bids are wanted Oct. 21 for constructing sewers, as advertised in The Engineering Record..

Mansfield, O.—Bids are wanted Sept. 21 for constructing 100 ft. of 3-ring 9-ft. radius brick arch over Ritter's Run at Virginia and East Corporation Alleys. F. M. Reny, City Clk.

Flint, Mich.—Bids are wanted Sept. 16 for 3,115 ft. 20-in. and 3,155 ft. 18-in. sanitary sewer, with 19 brick manholes, also 550 ft. 8-in. and 996 ft. 15-in. sewer; also 1,650 ft. 24-in. and 300 ft. 54-in. brick storm sewer. A. W. Hall, City Engr.

Logansport, Ind.—Bids are wanted Oct. 16 for the following extensions: 1,220 ft. 12-in. pipe; 207 ft. 10-in. pipe, and 700 ft. 8-in. pipe. Walter A. Osmer, City Engr.

Huntington, Ind.—Bids are wanted Sept. 24 for 3,000 ft. of pipe sewer, sizes from 10 to 30 in., rock excavation. Estimated cost, $10,000. Frank Guthrie, City Engr.

Swissvale, Pa.—Bids are wanted Sept. 21 for the purchase of $105,000 sewer bonds. R. W. Cummins, Chmn. Finance Com.

Ashland, Wis.—Bids are wanted Sept. 21 for building an 8-in. sewer in one alley. F. J. Colignon, Chmn. Bd. of Pub. Wks.

Greenville, Pa.—Bids are wanted Sept. 23 for furnishing material and constructing 12,118 ft. of vitrified pipe sewers. A. J. Gillespie, Boro. Secy.

Wooster, O.—Bids are wanted Sept. 27 for 1,390 ft. of 15-in. vitrified clay pipe sewer and 704 ft. of 6-in. laterals. W. T. Peckinpaugh, City Clk.

Cincinnati, O.—Bids are wanted Sept. 19 for the improvement of Forbus and Margaret Sts. by the construction of sewers and drains. Robt. Allison, Pres. Bd. of Pub. Service.

Albany, N. Y.—Bids are wanted Sept. 16 for constructing a vitrified stoneware pipe sewer in portions of Morris, Ontario and Seneca Sts. Isidore Wachman, Clk. Bd. Contract & Supply.

Woonsocket, R. I.—Bids are wanted Sept. 16 for 985 ft. of 18-in., 2,200 ft. of 15-in., 1,170 ft. 12-in., 2,010 ft. 10-in. and 3,710 ft. 8-in. pipe sewers in several streets.

Elizabeth, N. J.—Bids are wanted Oct. 1 for sewers in 3 streets, consisting of 2,625 ft. of 12-in. pipe, 202 6-in. connections, 3,630 ft. of 6-in. pipe to curb line, 25 manholes and 2 basins. N. K. Thompson, St. Commr.

South Fork, Pa.—Bonds to the amount of $6,000 have been sold for sewer construction.

Nashville, Tenn.—Sewer and street improvement bonds to the amount of $200,000 were sold Sept. 3.

Clarksburg, W. Va.—Paving and sewerage bonds to the amount of $40,000 were sold recently.

Waterbury, Conn.—City Engineer Cairns has estimated the cost of constructing a storm water channel for Little Brook from Hakins to Bronson Sts. at $6,000; and the estimated cost of continuing Little Brook conduit from Abbott Ave. to North Main St. is $12,000.

Portland, Me.—Local press reports state that the contract for constructing Fore and India Sts. sewer has been awarded to C. E. Trumbull & Co., of Boston, Mass., for $9,277.

East Hartford, Conn.—Contracts are about to be let for the construction of a sewer on Rector and Bigelow Sts.

St. Paul, Minn.—Bids are wanted Sept. 16 for sewers in a portion of Fairview and Goodrich Aves. C. H. Bronson, Clk. Bd. Pub. Wks.

Chicago, Ill.—Plans have been prepared by Lyman E. Cooley for a deep waterway and drainage canal designed as an extension of the sanitary canal through and beyond the northern section of the city. A bill will be presented to the next Legislature providing for this improvement.

Swedesboro, N. J.—Articles of incorporation have been filed by the Swedesboro Sewer Co. The capital stock is $5,000. The incorporators are Alexander B. Hewes, John C. Rulon, Geo. B. Mitchell and others.

Worcester, Mass.—The Committee on Sewers has voted to recommend the construction of sewers in Maywood and in Clapp Sts.

Marion, Va.—W. G. McDowell, of Lexington, is said to be making a survey of the town with a view to putting in a sewerage system, should the Council so decide.

Waukesha, Wis.—City Clk. Fred. A. Gaspar writes that the contract for building a septic tank has been awarded to August Dieman, of Waukesha, for $4,500.

Sea Isle City, N. J.—The City Council is stated to have revoked the franchise of the Sea Isle City Sewer Co., the company having failed to live up to the terms of the ordinance under which the franchise was granted.

Canon City, Colo.—City Clk. Ed. Minor writes that bids will probably be wanted about Oct. 1 for the construction of a sewerage system, estimated to cost $60,000. Eng. in Charge, Clifford Hall.

Franklin, Mass.—Town Clk. O. T. Doe writes that on Aug. 26 it was voted to construct a sewer system.

Burlington, Ia.—The City Council has ordered the construction of 300 ft. of 18-in. span stone arch sewer in "Old Hawkeye Channel" between Jefferson and Washington Sts. Estimated cost, $12,000. E. Steece, City Engr.

Cleveland, O.—Bids are wanted Sept. 17 for constructing a conduit to divert Giddings brook through Baldwin Ave. into Doan brook; also until Oct. 8 for constructing a sewer in Taylor St. Chas. P. Salen, Dir. Pub. Wks.

Nampa, Idaho.—It is stated that bids are wanted Sept. 24 for $15,000 bonds issued for the purpose of constructing 3,500 ft. of sewers. John H. Hart, City Clk.

Milford, Del.—Bids are wanted Sept. 17 for furnishing material and constructing approximately 1,500 ft. of 15 to 20-in. terra cotta sewers with storm water inlets and appurtenances. T. Chalkley Hatton, Consulting Engr., Wilmington, Del.

Houston, Tex.—Local press reports state that the lowest bid received for the construction of Hardy St. sewer, involving an expenditure of nearly $50,000, was from Herbert Shuter, of Houston.

York, Pa.—The Council has passed first reading the bill providing for the issue of $65,000 bonds for sewer and street improvements.

Williamsburg, Pa.—The Borough Council has passed an ordinance authorizing the Independent Sewer Co. to construct a sewer on certain parts of High and Second Sts.

Springfield, Mass.—Bonds have been sold to the amount of $25,000 for the Mill River Valley, Forest Ave. and Belmont Ave. sewers.

Brookline, Mass.—Bids are wanted Sept. 17 for constructing 60 ft. of 32 x 40-in. brick and 4,700 ft. of 8, 10 and 15-in. pipe sewer, in Princeton Road Section, and 3,100 ft. of 8-in. pipe sewer and 3,300 ft. of 10, 12, 15 and 18-in. surface water drain, in Wolcott Road Section. Alexis H. French, Town Engr.; James M. Codman, Jr., Chmn. Bd. of Selectmen.

Kankakee, Ill.—City Engr. R. D. Gregg writes that bids will be received Oct. 1 for the construction of Soldier Creek sewer 7,700 ft., estimated cost $20,000; and Riverview sewer, 3,700 ft., estimated cost $10,000.

Haverhill, Mass.—The Aldermen have under consideration the proposition to construct a 30-in. brick sewer in Mill St. at an estimated cost of $9,500.

Shawnee, Okla. Ter.—The Shawnee Sewerage & Drainage Co. has been granted a 50-year charter. Capital, $5,000. Directors: S. P. Richards, Walter Newman and F. M. Richards.

Spring Garden, Pa.—Bids are wanted Sept. 21 for constructing 1,200 ft. of sewer in Spring Garden Ave., in the Boro. of Spring Garden. Knopf & Milholland, Boro. Engrs., 413 4th Ave., Pittsburg.

Cleveland, O.—Mayor Johnson is said to be in favor of deepening and widening Doan Brook, at a cost of about $50,000.

McKeesport, Pa.—The Sewer Committee has recommended the construction of 3 12-in. sewers.

Crafton, Pa.—Bids are wanted Sept. 17 for $3,000 bonds for extending the sewerage system. T. C. Stephens, Boro. Clk.

Conneaut, O.—Bids are wanted Oct. 8 for constructing approximately 4 miles of sewers in Dist. No. 3 and 4. Geo. B. Pike, City Engr.

Gloversville, N. Y.—Bids are wanted Sept. 16 for furnishing material and constructing approximately 226 lin. ft. of 10-in., 592 lin. ft. of 8-in., and 528 lin. ft. of 4-in. pipe sewers, 1,350 lin. ft. of trenching about 6 ft. deep, 7 10-in. and 27 8-in. specials, etc. John J. Kelly, Chmn. Sewer Com.

Raton, N. Mex.—The contract for constructing a sanitary sewer system is stated to have been awarded to the J. M. O'Rourke Construction Co., of Denver, for about $20,000.

Ashland, O.—The estimated cost of the proposed sewer system, according to plans prepared by L. E. Chapin and approved by the State Board of Health, is $50,080; for disposal plant the estimated cost is $5,000.

Kansas City, Mo.—The Public Improvements Committee on Sept. 5 rescinded the $126,771 contract of Laird & Black for building the O. K. creek sewer extension from 25th and Fairmount to 8th and Santa Fe Sts.

Woonsocket, R. I.—Mayor Green has signed the ordinance appropriating $29,000 for sewers.

St. Paul, Minn.—Bids will be received by the Board of Audit at the office of the State Secretary, until Sept. 26, for constructing about 19 miles of drainage ditches, requiring 248,186 cu. yds. of excavating. P. E. Hanson, Member of Bd. For further information address Geo. A. Ralph, State Drainage Engr., Crookston, Minn.

Charles City, Ia.—It is stated that bids are wanted Sept. 16 for 4,140 ft. of 10 to 20-in. pipe sewers in certain streets. W. W. Dennis, City Clk.

Zelienople, Pa.—This borough is about to issue $4,000 bonds for the construction of a public sewer.

Joliette, Que.—See "Water."

Hull, Que.—The city engineer estimates the cost of building that portion of the main sewer from low water in Ottawa River to Kent and Division Sts., the sewer to be of brick, 4 x 6, with average depth of 13 ft., at $22,980.

Bedford, Ind.—Bids are wanted Oct. 1 for constructing a system of sanitary sewers, including all necessary manholes, flush tanks, septic tanks, etc. G. C. Houston, City Engr.

Luverne, Minn.—Bids are wanted Sept. 17 for 2,860 ft. of pipe sewers. E. C. Schwartz, Village Recorder.

Yazoo, Miss.—See "Water."

St. Paul, Minn.—Bids are wanted Sept. 23 for constructing a temporary sewer on Thomas St. and a sewer in Winslow Ave. C. H. Bronson, Clk. Bd. Pub. Wks.

New York, N. Y.—The following bids were opened Sept. 4 by Jas. Kane, Commr. of Sewers, for sewer in 12th Ave., East Side, bet. 47th and 50th Sts.: A, N. Y. Sewer Const'n Co., $16,356; B, Norton & Dalton, $17,251; C, W. E. Welsh, $14,805; D, W. J. Moore, 170 E. 89th St., awarded contract, $13,456; E, A. C. Gildersleeve, $15,581. The detail bids are as follows:

Quantities.			A	B	C	D	E
4-ft. wood bbl.	435	lin. ft..	$13.00	$12.00	$9.00	$12.00	$10.00
4-ft. wood box	133	"	9.50	12.00	9.00	10.00	11.00
4-ft. cir., brick,	50	"	11.00	12.00	9.00	12.00	12.00
4-ft. cir., brick,	32	"	10.35	12.00	9.00	12.00	11.00
4′ x 2′ 8″ sewer	60	"	12.25	12.00	9.00	6.00	9.00
4′ x 2′ 8″ "	562	"	8.50	10.00	9.00	6.00	9.00
4′ x 2′ 8″ "	82	"	6.30	7.00	9.00	5.00	8.00
3′ 6″ x 2′ 4″ "	191	"	6.00	7.00	9.00	5 00	7.00
12-in. culvert..	75	"	1.49	1.00	2.00	1.00	1.00
Rec. basins....	5	each....	149.00	150.00	150.00	150.00	125.00
Rock excav...	175	cu. ys...	3.00	......	......	......	3.00
Timber	15	M. ft....	....	25.00	......	......	.01

Dayton, O.—The following bids were opened Sept. 3 for sanitary sewers in Part of Districts 4 and 5: A, Gem City Const'n Co., $14,041 (awarded); B, John Williams & Co., $14,588; C, Wm. Rehling, $14,643; D, David Beard, $15,645; E, Chas. H. Hoglen, $15,876; F, J. M. Hennessey, $16,353. For detail bids see accompanying table:

Items and quantities.	A	B	C	D	E	F
Pipe, per lin. ft.:						
18,440 ft. 8-in.......	$.16	$.14	$.19	$.18	$.17	$.18
2,710 ft. 10-in.......	.22	.19	.25	.24	.23	.25
3,660 ft. 12-in.......	.30	.26	.32	.29	.30	.29
C. I. pipe, 12 ft. 12-in.	1.50	1.50	1.60	2.00	1.00	1.00
Cut, 800 ft., 0 to 6 ft.	.14	.14	.14	.15	.22	.18
17,310 ft., 6 to 8 ft..	.24	.22	.24	.25	.25	.30
5,760 ft., 8 to 10 ft..	.30	.35	.30	.35	.35	.45
650 ft., 10 to 12 ft..	.42	.45	.48	.45	.55	.80
290 ft., 12 to 14 ft..	.60	.65	.77	.55	.65	.90
Repairing:						
Brick, 40 sq. yds..	1.00	1.00	3.00	2.00	1.60	1.50
B'lder, 1,630 lin. ft.	.06	.07	.09	.15	.25	.07
Manholes, 58.........	25.00	26.50	22.00	30.00	25.00	15.00
Lampholes, 32.......	2.00	2.00	2.00	3.00	3.00	2.00
Flush tanks, 28.....	26.00	27.00	24.00	35.00	50.00	30.00
Lead pipe laid, 650 ft. ½-in.	.50	.33	.35	.40	.30	.50
Corp. cocks and specials, 28............	7.00	9.00	7.00	8.00	10.00	7.00
Sheet lumber left, 2 M ft. per M. ft. B. M...............	18.00	25.00	20.00	25.00	25.00	2.00

BRIDGES.

Indianapolis, Ind.—Bids are wanted Sept. 20 for constructing a concrete arch bridge at W. 30th St., ½ mile west of Little Eagle Creek, in Wayne Township. Harry B. Smith, Co. Aud.

San Mateo, Cal.—It is stated that bids are wanted by the Board of Trustees until Oct. 1 for concrete arches and girders for 4 bridges. Total estimated cost, $25,000. D. Bromfield, City Engr.

San Jose, Cal.—The contract for building a stone bridge with 2 spans of 60 ft. each, roadway 20 ft., at Long Bridge, has been awarded to John Doyle for $8,347.

Zanesville, O.—Jas. L. Starkey, Co. Aud., writes that the only bid received for the construction of the superstructure of draw span at the easterly end of the "Y" bridge, was from the Massillon Bridge Co., Massillon, O., as follows: Without street car tracks, $13,500; with one street car track, $14,000; with two street car tracks, $14,600.

Rochester, N. Y.—Local press reports state that plans for a $50,000 bridge, to cross the canal at Plymouth St., are being prepared at the office of the State Superintendent of Public Works in Albany.

Victoria, B. C.—Press reports state that the Government will construct a suspension bridge 300 ft. long at Chimney Creek; probable cost $40,000.

San Luis Obispo, Cal.—The City Engineer has been instructed to prepare plans and specifications for a bridge at French St.

It is stated that the County Surveyor has been instructed to make necessary survey and to prepare plans for bridges on Villa and Old Creeks on San Luis-Cayucos-Cambria road.

Fayette, Miss.—The Indiana Bridge Co., Muncie, Ind., is stated to have secured the contract for constructing an iron bridge over Cole Creek, at Calvit Ford, for $10,648.

Woodsdale, O.—Joseph Guillame is reported to have received the contract, $21,750, for constructing the substructure and superstructure of an iron bridge to cross Miami River.

Morristown, N. Y.—The Black Lake Bridge Co. has been incorporated with a capital stock of $40,000, for the purpose of constructing bridges in St. Lawrence County. The company proposes to construct a bridge across Black Lake at Edwardsville, between the towns of Morristown and Macomb.

Batavia, N. Y.—The Board of Aldermen and the Town Board have decided to construct a plate girder bridge, having a roadway 33 ft. wide and sidewalks on either side 7 ft. wide, to replace present structure at Walnut St.

Valley Center, Kan.—The citizens are about to petition the County Commissioners to construct a bridge across Big Arkansas River near Valley Center.

Ft. Scott, Kan.—The Gilfillan & Drake Flagstone Co. of this city is stated to have secured the contract for constructing all bridges and culverts needed on the Ft. Scott, Iola & Western R. R., including those on the new road between Moran and Piqua.

Jerseyville, Ill.—The citizens of Calhoun County and the western part of Jersey and Green Counties are agitating the construction of a bridge on the Jerseyville-Hardin road, at a probable cost of $4,000.

Hartford, Vt.—The Central Vermont Ry. officials are said to be considering the construction here, this fall, of a steel bridge which will replace the present iron structure.

Kankakee, Ill.—It is stated that a 2-span 300-ft. bridge is to be constructed in Kankakee County. Probable cost, $12,000.

Paris, Ill.—According to press reports the officials of the Cleveland, Cincinnati, Chicago & St. Louis Ry. contemplate constructing a steel bridge at Reservoir Park, on the Cairo division, north of this city.

Salt Lake City, Utah.—The A. Fisher Brewing Co. and others, have petitioned the Council to construct a viaduct over the railroad tracks at Second St. S. and 6th St. W.

San Rafael, Cal.—The City Engineer has been instructed to prepare plans and specifications for concrete bridges on Colloden and Belle Aves.

Iron City, Tenn.—Bids will be received by the Bridge Committee, at Lawrenceburg, until Oct. 5, for constructing a 3-span steel bridge across Shoal Creek in Iron City, bridge to have 100-ft. steel approach and 12-ft. roadway; also for constructing about 300 cu. yds. masonry. F. M. Cannon, Chmn. Com.

Vicksburg, Miss.—The only bids at $15,000 received Sept. 4 for an iron bridge over Big Black River has been rejected and new bids will be opened Oct. 9. Wm. Curphy, Pres. Bd. of Supervisors.

Roswell, New Mex.—It is stated that bids are wanted by the County Commissioners until Oct. 7 for constructing a steel bridge, 400 ft. long and 16 ft. wide, 3 miles east of this place.

Dartmouth, Mass.—A committee has been appointed to construct a bridge, 30 ft. wide, at a probable cost of $30,000.

East Providence, R. I.—Bids recently received for constructing a bridge at Roger Williams Ave., having been declared too high, the Council has decided to modify present plans and to ask for new bids.

Morton, Minn.—It is stated that bids are wanted Oct. 1 for building a steel highway bridge, consisting of one span, 138 ft. long, on cylinder piers, across Minnesota River. J. T. Brooks, Co. Auditor, Beaverfalls.

Albany, N. Y.—Bids are wanted by the Superintendent of Public Works, until Sept. 19, for constructing Green's bridge, over the Glens Falls feeder, in Queensbury; a steel girder bridge over Champlain Canal at Fulton St., Waterford; for repairing and rebuilding the retaining walls, sidewalks and earth approaches at the northern end of Liberty St. bridge, in Penn Yan, and for constructing a bridge over Champlain Canal, Cohoes. John N. Partridge, Supt. of Pub. Wks.

Bay City, Mich.—It is stated that bids are wanted Sept. 21 for constructing 3 stone abutments for a bridge across Perry Creek, on the Garfield Road. W. D. Richardson, Deputy Clk. County Road Com.

Charles City, Ia.—The County Board of Supervisors has authorized the construction of a one-span steel bridge at Milwaukee St. at a cost, including approaches, of about $15,000.

Deerpark, Ill.—At a town meeting held Sept. 7 the citizens voted in favor of appropriating $7,000 for the raising and extending of a highway bridge in Deerpark Township.

Port Kennedy, Pa.—It is stated that a $20,000 bridge is to be constructed at Port Kennedy.

Evansville, Ind.—It is stated that $50,000 will be appropriated by the County Council for bridge purposes.

Okolona, Miss.—Bridge bonds amounting to $10,000 have been sold.

Morgantown, W. Va.—The Board of Regents of the West Virginia University has granted permission to the County Court to construct a bridge, 450 ft. long, across the deep ravine which passes through the University campus.

PAVING AND ROADMAKING.

Cohoes, N. Y.—Bids are wanted Sept. 20 for the completion of the contract of Martin Murray for grading Garner St. extension, as advertised in The Engineering Record.

Rye, N. H.—Bids will be received by the New Hampshire Boulevard Commission, Portsmouth, N. H., until Sept. 26, for building a section of State boulevard in the town of Rye. Alfred F. Howard, Chmn.

Rome, N. Y.—Bids are wanted Sept. 24 for asphalt pavement on E. Liberty St. Jay Capron, City Engr.

White Plains, N. Y.—Bids are wanted Sept. 23 for macadamizing, grading, curbing and otherwise improving portions of 3 streets. Wm. B. Sutherland, Village Clk.

Reno, Nev.—Bids are wanted Sept. 25 for grading, paving with asphalt and curbing with granite on Commercial Row. W. A. Fogg, Clk. of the Bd. of County Commrs.

Peoria, Ill.—Bids are wanted Sept. 17 for 4,937 cu. yds. excavation, 5,828 sq. yds. brick paving, 3,457 lin. ft. combined curb and gutter, 218 lin. ft. straight curb and 355 lin. ft. protection curb on University St. and Bradley Ave. H. E. Beasley, City Engr.

Lodi, N. J.—Bids are wanted Sept. 16 for macadamizing portions of several streets; also for grading, curbing and guttering on several other streets. R. H. Holmer, Boro. Clk.

Albany, N. Y.—Bids are wanted by the Board of Contract & Supply until Sept. 16 for grading, curbing and paving with sheet asphalt, repairing and laying flag sidewalks, and building receiving basins on portions of Broadway, Columbia and Stuben Sts.; also for grading, curbing and paving with vitrified bricks or blocks, repairing and laying flag and vitrified brick sidewalks, building receiving basins and laying vitrified pipe house drains in Perry St. and Livingston Ave. Isidore Wachsman, Clk. of Bd.

Meadville, Pa.—Bids are wanted Sept. 18 for grading, curbing and paving Market St., 2,860 sq. yds., with brick; also for paving Walnut St., 2,530 sq. yds., with brick. A. C. Pardee, City Clk.

Cleveland, O.—Bids are wanted Oct. 2 for grading, draining, curbing and paving with brick on Wade Park Ave. Chas. P. Salen, Dir. of Pub. Wks.

Buffalo, N. Y.—Bids are wanted Sept. 19 for paving a portion of Grace St. R. G. Parsons, Sec'y Bd. of Pub. Wks.

Charleston, S. C.—Bids are wanted Sept. 18 for paving with South Carolina block a portion of the County Roadway. Wm. P. Cantwell, County Supervisor.

Baltimore, Md.—Bids are wanted Sept. 18 for grading and paving portions of Augusta and Collins Aves., with macadam pavement and vitrified brick gutters. B. T. Fendall, City Engr.

Norfolk, Va.—See "Government Work."

Cincinnati, O.—Bids are wanted Sept. 19 for the improvement of Webb Alley by grading, curbing and paving the roadway with brick. Robert Allison. Pres. Bd. of Public Service.

Columbus, O.—C. M. Addison, Clk. of the Bd. of Pub. Wks., writes that bids will be received Sept. 16 for furnishing, f. o. b. cars at Columbus, 400,000 paving blocks. Bids are also wanted at the same time for resurfacing the roadway of Town St. with asphalt and repairing the paved gutters with brick or block; also for grading and paving Goodale St. with brick or block.

Huntington, Ind.—Bids are wanted Sept. 24 for 17,000 sq. yds. of brick, asphalt or macadam paving, 10,000 lin. ft. of curb, 6,000 ft. of sidewalk and 13,000 cu. yds. of excavation. Work to commence in April, 1902. Frank Guthrie, City Engr.

Nashville, Tenn.—See "Sewerage and Sewage Disposal."

Troy, N. Y.—The Board of Estimate & Apportionment has asked the Council to authorize the issue of bonds for one-half the cost of paving Oakwood, Vandenburgh and Spring Aves. and Ferry St.

Clarksburg, W. Va.—See "Sewerage and Sewage Disposal."

Des Moines, Ia.—A. C. Frick, Clk. of the Bd. of Pub. Wks., writes that the contract for about 3,625 sq. yds. of 1½-in. asphalt paving on W. 26th St. has been awarded to the Capital City Brick & Pipe Co. of Des Moines at $1.99 for Trinidad Pitch Lake asphalt. The contract for 1,150 ft. of Portland cement curbing on W. 2d St. and 558 ft. on W. 29th St. has been awarded to J. C. Likes, of Des Moines, at 46 cts. per lin. ft. The contract for paving Brattleboro and 29th Sts. with brick was also awarded to J. C. Likes at $1.73.

Algiers, La.—Specifications have been prepared for paving with asphalt in several streets.

Hamburg, N. Y.—See "Electric Railways."

Elizabeth, N. J.—The following bids for 5,625 sq. yds. block pavement on Chestnut St. were opened Sept. 3 by the Street Commissioner: B. M. & J. F. Shanley Co., Newark, N. J., $10,600; James Potts, Elizabeth, N. J., $11,553.

Kansas City, Mo.—Bids are wanted Sept. 18 for paving and constructing artificial stone combined curb and gutters on both sides of Benton boulevard. Geo. E. Kessler, Sec'y Bd. Park Commrs.

St. Louis, Mo.—Bids are wanted Sept. 20 for considerable brick paving, etc. Hiram Phillips, Pres. Bd. Pub. Improvements.

Cedar Rapids, Ia.—Bids are wanted Sept. 20 for brick pavement on 6th St., asphalt pavement on 3d Ave. and macadam on 13th St., East. J. D. Blain, City Recorder.

Newark, N. J.—Local press reports state that bids will be received by the Superintendent of Public Works until Sept. 19 for paving portions of several avenues.

Pittsburg, Pa.—Bids are wanted Sept. 30 for $550,000 bonds issued for the purpose of building, improving and repairing public roads, etc., in Allegheny County. W. E. Thompson, Co. Compt.

Norfolk, Va.—The Common Council has passed a resolution providing for the curbing, grading and paving with either Belgian block or asphalt, of a portion of Washington St.

York, Pa.—See "Sewerage and Sewage Disposal."

Toledo, O.—Bids are wanted Oct. 14 for block pavement, on a 6-in. concrete or broken stone or an 8-in. sand foundation, on portions of 4 streets. John E. Connell, City Clk.

Crafton, Pa.—Bids are wanted Sept. 17 for $7,000 street improvement bonds. T. C. Stephens, Boro. Clk.

Spring Garden, Pa.—Bids will be received by Knopf & Milholland, Boro. Engrs., 413 4th Ave., Pittsburgh, until Sept. 21 for grading, paving and curbing Spring Garden Ave., in Boro. of Spring Garden.

Freeport, Ill.—Bids are wanted Sept. 17 for grading, placing foundations under street car tracks and paving Taylor Ave., Stephenson and Walnut Sts. G. A. Huenkemeier, Chmn. Bd. of Local Improvements.

Cohoes, N. Y.—Bids are wanted Sept. 20 for paving Olmstead and Division Sts. Wm. J. Elliot, Clk. Pub. Improvement Comm'n.

Janesville, Wis.—Jas. Cape & Son, of Racine, Wis., are stated to have received a $20,000 contract for macadam paving in Janesville.

Gallipolis, O.—Bids are wanted Oct. 1 for paving with brick on portions of 2d and Olive Sts. Geo. F. Bovie, City Clk.

Hoboken, N. J.—It is stated that bids are wanted Sept. 25 for asphalt pavement on several streets. John Haggerty, City Clk.

New Haven, Conn.—City Engr. C. W. Kelly writes that the contract for paving Church St., between Elm and Chapel Sts., with asphalt has been awarded to the New England Improvement Co., of New Haven, at $2.81 per sq. yd.

Pekin, Ill.—An ordinance has been passed providing for the improvement of portions of 4th, Elizabeth and Capitol Sts., by paving with brick. Chas. J. Skaggs, City Clk.

Newburg, N. Y.—At the meeting of the Board of Public Works, held Aug. 30, a resolution was adopted making a requisition on the Common Council for $47,000 for the purpose of laying a granite block pavement on Broadway.

Cleveland, O.—The County Commissioners have passed a resolution declaring their intention to improve a portion of Detroit St. by paving with either asphalt or brick. Estimated cost, about $50,000.

Michigan City, Ind.—Bids are wanted Oct. 14 for macadamizing E. 7th St., 4,400 yds.; also for paving Baker Ave. with brick, 6,600 yds. H. M. Miles, City Engr.

St. Paul, Minn.—It is stated that improvements involving an expenditure of $60,000 are to be made at the Union Stock Yards, South St. Paul., paving being the principal part of the work.

The Assembly Committee on Streets has decided to make a favorable report on the final order for paving Selby Ave. with asphalt.

Union Hill, N. J.—The lowest bid received for improving Jefferson St. is stated to have been submitted by Callery & Murphy, at $14,589.

Denver, Col.—The Board of Public Works proposes to pave portions of Race and High Sts., also 13th and 14th Aves., with disintegrated granite, 8-in. thick.

Minneapolis, Minn.—At a meeting held recently the City Council passed, over the Mayor's veto, the resolution to issue $150,000 permanent street improvement bonds.

Muskegon, Mich.—Contracts for paving have been awarded as follows: Lake St., to John Hughes, of Muskegon, for $33,433, using Townsend brick; Ransom St., Luten & Reynolds Co., Grand Rapids, $9,364, Massillon brick; Jefferson St., Luten & Reynolds Co., $5,269, Massillon brick; Pine St., W. R. Jones, Muskegon, $12,839.36, Bolen's brown granite brick.

Bids will soon be received for paving in several streets. C. S. Gamble, City Engr.

Washington, D. C.—Morris Hacker, Supt. of Roads, writes that the following bids were opened Sept. 7 by the Commissioners, D. C., for improving Connecticut Ave. west of Rock Creek:

Grading:	A	B	C
Below present grade, 5,300 cu. yds.....	$.77	$.89	$1.00
Above present grade, 14,000 cu. yds....	.33	.43	.50
Rem. and replace macadam, 3,200 c. y..	.50	.63	.60

Totals.—A, Geo. B. Mullin, Tenleytown, D. C., $10,301 (awarded); B, Lyons Bros., Brookland, D. C., $12,753; C, Coogan Bros. & Forschner, $14,220.

POWER PLANTS, GAS AND ELECTRICITY.

Brazil, Ind.—Bids are wanted Oct. 1 for lighting by electricity, for a period of years, as advertised in The Engineering Record.

Utica, N. Y.—The Utica Electric Light & Power Co. is stated to have secured the contract for lighting the city with electricity for 5 years at 30 cts. per night per light for arc lamps of 2,000 c. p.

Toledo, O.—The Trustees of the Toledo State Hospital are stated to have petitioned the State Emergency Board for $6,000 to secure an electric plant.

Brattleboro, Vt.—The Brattleboro Gas Light Co. is reported to have engaged an engineer to make surveys and plans for a 33-ft. dam, to be constructed about a mile from the mouth of the West River.

Montreal, Que.—The Royal Electric Co. is stated to have secured the contract for lighting the city for 5 years at $60 per arc lamp per year. H. H. Henshaw, Pres., 94 Queen St.

Baltimore, Md.—S. B. Medairy and R. B. Fentress, of Norfolk, Va., are stated to have petitioned this city for a franchise to lay pipes in the city for the transmission of both hot and cold air. If franchise is secured they will build a plant to cost from $300,000 to $500,000.

New Richmond, Wis.—The New Richmond Roller Mills Co. is reported to be surveying the power available in Apple River at Huntington, with a view to developing it.

Geddes, S. D.—The Town Council is stated to have granted the Acetylene Apparatus Mfg. Co. of Sioux City, Ia., a 20-year franchise to construct and operate a public lighting plant in Geddes.

Owatonna, Minn.—It is stated that the Owatonna Electric Co. will construct a large addition to its plant and will extend the heating and gas systems.

Johnstown, Pa.—The Consumers' Electric Light, Power & Hgt. Co. is stated to have been formed with a capital of $200,000, to construct a plant for lighting and heating purposes. A. M. Custer, Acting Secy.

St. Albans, Vt.—W. A. Brackenridge, Ch. Engr. Niagara Falls Power Co., is reported to have been engaged by the St. Albans Electric Light & Power Co. as hydraulic engineer in charge of the construction work. He is reported to be here now and will make plans for the best utilization of the power.

Collinston, Utah.—Wm. C. Weaver, of Ogden, Receiver of the Bear River Irrigation Co., is reported interested in a company recently organized to construct a plant here to generate 5,000 H.-P., the water to be secured from Bear River Canyon. Engineers Sterling & Sterling are reported to be preparing the preliminary plans.

Rolfe, Ia.—The citizens are stated to have voted to grant the Rolfe Gas Co. a franchise for a gas plant.

Helena, Mont.—M. H. Gerry, Jr., Gen Mgr. of the Missouri River Power Co., writes that the company expects to construct an additional dam at a point below its present works, and not far from Stubb's Ferry on Missouri River. Construction will not begin for several months, surveys and designs not having been completed yet. The new dam will be approximately 40 ft. in height and 800 ft. in length, and will be designed and constructed by the company's own engineering force, under the direction of the general manager.

Bradner, O.—Bids are wanted Sept. 28 for $13,500 electric light bonds. H. C. Ahlf, Village Clk.

College Hill, Pa.—Bids are wanted Sept. 17 for the purchase of electric light bonds. Address The Burgess, College Hill, Beaver Falls, Pa.

Clarinda, Ia.—The city proposes to put in a power plant at an estimated cost of $15,000. L. W. Lewis, Chmn. of Com.

Cold Spring, Minn.—Marcus Maurin is reported to have received a franchise for an electric light plant.

Morgantown, W. Va.—It is stated that the Morgantown Electric Light & Power Co. has sold its plant and franchise to a syndicate composed of L. C. White, S. D. Hirschmann and others. It is also reported that the plant will be enlarged. An electric road is also in contemplation.

San Francisco, Cal.—The People's Gas & Electric Co. is reported incorporated; capital $3,000,000; principal place of business, San Francisco. Directors: G. D. Clark, F. C. Breekman and others.

St. Paul, Minn.—It is reported that the Edison Electric Light & Power Co. will build a 3-story addition to its transforming plant in Cedar St., to cost $8,000. Improved machinery costing $85,000 will be placed in the new structure.

Butte, Mont.—The County Commissioners have granted the Missouri River Power Co. a franchise to construct two lines of electric light and power poles along the highways of Silver Bow County.

Marshfield, Vt.—Dr. H. S. Carver, J. W. Mears and M. E. Beckley are reported to have recently formed an electric power company and to be preparing to build a plant.

Fremont, Neb.—The Council is reported to be considering the question of putting in one or more new boilers at the city pumping and lighting station.

Ontario, Cal.—The Edison Electric Light Co. of Pomona is stated to have petitioned the Town Trustees for a franchise to erect poles and lines over the streets.

Charlestown, W. Va.—Attorney S. M. Noyes of Wheeling, W. Va., writes that parties whom he represents propose to build an electric light plant at Charlestown, but plans have not yet been made.

Boise, Idaho.—Judson Spofford, Gen. Mgr. of the Boise-Payette River Electric Power Co., writes that it is proposed to construct an electric plant on Payette River 20 miles north of Boise. A. J. Wiley, of Boise, Engr. in Charge.

Tunica, Miss.—The Tunica Electric Light Co. of Tunica has been chartered. Capital $2,500. J. T. Watson, A. J. Dorsey and J. W. Brown, of Tunica, are interested.

Hennessey, Okla. Ter.—See "Water."

Wyocena, Wis.—B. C. Keeley is reported interested in the construction of a water power plant which will furnish electric light for Wyocena, Pardeeville and Rio.

Paris, Ky.—The Paris Electric Light Co. has been incorporated, with a capital of $30,000.

Altamont, Ill.—City Clk. Byron Piper writes that the contract for constructing a municipal electric light plant has been awarded to T. E. Reed, of Casey, Ill. (now in Altamont) for $12,875.

Richmond, Va.—J. P. Pope, Supt. of the Virginia Electrical Ry. & Development Co., writes that contemplated improvements and extensions will cost about $200,000. Reuben Shirreffs, of Richmond, Engr. in charge.

Yazoo, Miss.—See "Water."

Sonora, Cal.—C. B. Zeek, Sec'y of the Sierra Electric Power & Water Co., writes that contemplated improvements will cost about $200,000, and bids for same will be asked in January, 1902. C. H. Corter, Pres. of the company. D. A. Jones, of Sonora, Engr. in Charge.

Tullahoma, Tenn.—See "Water."

Orange, N. J.—The United Electric Co. is stated to have received the contract for furnishing 300 or more arc lights of 2,000 c. p. on a 5-year contract at $85 per light per yr. The company promises to bury its wires in Main St. at once and to lay additional subways at the rate of a half mile a year.

Huntington, Ore.—See "Water."

Berkeley Springs, W. Va.—S. F. Shelly writes that he proposes to establish a large producer gas plant for the purpose of furnishing power and heat for industrial purposes.

San Rafael, Cal.—The Marin County Supervisors are stated to have granted the California Central Gas & Electric Co. a franchise to erect poles and string wires for supplying light and power to this county.

Union City, Ind.—The Union Heat, Light & Power Co., of Union City, is reported to have been incorporated; capital, $50,000. Incorporators: G. W. Patchell, L. C. Huesman and P. E. Goodrich.

Gloversville, N. Y.—Bids are wanted Sept. 23 for furnishing and operating for a period of 10 years, beginning March 1, 1902, 120 series enclosed arc electric lamps. Wm. M. Harris, Chmn. Lighting Com.; M. V. B. Stetson, City Clk.

Birmingham, Ala.—The Birmingham Railway, Light & Power Co. proposes to improve its gas plant and extend mains. Ford, Bacon & Davis, of Birmingham, Engrs.

Aurora, Ore.—A. B. Kurtz, Mgr. Union Electric Light & Water Co. of Woodburn, is stated to have secured a 25-year light franchise in Aurora and will furnish 4 arc lights for the streets and 7 hydrants for fire and sprinkling purposes. He has also secured 300 H.-P. here and will at once proceed to transmit same to his plant at Woodburn and later on will take in Hubbard, Gervais and Mt. Angel.

Niobrara, Neb.—Engineer Arnold C. Koenig of Grand Island, in his report to the Irrigation & Water Co. in regard to developing the water power from the Niobrara River, estimates the cost of plant to deliver 1,500 net electrical H.-P., including dam and head-gate, complete, turbine installation, electrical installation, 4 bridges, flumes, culverts, spillways, etc.: 360,000 cu. yds. of excavation, 100 acres right-of-way, buildings and incidentals, $125,000 or $88.33 per H.-P.; operating expenses, $14.50 per H.-P. per year. Cost of 3,000 net electrical H.-P. with canal 9 ft. in depth and 52 ft. head, estimated, complete, $185,000, or $61.66 per H.-P.; operating expenses, $10.75 per H.-P. per year.

ELECTRIC RAILWAYS.

Platte City, Mo.—The Kansas City, Platte City & St. Joseph Electric Ry. is stated to have received a right of way through Platte City.

Noblesville, Ind.—The Council is stated to have adopted an amendment to the franchise of the Central Traction Co., which provides that it shall run through the entire length of the city, on 9th St.; that it shall locate its power house within the corporate limits, and begin work on the road immediately.

Lawrenceville, Ill.—Dr. W. C. Irwin and Jas. A. Hogue of Salem, Ill., are reported interested in the construction of an electric railway from Lawrenceville to O'Fallon.

Cincinnati, O.—The County Commissioners are stated to have granted franchises to the Rapid Ry. Co. and the Suburban Traction Co., the first over Montgomery pike, the other over Ohio pike. G. R. Scrugham of Cincinnati is Pres. and Mgr. of both companies.

Newburgh, N. Y.—L. W. Y. McCroskery is reported interested in the construction of an electric railway from Newburgh to Marlborough.

Edwardsville, Ill.—The Council is stated to have granted the Mississippi Valley Transit Co. a franchise to construct a line on Buchanan St.

Traverse City, Mich.—Peninsula Township has voted to issue $20,000 bonds to aid in the construction of an electric railway from Traverse City around the peninsula.

Berwick, Me.—The State R. R. Commissioners are stated to have approved the articles of association of the Berwick, Eliot & York St. Ry. The line is to be 20 miles in length with the capital of $80,000. Incorporators: J. F. Hill, H. M. Heath, C. R. Hall and others.

Shelbyville, Ind.—Bert De Prez, vice-president of the company which proposes to construct an electric railway from Shelbyville to Indianapolis, writes that the estimated cost of said work is $500,000. E. K. Adams, Pres. of company; T. E. Goodrich, Secy., and J. R. Messick, Treas. B. L. Baldwin, of Cincinnati, O., Engr. in Charge.

Custar, O.—The Council is stated to have granted a franchise to the Toledo, Columbus, Springfield & Cincinnati Ry. Co. Mr. Finch, of Lima, and Mr. Heston, of Toledo, are among the promoters.

Norwood, O.—The Council is stated to have granted a franchise to the Cincinnati Traction Co. J. Harris, Supt., Cincinnati.

Kewaunee, Wis.—The Council is stated to have granted a franchise to the Manitowoc & Northern Traction Co.

Lake Geneva, Wis.—The Beloit, Delavan Lake & Janesville Electric Ry. Co. is stated to have secured a franchise through the city.

Golden, Colo.—The Denver & Northwestern Ry. Co. is stated to have received a franchise to construct an electric railway in Jefferson County.

Peoria, Ill.—The Peoria Belt Line Ry. Co. has been incorporated, with a capital of $100,000. Incorporators: Theo. J. Miller, W. T. Irwin and others.

Hamburg, N. Y.—D. W. Allan is stated to have received a franchise for an electric railway on Hawkins Ave. He will macadamize the street; width, 30 ft.

Ambler, Pa.—A charter is stated to have been granted to the Whitemarsh & Upper Dublin St. Ry. Co., with a capital of $36,000, to build a line about 6 miles long in and around Ambler.

Pittsburg, Pa.—The Pittsburg & Birmingham Traction Co. is reported to have in contemplation some extensive improvements. G. S. Davison, Gen. Mgr., Pittsburg.

Akron, O.—Gard & Seiverling, of Kalamazoo, Mich., are reported to have secured the contract for constructing the line between Akron, Canton and Massillon, for the Northern Ohio Traction Co.

Syracuse, N. Y.—The State R. R. Commissioners are stated to have granted permission to the Syracuse, Skaneateles & Moravia R. R. Co. to construct an electric railway in Onondago County.

Olean, N. Y.—The Olean St. Ry. Co. is stated to have received permission to issue bonds to the amount of $155,000 to be used in constructing an extension to Bolivar. F. Mason, Ch. Engr., Olean.

Petoskey, Mich.—C. A. Thatcher, of Toledo, O., is stated to have secured franchises in Petoskey and Harbor Springs.

Derby, Conn.—It is stated that the Fair Haven & Westville R. R. Co. contemplates constructing an electric railway extension from Yale Field to Derby early next spring. L. A. Farnham, Ch. Engr., New Haven.

Camillus, N. Y.—The Town Board is stated to have granted a franchise to Chas. A. Lux, of Clyde.

Catawissa, Pa.—The Council is stated to have granted the Columbia & Montour Electric Ry. Co. a right of way through the borough.

Birmingham, Ala.—Geo. H. Davis, of New York, is stated to have been appointed manager of railway department of the new-formed Birmingham Ry., Light & Power Co., and will especially look after the reconstruction of the various plants and improvements which the company is to make, and for which $1,000,000 will be expended.

Iron Mountain, Mich.—The Menominee Range R. R. Co. is stated to have secured a franchise in Breitung Township for an electric railroad.

Steubenville, O.—The Belmont County Commissioners have granted the Steubenville, Mungo & Ohio Valley Traction Co. a franchise for the construction of an electric line from Jefferson County line to the northern corporation line of Martin's Ferry. The road will be built next spring.

Conneaut, O.—The Conneaut & Southern Ry. Co. is reported incorporated, with a capital of $10,000, to construct a railway from Conneaut to Kingsville. Incorporators: Geo. J. Chapman, Clifford W. Smith and others.

Colorado Springs, Colo.—W. A. Otis & Co., C. M. McNeill and others are reported interested in the construction of an electric railway to the summit of Pike's Peak, the line to be from 11 to 15 miles in length.

F. L. Dana and Chas. Zobrist are reported to have decided to construct a street car line to Prospect Lake. The lake is about 1½ miles from the center of the city. Probable cost of building this line wil be $25,000.

Newton, Ia.—The Newton Business Men's Association is reported to be considering a proposition from eastern capitalists, to construct an electric railway from Des Moines to Newton.

Nashville, Ind.—Joseph I. Irwin, of Ft. Madison, Ia., is reported interested in the construction of an electric railway in Nashville.

Warsaw, Ind.—The Kosciusko County Commissioners are stated to have granted a franchise to J. F. Rothwell, of St. Louis, to construct an electric railway in Van Buren and Turkey Creek townships.

Morgantown, W. Va.—See "Power Plants, Gas and Electricity."

Goshen, Ind.—The Goshen Southern Traction Co. is reported incorporated with a capital of $50,000 to operate a street railway in Goshen and an interurban line from Goshen to Syracuse. Directors: Louis M. Latta, Chas. A. Wehmeyer and others.

Amsterdam, N. Y.—The State R. R. Commission is stated to have granted the Amsterdam St. R. R. Co. permission to issue a $1,250,000 mortgage to provide for 20 miles of new construction. The commission also approved the company's application to increase its capital from $250,000 to $1,000,000, this increase also to be used in new construction. The company proposes to build a line to Johnstown and another to Schenectady.

Yazoo, Miss.—See "Water."

Portland, Ind.—C. W. McLaughlin, representing the Eastern Indiana Traction Co. has petitioned the Council for a franchise.

Gloversville, N. Y.—Bids are wanted by the F., J. & G. R. R. Co. until Sept. 21 for the grading and masonry necessary for the construction of about 25 miles of electric railway. J. N. Shannahan, Ch. Engr.

Los Angeles, Cal.—The Los Angeles Ry. Co. is stated to have received a franchise for a double track electric railway through the 2d and 3d Wards.

Depew, N. Y.—The Buffalo & Depew Ry. Co. is reported to be making arrangements to extend its line from Burlington Ave., Depew, to Central Ave., Lancaster. D. A. Hegarty, Mgr.

Canastota, N. Y.—The Oneida Traction Co. has been incorporated with a capital of $500,000 to construct an electric road, 10 miles long, from Canastota to Sherrill. Henry C. Stone, of Oneida, is one of the directors.

Meadville, Pa.—D. L. Starr, of Pittsburg, Sec'y of the Crawford County St. Ry. Co., writes that, owing to delay in securing franchises, contracts have not been let for the construction of an electric road, 29 miles in length, between Meadville and Titusville. Specifications will be ready for contractors about Oct. 11, 1901.

RAILROADS

Washington, D. C.—A press report states that the Richmond-Washington Co. has been chartered in New Jersey, with a capital of $3,000,000; the company will own the route from Washington, D. C., to Richmond, Va., embracing the Washington Southern and the Richmond, Fredericksburg and Potomac Railroad. It is intended to double track the whole line and otherwise improve it as soon as possible. Saml. Rea of Philadelphia, Pa., 4th vice-pres. of the Pennsylvania R. R., is reported to be managing the details of the organization.

Denver, Colo.—A press report states that the Colorado & Northwestern R. R. is to be extended to Salt Lake City, Utah. Chas. B. Culbertson, Gen. Mgr., Boulder.

Ashland, Me.—The State R. R. Commissioners are stated to have granted the petition of the Bangor & Aroostook R. R. Co. for authority to build an extension from Ashland to Ft. Kent, a distance of 50 miles. M. Burpee, Ch. Engr., Houlton.

Nanaimo, B. C.—The Local Board of Trade is reported to have engaged Dennis Harris to survey the route for a railway to Alberni.

Dunkirk, N. Y.—The question of constructing an underground crossing at the intersection of Eagle and W. 3d Sts. is under consideration. The L. S. & M. S. R. R. is on 3d St. Tracy W. Miles, Supt. Eastern Div., Buffalo.

Pueblo, Colo.—The Pueblo, Gunnison & San Juan R. R. Co. of Ouray, has been incorporated; capital, $100,000. Incorporators: J. W. Benson, Geo. A. Foot and others.

East Granby, Conn.—The State R. R. Commissioners are stated to have approved the route of the East Granby & Suffield R. R., which plans to build a line about 4½ miles in length. Chas. N. Bates, East Granby, and Chas. T. Bissell, Suffield, are among the incorporators.

Friedens, Pa.—A charter is stated to have been granted to the Quemahoning Branch R. R. Co. to construct a line from Frieden's Station to Glessner, a distance of 25 miles; capital, $250,000. L. F. Loree, Pres., Baltimore, Md.

New York, N. Y.—The Rapid Transit Subway Construction Co. is stated to have awarded to the Allis Chalmers Co. a contract for eight 5,500-H.-P. stationary engines, and to the Babcock & Wilcox Co. an order for 48 boilers of 600 H. P. each; contract reported to amount to $1,500,000.

Reading, Pa.—Geo. W. Beard & Co., 530 Court St., are stated to have received the contract for erecting a coaling station and a water supply station for the Reading Ry. Co.; contract price reported to be about $50,000.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Bath, N. Y.—Bids will be received by Geo. W. Dunn, Pres. Bd. Trus., New York State Soldiers and Sailors' Home, Bath, until Sept. 23, for furnishing 2 boilers f. o. b. at Bath, for setting 2 new and resetting 4 old boilers, and for disconnecting and reconnecting 4 old and connecting 2 new boilers, also for changing outside electric wiring and rebuilding the pole lines, at the same institution.

Baltimore, Md.—Bids are wanted Sept. 18 for erecting a brick building for Engine Co. No. 22; also for changing motive power of present elevator in city hall. Thos. G. Hayes, Pres. Bd. of Awards.

Martinsville, Ind.—Bids are wanted Oct. 7 for furnishing and installing a low-pressure gravity steam heating and ventilating apparatus in the court house. Geo. Pearcy, Chmn. Bd. Co. Commrs.

Dubuque, Ia.—The contract for constructing the Carnegie-Stout Free Library building has been let to John Field of Omaha, Neb., for $72,117.

Springfield, Mass.—Fire department bonds to the amount of $40,000 and $114,000 school bonds have been sold.

Havre de Grace, Md.—Stephen J. Seneca and his wife of Havre de Grace, Md., are to build a church for the Methodist Episcopal Congregation of this place, to cost $35,000. Rev. Mr. Hayes, Pastor.

Sioux Falls, S. D.—G. O. Keesler is stated to have received the contract for erecting the Carnegie Library for $18,890.

St. Paul, Minn.—Bids are wanted Sept. 24 for all labor and material necessary for the roofing and skylights for the new State Capitol, including steel supports for same. Channing Seabury, Vice Pres. Bd. State Capitol Commrs.

New York, N. Y.—A new church and rectory will be erected on Delancey and Cannon Sts. at a cost of $50,000 by the Church of St. Rose of Lima. Rev. Peter C. McNamee, Pastor. Architect, Jas. C. Kirby.

Lake Linden, Mich.—L. F. Ursin, of Calumet, is stated to have received the contract to erect the town hall, for $18,292.

New York, N. Y.—Bids are wanted Sept. 19 for certain additions and alterations (designated as "electric wiring," "steam plant," "pump room" and "toilet rooms"), to the Metropolitan Museum. Geo. C. Clausen, Commr. of Parks.

Reading, Pa.—Bids are wanted Sept. 25 for erecting a fire station at 15th and Muhlenberg Sts. E. L. Lindemuth, City Clk.

Trenton, N. J.—Bids will be received until Sept. 16 by the Building Committee at the office of the architects, Brouse & Arend, First National Bank Bldg., Trenton, for the erection of an addition to and a laundry building for the Mercer Hospital.

Indianapolis, Ind.—Bids are wanted Sept. 18 for furnishing material and labor necessary to construct, install and complete the steam heating apparatus, plumbing and gas fitting, electric illuminating system and an engine and dynamo in the new east wing of the City Hospital. Albert Sahm, Chmn. Bd. Pub. Wks.

Bainbridge, Ga.—Bids are wanted Oct. 15 for building and completing a court house, cost not to exceed $35,000. B. A. Lytle, Chmn. Bd. of County Commrs.

Bremer, Me.—Plans are being prepared for a new stone building for the Methodist Church. Cost, $10,000.

San Antonio, Tex.—The Rieley Gordon Co., of Dallas, is stated to have prepared plans for the Travis Park M. E. Church, to cost about $35,000.

Newport News, Va.—The Newport News Baptist Church will erect a new edifice, to cost about $30,000.

Butte, Mont.—The County Commissioners are stated to have decided to erect a new county hospital, to cost about $20,000.

Salt Lake City, Utah.—C. M. Neuhausen, 528 Dooly Blk., is stated to be preparing plans for a new wing to the Holy Cross Hospital, to cost about $25,000.

Ft. Smith, Ark.—Hoffman & Blakeley are reported to be preparing plans for a new German Lutheran Church, to be erected at 10th and D Sts., to cost about $17,000.

Muncie, Ind.—This city proposes to build a library at a cost of $50,000. C. A. Budd, Chmn. of Com.

Riverside, Cal.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Oakland, Cal.—The Trustees of the Merritt Hospital are reported to be considering the construction of a hospital, to cost about $600,000. Dr. A. J. Russell is one of the trustees.

Chicago, Ill.—Wm. J. Brinkman, 163 Randolph St., is reported to be preparing plans for a chapel and school to be erected on Grand Boulevard and 49th St., for the Corpus Christi R. C. Church, to cost $40,000. Rev. F. S. Henneberry, Pastor.

Alger, Mich.—It is stated that bids are wanted Sept. 17 for erecting a county building at Alger, according to plans prepared by Charlton, Gilbert & Demar, of Marquette.

Chippewa Falls, Wis.—The Mueller Co., 197 Reed St., Milwaukee, is stated to have received the contract for the steam heating of the administration building, school building and east and west dormitories for the Home for Feeble Minded at Chippewa Falls, for $11,472.

Newport, R. I.—It is stated that plans are being prepared for a memorial building to be presented to the Newport Hospital Trustees by Mrs. Cornelius Vanderbilt. It will be erected at the east end of the hospital grounds, near Powell Ave.

Rolling Fork, Miss.—The Board of Supervisors is stated to have awarded the contract for erecting a court house here to J. J. Glandfield for $24,500, all former contracts having been canceled.

Detroit, Mich.—Bids are wanted Sept. 23 for the fireproofing and concrete work of the aquarium and horticultural building on Belle Isle Park. M. P. Hurlbert, Secy. Commrs. of Parks & Boulevards.

Poplar Bluff, Mo.—Bids are wanted Sept. 16 for erecting a city hall. Wm. A. Spencer, City Clk.

Mansfield, O.—It is reported that bids received recently for remodeling the Richland County Court House have been rejected, all being in excess of the appropriation, which is $50,000. New bids will be received. C. L. McClellan, Deputy Clk.

Allentown, Pa.—Bids are wanted Sept. 17 for erecting an engine house in the 1st Ward for the Allen Steam Fire Engine Co., No. 7, also for erecting in the 11th Ward an engine house for the Franklin Fire Co., No. 10. Jas. L. Schaadt, Mayor.

Nashville, Tenn.—Bids are wanted Sept. 17 for erecting an engine house on Summer St. Alex. G. Fite, Chmn. Bd. Pub. Wks.

Bridgeport, Conn.—Local press reports state the Committee on New Municipal Buildings on Sept. 9 accepted the detailed plans of McKim, Mead & White, of New York, for the proposed city hall. Cost not to exceed $425,000.

BUSINESS BUILDINGS.

Carnegie, Pa.—Dushane & Lewis, of Carnegie, are stated to have secured the contract for constructing the plant of the Chartiers Valley Brewing Co. at Carnegie, at an estimated cost of $165,000.

Camden, N. J.—The contract for constructing the plant of the Whitney Car Wheel Co. in Camden, is stated to have been awarded to M. P. Wells & Co., Crozier Bldg., Philadelphia, Pa., for $48,885.

Philadelphia, Pa.—It is stated that the Crane Ice Cream Co. will erect a 4-story building on 18th and Filbert Sts., to cost about $50,000.

New Haven, Conn.—L. W. Robinson, Exchange Bldg., is reported to be completing plans for a building to be erected on Orange and Court Sts. for the City Missionary Association, to cost about $35,000.

Buffalo, N. Y.—The Northwestern Hotel, at Military Road and Lansing St., is reported to have been destroyed by fire Sept. 4.

Harrand, Ill.—E. B. Hunt, of Hunt-Helm-Ferris & Co., writes that a 3-story brick building, 110 x 60 ft., is about to be erected. It will be used entirely for shipping and storage facilities.

Ft. Wayne, Ind.—The Wabash R. R. Co. is stated to have decided to erect next spring a $100,000 depot. W. S. Lincoln, Ch. Engr., St. Louis, Mo.

Bristol, Conn.—The Bristol Mfg. Co. will erect a 2-story brick mill 60 x 150 ft., using the present power. F. G. Hayward, Secy.

Denver, Colo.—The Fraternal Union of America is stated to have completed plans for a $30,000 building to be erected on Champa and 14th Sts.

Atlantic City, N. J.—Rogers & MacFarlane, 73 Moffat Bldg., Detroit, Mich., are stated to have completed plans for a 6-story stone, brick and steel hotel 175 x 146 ft., to be erected on Michigan Ave. and the beach. Joseph N. Borden and Dr. Philip Marvel are reported interested.

Ashland, Va.—Bids are wanted Sept. 20 for erecting a hotel here. Plans and specifications are at the office of E. L. C. Scott, Ashland.

Marietta, O.—The A. T. Nye & Son Co., Mfgrs. of Stoves, is to erect an addition to its plant; it will be a 3-story brick building 40 x 118 ft.

Springvale, Me.—The Maine Alpaca Co., of Springvale, will erect a new building 110 x 60 ft.

Kansas City, Mo.—The Metropolitan St. Ry. Co. is about to build a $40,000 brick car shop and barn at 9th and Lister Sts. C. F. Holmes, Gen. Mgr., Kansas City.
John H. Hobbs is about to build a $40,000 brick store at 1434 W. 9th St.

Sharon, Pa.—A press report states that Albert Ward will erect a $45,000 hotel at this place.

Chicago, Ill.—Geo. Beaumont, 115 Dearborn St., is stated to have prepared plans for a 3-story warehouse to be built on Union Place and 22d St., for John McConnell; cost, $45,000.

Cleveland, O.—Bids are wanted Oct. 14 for $110,000 market house bonds. Geo. P. Kurtz, City Treas.

Chicago, Ill.—Permits have been issued to the Illinois Central R. R. Co. for an addition to the grain elevator in slip C at foot of S. Water St., to cost $125,000, and to the Chicago Edison Co. for a 3-story structure, 50 x 151 ft., at 1094-1096 W. Madison St., to cost $55,000.
S. A. Treat, 279 Dearborn St., is stated to have prepared plans for a 7-story addition to the Windermere Hotel, at 56th St. and Cornell Ave., to cost $50,000.
Sauer, Dwyer & Co., 190-192 Michigan Ave., propose to rebuild their warehouse. The new building will be 75 x 205, 3 stories high and mill construction.

Boston, Mass.—Permits have been issued for the following buildings: For a 6-story brick and fireproof dormitory with one store, to be erected on Botolph and Irvington Sts. for the Technology Chambers Trust; cost $225,000. Architect, Walter H. Kilham, 9 Park St. Builder, Geo. Fuller Co.; and for a 4-story brick stable to be erected at 477 Harrison Ave. for the Eben D. Jordan Estate, cost $80,000. Architects, Wheelwright and Haven, Colonial Bldg. Builder, Gerry E. Northup, 458 Harrison Ave.

DWELLINGS.

Boston, Mass.—Architect Arthur H. Bowditch, 112 Water St., has filed plans for a 6-story brick fireproof apartment dwelling, to be erected at Boylston and Hemmenway Sts. Owners, the Charlton Hotel Trust. Builder, Geo. A. Fuller Co., 27 State St. Estimated cost, $300,000.
Architect Jas. Mulcahy, 66 State St., has filed plans for 3 brick and stone family dwellings for Mary E. J. McLaughlin, Sharon, Mass., total estaimated cost $101,000. Location, 150 Draper St. and 263-265 Bowdoin St.

Chicago, Ill.—Wilson & Marshall, 218 La Salle St., are reported to be preparing plans for a 3-story residence, to be built for Wm. T. Fenton at Ellis Ave. and 48th St. at a cost of $25,000.
Huehl & Schmidt, 163 Randolph St., are stated to have prepared plans for a 2-story residence, 27 x 80 ft., to be built on East End Ave., south of 54th St., for Wm. Mohr, at a cost of $20,000.

SCHOOLS.

Des Moines, Ia.—Bids are wanted Sept. 23 for the basement, power house and tunnel from power house to main building of the new West Des Moines High School.

Weyauwega, Wis.—H. P. Knutsen of Waupaca is stated to have received the contract for erecting a school here, for $16,000.

Springfield, Mass.—See "Public Buildings."

Cumberland, R. I.—Bids are wanted by the Building Committee for New School House at Valley Falls, Cumberland, until Sept. 23 for erecting a school. Wm. R. Walker & Son, Archts., 17 Custom House St., Providence.

Victoria, B. C.—Thos. Catteral, 49 1st St., is stated to have secured the contract for erecting the high school, for $21,442.

Niagara Falls, N. Y.—Bids are wanted Sept. 23 for erecting a high school to cost $150,000. Geo. F. Diemer, Clk. Bd. of Educ.

Watertown, N. Y.—Bids are wanted Sept. 25 for constructing a high school. Geo. A. Lance, Chmn. Bldg. Com.

Allegheny, Pa.—McGirress, Smith & Co. are stated to have received the contract for ventilating and heating the high school annex, for $42,377.

La Crosse, Wis.—The Board of Education is reported to have decided to accept the Common Council's proposition to establish a fund for a new high school to cost $75,000; $20,000 is already set aside.

Covington, Ky.—Geo. Lubrecht, of Covington, is superintending the digging of foundations for a $17,000 school to be built this fall on 5th St. for the Sisters of Notre Dame.

South Bend, Ind.—The proposed Oliver School building will cost $20,000.

Muskegon, Mich.—The J. J. Howden Co., 36 Morris St., is stated to have secured the contract for installing a complete heating system in the Hackley Manual Training School, for about $15,000.

Lewiston, Idaho.—The Trustees of the Lewiston State Normal School are stated to have adopted plans for a training school and bids for construction will soon be called for. The contract for additions to the normal school dormitories will, it is reported, be let at the same time.

Hartford, Conn.—Halsey B. Philbrick, 111 Edwards St., is stated to have secured the contract for erecting the Wethersfield Ave. school addition; $65,000 has been appropriated for this purpose.

Warren, R. I.—The plans of Albert H. Humer, of Pawtucket, are stated to have been accepted for a $30,000 school to be erected on Joyce St. and Railroad Ave.

STREET CLEANING AND GARBAGE DISPOSAL.

Glenville, O.—The Council has awarded the contract for removing garbage to the Newburg Reduction Co. at $1,800 for a year.

Canton, O.—The City Council has authorized the purchase of a site in Jackson St. on which it is proposed to construct a garbage plant. Bonds to the amount of $20.000 will be sold at once. John B. Gravis, Chmn. of Com.

South Orange, N. J.—Bids are wanted Sept. 16 for performing scavenger work for a term of one year from Oct. 1, 1901. M. A. Fitzsimmons, Village Clk.

McKeesport, Pa.—The contract for erecting an addition to the garbage plant has been awarded to Briggs Bros. for $2,116.

Wilmerding, Pa.—Jas. L. Waddell has made a proposition to the Council to build a furnace and dispose of the garbage of Wilmerding, at fixed rates, if granted a 10-year franchise.

Salt Lake City, Utah.—Local press reports state that the following bids were opened Sept. 3 for a garbage crematory: Municipal Engineering Co., New York, two-cell crematory complete, with building, capacity 40 tons daily, $9,300. Engle-Thompson Cremating Co., Newton, Ia., 30-ton furnace, the city to furnish all materials and labor, on a royalty of $1,000. Bridgeport Boiler Works Co., steel stack furnace, wood building, $9,100; brick stack, fire-proof building, $11,900. Dixon Garbage Crematory Co., Toledo, O., $8,027.25 to $15,130.50, according to whether structure is of brick or steel, and with or without double furnaces.

St. Louis, Mo.—The bill authorizing the Board of Health to let a new contract for the reduction of garbage, was finally passed by the Municipal Assembly on Sept. 6. The new contract will be for 3 years from next November.

Saginaw, Mich.—The Common Council has under consideration a proposition from the Dixon Garbage Crematory Co., of Toledo, for the establishment of a garbage plant.

Milwaukee, Wis.—The City Council Committee on Health recommends an appropriation of $20,000 for the equipment of the garbage plant with apparatus for transferring garbage from the mainland to Jones island.

GOVERNMENT WORK.

Elmira, N. Y.—Bids are wanted Oct. 10 at the Treasury Dept., Washington, D. C., for the construction of the U. S. Post-Office at Elmira, as advertised in The Engineering Record.

Carrollton, Ky.—Bids are wanted at the Treasury Dept., Washington, D. C., until Sept. 30 for furnishing the heating apparatus for the U. S. Post-Office at Carrollton, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Sept. 19 for the installation of steam and exhaust piping, etc., for the Interior Dept. buildings, known as Old Post-Office building and Patent Office building. E. A. Hitchcock, Sec'y Dept. of Interior.

Washington, D. C.—The contract for constructing the extension of the Government Hospital for Insane has been awarded to Horton & Hemenway, of Providence, R. I., for $910,000.

New York, N. Y.—According to press reports, Cramp & Co., builders, are receiving bids for the erection of a boat storehouse to be erected at the New York Navy Yard for the United States Government. The structure will measure 100 x 300 ft., to be constructed of brick and steel, and be three stories in height.

Norfolk, Va.—The following bids were opened Sept. 7 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing 10,000 sq. yds. of vitrified brick pavement on concrete base at the Norfolk Navy Yard: Penn Bridge Co., Beaver Falls, Pa., $2,37 per sq. yd.; General Supply Co., Norfolk, $2.31; Frank Pidgeon, Saugerties, N. Y., $2.45 and $2.47.

Ft. Monroe, Va.—The lowest bid received Sept. 6 at the U. S. Engineer Office, Norfolk, for a stone sea wall 960 ft. long about Ft. Monroe, is stated to have been from Chas. W. Johnston, of Lewes, Del., at $50,810.

Detroit, Mich.—Contracts for dredging Hay Lake Channel are stated to have been awarded as follows: Section 1, being in hardpan and gravel, to Henry Hickler, of Sault Ste. Marie, at 56 cts., total $155,456; Section 2, being in clay and gravel, to Sam. O. Dixon, of Milwaukee, at 11.4 cts. per cu. yd., total $175,340; Section 3, being in sand, clay and gravel, to Hingston & Woods, of Buffalo, at 15⅝ cts. per cu. yd., total $142,434.

Genoa, Neb.—The contract for the erection of an Indian School building at Genoa is stated to have been awarded to J. B. Herrman, of Norfolk, Neb., at $23,585.

Pierre, S. D.—R. M. Pringle, Government Superintendent of Engineering, is said to be preparing plans for a new system of sewerage and an electric light plant at the Government Indian school. Both improvements to be put in this fall.

New York, N. Y.—The following bids were opened Sept. 7 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a 3-story brick and steel building, 100 x 300 ft., at the New York Navy Yard: Tidewater Building Co., N. Y., $174,138; H. Probst, N. Y. City, $172,700; Lewison & Joust, N. Y. City, $183,374; R. H. Hood & Co., N. Y. City, $159,700; J. A. Stevenson, L. I. City, N. Y., $183,393; O'Brien & Hoolihan, Syracuse, N. Y., $181,839; Penn Bridge Co., Beaver Falls, $183,633; R. A. Griefen, Chicago, Ill., $157,850; L. L. Leach & Son, Chicago, Ill., $183,000; Cramp & Co., Bridgeton, N. J., $158,980; Merrick Fireproofing Co., Jersey City, $165,000; P. J. Carlin & Co., Brooklyn, $175,414.

Portsmouth, N. H.—The Bureau of Yards & Docks has awarded the contract for the Coaling Plant at Portsmouth (bids for which were opened on Aug. 24) to Snare & Triest, of New York City, for $175,000, of which $100,000 is immediately available.

Ft. D. A. Russell, Wyo.—Bids are wanted Oct. 9 for furnishing labor and material requisite for improving 7,700 ft. of roadway on military reservation at Ft. D. A. Russell, and constructing a gateway. Address Maj. J. W. Pope, Ch. Q. M.

Santiago, Cuba.—See "Sewerage and Sewage Disposal."

Stockton, Cal.—Bids are wanted at the Treasury Dept., Washington, D. C., until Oct. 21 for furnishing heating apparatus complete in the U. S. Post-Office, Stockton, as advertised in The Engineering Record.

Chicago, Ill.—The following bids were opened Sept. 3 by Maj. J. W. Willard, Corps of Engrs., U. S. A., for constructing 4 miles of Western Section, Illinois & Mississippi Canal:

Bidders.	Mile 29, 35,789 c. y.	Mile 30, 99,513 c. y.	Mile 31, 113,137 c. y.	Mile 32, 112,043 c. y.
S. P. Bennett, Annawan, Ill...	$11.25	$11.25	.....	.....
Jno. J. McCaughey, Chicago..	13.46	9.79	$16.42	$11.79
Flynn Bros, Annawan, Ill......	19.00	15.40	22.00	12.40
Pound Const'n Co., Chicago...	25.00	19.00	25.00	25.00
Katz & Callahan, Omaha, Neb.	11.75	11.75	12.09	12.09

MISCELLANEOUS.

Manitowoc, Wis.—The City Council has decided to dredge a portion of the river at an estimated cost of $12,000.

New York, N. Y.—Bids are wanted Sept. 19 for setting bluestone edging, building walk basins, laying drain pipe, constructing asphalt walks, etc., in Hudson Park. Geo. C. Clausen, Commr. of Parks.

Philadelphia, Pa.—Bids are wanted Sept. 17 for deepening the channels of the Delaware and Schuylkill Rivers. Wm. C. Haddock, Dir. Dept. of Pub. Wks.

Philadelphia, Pa.—Bids are wanted Sept. 17 for repairing walks, grading, filling and repairing buildings in squares. Abraham L. English, Dir. Dept. of Public Safety.

New Orleans, La.—The following bids were opened Aug. 27 by the Board of Commrs., Port of New Orleans, for the construction of a wharf on Henderson St.: J. W. Thompson, $44,381; J. H. Gardner, New Orleans (accepted), $36,205.

New Orleans, La.—Two ordinances are before the City Council for privileges of laying pipe lines in the streets for the distribution of fuel oil.

New York, N. Y.—The contract for constructing pavilions on North Brother Island has been awarded to John R. Sheehan Co., N. Y. City, for $17,800.

Jersey City, N. J.—The N. Y. Journal of Commerce states that the Pennsylvania R. R. Co. is about to build two iron piers, each 700 ft. long and 2 stories high, in Jersey City.

Randalls Island, N. Y.—Bids are wanted Sept. 27 for furnishing and installing pipe covering at the House of Refuge for Juvenile Delinquents, as advertised in The Engineering Record.

Oakland, Cal.—Local press reports state that the Oakland Harbor Development Co., of which Jas. L. De Fremery is president, contemplates improvements which it is estimated will cost about $50,000.

Albany, N. Y.—Bids will be received by John N. Partridge, Supt. of Public Works, at Albany, until Sept. 19, for constructing a vertical wall on the south side of Erie Canal in Eagle Harbor and for improving Glen Creek, between the Northern Central Ry. and the Chemung Canal in Watkins.

Upper Sandusky, O.—Park bonds to the amount of $30,000 have been sold.

Monroe, La.—The Board of Commissioners of the Tensas Basin Levee District has voted to issue $65,000 bonds for the construction of the levee in Arkansas known as the Lucca Loop levee.

Ft. Thomas, Ky.—Consulting Engr. Ward Baldwin, of Cincinnati, O., writes that the contract for building 4 concrete piers for the Union Light, Heat & Power Co. has been awarded to W. B. Van Sandt, Atlas Bank Bldg., Cincinnati, O., as follows: Excavation to 6 ft. depth, 35 cts. per cu. yd.; excavation more than 6 ft. deep, 45 cts. per cu. yd.; 1:3:6 concrete in footings, $6.75 per cu. yd.; 1:2:4 concrete in piers, $7.50 per cu. yd. All cement best Portland.

NEW INDUSTRIAL PLANTS.

H. Scherer & Co., Detroit, Mich., are erecting a 2-story and basement building, 280 ft. long, for finishing forgings.

The Peerless Mfg. Co., Louisville, Ky., is erecting two 1-story buildings, 360 x 181 and 135 x 253 ft., respectively. An electric power plant of 100 to 150 H.-P. will be installed.

The York, Pa., Wagon Gear Co. is building a 3-story and basement 40 x 80-ft. addition and a 36 x 39-ft. power house. A 125-H.-P. boiler and a 100-H.-P. engine will be installed.

The Hartford, Conn., Foundry Co. expects to build a 300 x 75-ft. foundry and equip it with compressed air and electrical machinery.

The Kerrihard Co., Red Oak, Ia., is rebuilding its foundry and machine shop, recently burned.

C. W. Tebault, Norfolk, Va., is interested in the organization of the Norfolk Ship-Building and Dry Dock Co., which will erect a plant on 500 acres on Hampton Roads.

A company has been organized in New Castle, Pa., with a capital of $125,000, to erect a rolling mill. The officers of the company are: Pres., L. I. Bregman, Cleveland, O.; Vice-Pres. and Gen. Mgr., A. F. Baumgarten, Pittsburg; Supt., W. C. Maloney, Pittsburg. Correspondence relative to purchasing should be addressed to A. F. Baumgarten & Bro., 518 Park Bldg., Pittsburg.

The Philadelphia, Pa., Tapestry Mills, Allegheny Ave. & Front St., are erecting a 90 x 260-ft. building, the extra boiler capacity for which will be 300 H.-P.

The Turner Worsted Co., Cleveland, O., hopes next year to build a new power house and install 1,000 H.-P. in engines and generators.

The Florida Paint Co., Jacksonville, Fla., is building a 4-story and basement 30 x 105-ft. factory, and is in the market for paint machinery, elevators, etc.

The Swindell Bros. Cold Storage Co., Kalamazoo, Mich., will erect a 4-story and basement 50 x 80-ft. cold-storage building.

The Willamette Boiler Works, Portland, Ore., are building an 80 x 125-ft. shop, to be equipped with a 20-ton traveling crane.

The following bids were opened Sept. 3 by the Harbor Commissioners, Montreal, Que., for the construction of a grain elevator (aggregate capacity 1,000,000 bushels), in the center of the harbor: J. A. Jamieson, Montreal, $642,000 (awarded, subject to the approval of the plans by the Minister of Public Works); the Barnett & Record Co., Minneapolis, Minn., $820,000; McDonald Engineering Co., Chicago, Ill., $975,000; A. F. Chapman & Co., Buffalo, N. Y., $1,090,000.

The Standard Vehicle Co., Pontiac, Mich., is building a 5-story, 75 x 130-ft., factory, and will install an 80-H.-P. boiler and a 40-H.-P. engine.

The Union Bag & Paper Co., 1 Broadway, New York, will build a boiler house at Sandy Hill, N. Y., to contain four 600-H.-P. batteries of water-tube boilers, three to be installed, including economizer, induced draft, coal-handling machinery and mechanical stokers.

BUSINESS NOTES.

The Federal Asphalt Co., said to be in control of asphaltum beds in four counties of Kentucky, has been organized with a capital stock of $5,000,000. The officers are: M. D. Coffeen, Pres.; Joseph Huffaker, Vice-Pres.; A. H. Loeb, Treas.; F. L. Warner, Sec'y. All the officers are residents of Chicago, with the exception of Joseph Huffaker, who is a resident of Louisville.

At a meeting of the directors of the Illinois Bridge & Iron Co., Sullivan, Ill., a dividend of 15 per cent. was declared for the first six months and 20 per cent. for the second six months of its existence. At a recent stockholders' meeting the capital stock was increased from $25,000 to $50,000.

The Reeves Pulley Co., Columbus, Ind., is so pushed in its transmission appliances department that a 56 x 112-ft. brick addition is under construction to afford room for heavy machinery used in building large transmission systems. The pulley department is also very busy, and is now finishing a main drive pulley 16 ft. in diameter and 31 ins. on the face. It is built entirely oı oak and is guaranteed to weigh 12,000 lbs.

The interests of the Scherzer Rolling Lift Bridge Co., of Chicago, have become so extensive in Russia as to require the establishment of permanent general offices at St. Petersburg. Eduardovitch O. Gagen has been appointed a special representative of the company for the empire and will visit all the important Russian sea-ports and waterways, returning by way of the Trans-Siberian and Chinese Eastern Railroads. He will also visit the principal sea-ports of Japan to develop the company's business already established there.

In the article on the steam plant in the Atlantic Mutual Building, New York, in The Engineering Record of September 7, it should have been stated that the boilers were equipped with the Potter mesh separator and superheater, which is used in many other large office structures in the city, including the Park Row, St. Paul, Empire, Broad Exchange and Mutual Life Buildings.

Galgano Bros. have been awarded a contract for paving Le Count Place, New Rochelle, N. Y., with the creo-resinate wooden paving block, made by the United States Wood Preserving Co., 29 Broadway, New York.

The H. W. Johns Mfg. Co., 100 William St., New York City, reports having recently received the following contracts: William Cramp & Sons Ship & Engine Building Co., Philadelphia, for work on the U. S. battleship "Maine," installing asbestos non-splinterable bulkhead insulation; Mackay residence, Roslyn, L. I., N. Y., using fire-felt sectional covering; all the covering at the Hahne Building, Newark, N. J., using fire-felt, asbestocel, anti-sweat and homogenous brine, sectional covering, also fire-felt blocks and cement; State Normal School, Fredonia, N. Y., using nonburn, fire-felt sectional covering; New York State Custodial Asylum, Newark, N. Y., nonburn and fire-felt covering; Strathmore Apartments, 52d St. and 7th Ave., asbestocel covering; Connecticut State Prison, using asbestocel covering and asbestocel sheets, finished with cement; Youngstown, O., Consolidated Gas & Electric Co., using 1½-in. fire-felt sectional and also 1½-in. asbestos cement; Fazenweather Building, New Haven, Yale College, fire-felt and cement felting; Newark, N. J., Free Library, using fire-felt and cement felting; Scoville Mfg. Co., Waterbury, Conn., covering for new insulation of engines, H. W. Johns Mfg. Co.'s materials used.

The Phoenix Iron Works, Meadville, Pa., has given a contract to the Penn Bridge Co., Beaver Falls, Pa., for the structural work of a new boiler shop, which will more than double its present capacity, and additions are also being made to the foundry and engine departments.

Armour & Co., Chicago, are installing in their new elevator at New Orleans, La., an electric plant, consisting of 125 and 60-H.-P. engines, built by the Ball Engine Co., Erie, Pa.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Sept. 16.	Melrose Park, Ill	Sept. 7
	Adv., Eng. Record, Sept. 7.	
Sept. 17.	Ft. Mansfield, R. I	Sept. 7
Sept. 17.	Glenwood, Minn	Sept. 7
Sept. 17.	Hendricks, Minn	Sept. 7
Sept. 17.	Conduit, Cleveland, O	Aug. 31
Sept. 18.	Soerabaya, Java	July 20
Sept. 20.	Longmont, Colo	Aug 24
Sept. 21.	Washington, D. C	Aug. 17
Sept. 21.	Washington, Pa	Sept. 7
Sept. 21.	San Francisco, Cal	Sept. 14
Sept. 24.	Tullahoma, Tenn	Sept. 14
Sept. 25.	Philadelphia, Pa	Sept. 14
Sept. 27.	Minneapolis, Minn	Sept. 14
Sept. 30.	Ft. Yates, N. D	Sept. 7
Oct. 1.	Burlington, Ia	June 29
	Adv., Eng. Record June 29.	
Oct. 1.	New York, N. Y	Sept. 14
Oct. 3.	Tunnel, Newark N. J	Sept. 14
Oct. 5.	Water Gates, Washington, D. C	Aug. 3
	Adv., Eng. Record, Aug. 3.	
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
——	Pump, etc., Lynchburg, Va	Sept. 14
	SEWERAGE AND SEWAGE DISPOSAL.	
Sept. 16.	Flint, Mich	Sept. 14
Sept. 16.	Albany, N. Y	Sept. 14
Sept. 16.	Woonsocket, R. I	Sept. 14
Sept. 16.	St. Paul, Minn	Sept. 14
Sept. 16	Gloversville, N. Y	Sept. 14
Sept. 16.	Charles City, Ia	Sept. 14
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Sept. 20.	Cohoes, N. Y	Sept. 14
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

In the midst of the universal mourning into which this country was plunged a few days ago, by the brutal assassination of its chief magistrate, it was gratifying to learn, among the many testimonials of widespread sympathy throughout foreign lands, of further evidence of the strong bond of kinship between this and the parent country, in the following cable message from the Institution of Civil Engineers to the American Society of Civil Engineers:

American Society of Civil Engineers,
220 West Fifty-seventh Street, New York:

Mansergh, president, expresses the profound sorrow and sincere sympathy of the Institution of Civil Engineers on the tragic death of your honored chief, McKinley.

London, September 17.

Some Features of Steel-Concrete Construction.

The informal discussion of the subject of steel-concrete construction at the annual convention of the American Society of Civil Engineers, held at Buffalo in June of this year, and published in the "Proceedings" of the Society for August, is practically the first interchange of professional views by American engineers on this type of construction. The paper by Mr. von Emperger published in the "Transactions" of the Society for April, 1894, can scarcely be said to have produced discussion of a practical character, although the paper was an actual introduction of the subject to American engineers. Since the publication of that paper, a large number of steel-concrete arch bridges, mostly for highway traffic, have been built, both in this country and abroad. These highway structures have in some cases been built with spans of considerable length, up to nearly 150 feet. They have been approved by civil engineers of reputation and they have been tested in actual use to an extent which demonstrates that they have come to stay. It is well, therefore, to give careful consideration to such points as were raised at the annual convention of the Society at Buffalo, referred to at some length in another column, and which touch upon some of the most important matters connected with the design of steel-concrete structures.

Obviously one of the most important elements of design is the value of the unit stresses to be employed. The combination of the two materials is supposed to be so intimate and enduring that the entire mass acts as a unit. It must be admitted that there is some substantial doubt whether this result has always been attained, although there is no reason why it should not be. At any rate, all questions of design must be predicated on that condition as existing

The qualities of steel are so well known that there should be no reasonable doubt as to the stress to be permitted in it. In some cases a net tensile stress of 20,000 pounds per square inch has been considered a proper working value, and in mild steel in highway structures that value may be considered satisfactory, although it certainly is high enough. Possibly 16,000 to 18,000 pounds per square inch in net section would in many cases be preferable to the higher value. For railway purposes 12,000 to 15,000 pounds per square inch of net section would be suitable limits for working stresses depending upon length of span and weight of structure.

In the compression flanges the greatest working stresses may without objection be taken equal to those allowed on the net area of the tension flanges, if the corresponding stress in concrete will permit this to be done. At first sight this may not seem reasonable. It is to be remembered, however, in the first place that the compression flange, like that in tension, is solidly imbedded in the concrete mass and hence that the compressed metal will not be subjected to lateral bending; hence, it may be treated as if in short blocks. It is further to be remembered that so far as investigations thus far indicate, metal in compression suffers no fatigue. It is probable on the other hand that the imbedding of the metal of the tension flange in the same mass of concrete has, in a sentimental way, at least, aided in giving the impression that the tensile metal may somehow be subjected to a greater unit stress than if it were used as in an all-steel structure. It is not easy to assign any well-grounded reason for using higher unit tensile stress in the combination structure than in the all-steel bridge. Indeed, it might seem more reasonable to argue in precisely the other direction. Concrete is weak in tension and hence is so liable to crack that it would appear defensible to give the tensile steel section a little surplus of strength rather than an unusually high working stress. The mass of the combination arch is, however, so heavy in comparison with the moving load that the shocks to which the all-steel bridge is subjected will be essentially absent. The tensile stresses, therefore, in the imbedded rib approach very closely the purely static condition.

Satisfactory values for the unit stresses to be allowed in the concrete are not so easily determined, for at least two reasons. In the first place, empirical values for the ultimate tensile and compressive resistances for concrete, for the varying proportions of the ingredients used, have not yet been determined by a sufficient number of tests, particularly in view of the qualities of different brands of cement and of the varying influences of different methods of mixture and of treatment while putting the material in place. Again, the resisting properties of the concrete will depend on its age, on the amount of ramming as affecting the air voids in the mass, and possibly on the degree of wetness. Obviously concrete of arched ribs in which the steel work is imbedded should be rich and strong; probably for most purposes the proportions of 1, 2 and 4 are not unreasonable, although a less rich mixture might in some cases be permissible. With those proportions, assuming proper mixture and satisfactory treatment in putting the concrete in place, an upper limit of working stress of 500 pounds per square inch in compression may be used, while in tension 50 to 60 pounds per square inch would not be too high. Manifestly these values presuppose excellent quality of materials and the right method of treatment, both in mixing and in putting in place, but nothing is assumed beyond what is practicable in first-class work.

The foundation of the theory of these combination structures is in reality the elastic properties of the two materials employed. The modulus of elasticity is known with accuracy for steel, but that is not the case with the concrete. Some of the older experiments on concrete indicated a value for the modulus of elasticity in tension or compression not far from 1,000,000 pounds per square inch, whereas later tests so far as they have been made indicate a modulus running from 2,500,000 pounds to over 4,000,000 pounds per square inch. The elastic behavior of concrete, even of considerable age, is frequently erratic. Indeed, it would sometimes seem that for relatively low intensities of stress it had no true modulus. Any irregularity in the interior of a mass of concrete, such as arising from air voids or incomplete mixing, would obviously materially affect the modulus. What is imperatively needed is a considerable extension in the empirical determination of the modulus at different ages, with different degrees of mixture and with varying conditions of manufacture, similar to those employed in actual work. In view of the experience thus far enjoyed it would appear that a modulus of about 3,000,000 pounds per square inch for the rich concrete for combination structures is not far wrong.

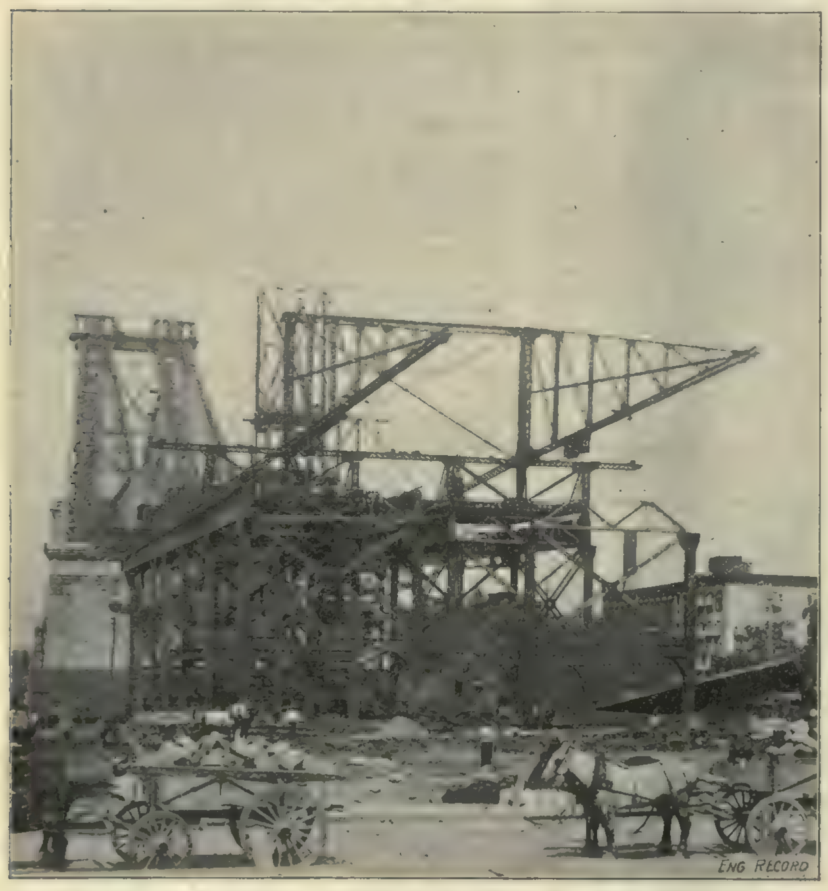
The matter of temperature stresses occupied a prominent place in the discussion at the annual convention of the Society. Anyone who has made computations for temperature stresses in a steel-concrete arch without hinges will admit that these stresses are relatively high, and should be provided for if the assumed temperature changes actually take place, but just there is a point of very grave doubt. The actual material of the rib is usually protected from the direct action of the sun by the pavements, both of roadway and sidewalk, while almost, if not the entire soffit, is in the shade and generally over the water. If there is added to these considerations that of the relatively large mass of the arch, it will readily be seen that the actual changes of temperature in the whole mass of the structure must be far less than that of the atmosphere. It is clear from these considerations that the temperature stresses even in an unhinged arch may be but a small portion of those computed from the extreme temperature range of the atmosphere. It would not be surprising if they were less even than one-fourth of that amount.

A Water-Power Plant of the low-head class not uncommon on the Continent has been installed at the barrage de Poses on the Seine, in Eure, France. This plant, which is located at a dam between two locks on opposite banks of a branch of the river, thus rendered navigable, operates the locks and lights the water-way. The equipment includes a turbine of the Fontaine type, 59 inches in diameter, which attains about 30 horse-power under a head of 13.1 feet and does not fall under 12 horse-power with a head of 2.6 feet. The complete plant is described in detail in a recent issue of "Le Génie Civil."

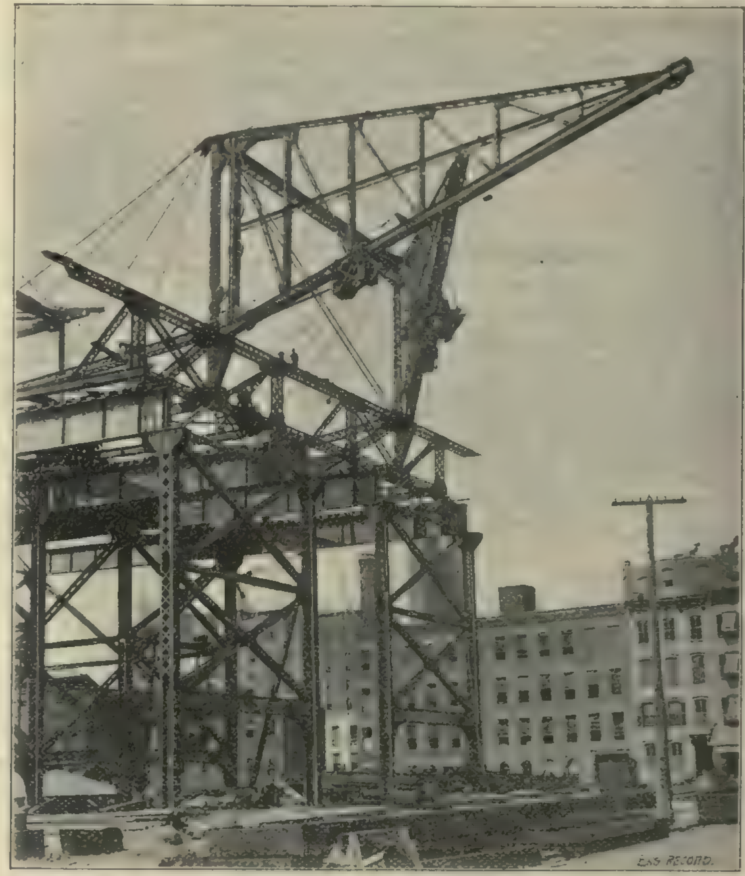
Erection of the New East River Bridge Approaches.

The approaches of the New East River Bridge, New York City, are 2,500 feet and 1,744 feet long, and weigh about 12,000 tons and 6,000 tons on the Manhattan and Brooklyn sides of the river, respectively. The standard structure consists of a three-deck steel viaduct 114 feet wide in the clear between hand rails, with 62½-foot plate girder spans and four longitudinal rows of vertical columns, spaced 11 feet and 43½ feet each side of the axis of the viaduct. The viaduct is on a 3 per cent. grade and at the lower end the columns have heavy Z-bar sections, and are unbraced except for transverse and longitudinal solid plate knee braces at the top. In the higher parts of the structure the columns are braced by longitudinal struts and diagonals to make alternate towers and open panels, and have much lighter cross sections composed of plates and angles. There are four lines of longitudinal plate girders, seated directly on the column caps and supporting across their top flanges the street-car floor beams, with 13½-foot cantilever bracket projections on the outer ends to carry the highway platforms.

The two center lines of girders carry the columns of the elevated railroad structure, which virtually forms a second viaduct imposed above the first one. It has light vertical columns 22 feet 10 inches apart longitudinally, with floorbeams on top for the double-track elevated railroad, which is carried by four lines of web-connected stringers. Next below these floorbeams is transverse sway-bracing, then a bicycle floor and below that, at the level of the street car tracks, is the footwalk. The center rows of the main columns in the first story of the viaduct are braced to those of the outer rows by transverse lattice girders in the planes of and directly underneath the main floorbeams, but they are not directly braced together across the axis of the viaduct, where the only transverse members are those of the footwalk, bicycle and elevated railroad track floorbeams and the sway braces under the latter. The approaches were described and their details illustrated in The Engineering Record of May 12, 1900.



THE 70-TON TRAVELER; WOODEN TRAVELER IN BACKGROUND.



BOOMS AND 20 TON TROLLEYS OF 70-TON TRAVELER.

The 192-foot right of way acquired by the bridge commissioners has been cleared of houses and other obstructions, the foundations for the retaining walls and the column pier footings have been built, and the erection of the approach superstructure is now well under way on the Brooklyn side. The steel work is delivered in Brooklyn by lighters, which load it on special heavy trucks and it is then distributed along the right of way, where it is jacked on skids and lowered to the ground, or delivered directly to the booms of the erecting travelers.

The erection problem was carefully studied and it was concluded that although the work could all be assembled at one operation by a single traveler, it would be more expeditious and perhaps more economical to use two independent travelers. The first of these, it was decided, should erect the lower columns and their girders, moving forward as fast as practicable without regard to the upper tiers of columns and beams, thus providing a platform on which the second traveler could advance, as convenient, to erect the second story. This system prevents any delay in setting the main columns and girders on account of a wait for other parts of the steel work, requires lighter and shorter travelers, is less complicated, enables the travelers and the different portions of the work to be handled independently, and has so far proved satisfactory.

Both travelers run on top of the main longitudinal girders. The advance traveler is of steel, weighs about 70 tons, has an overhang one panel long, and is designed on the general principles of ordinary viaduct travelers, but differs materially from them in arrangement, details and equipment. It has a horizontal floor platform 60 feet long and 87 feet wide, with four longitudinal sills and transverse girders and lateral bracing as indicated in the plan view shown herewith. The front transverse girder forms the lower chord of a riveted truss 10 feet deep, with its top chord overhanging the end vertical posts about 16 feet on each end. Two intermediate vertical posts, 27¼ feet each side of the center, are extended 30 feet above the top chord to form masts for two triangular trussed booms about 75 feet long and 30 feet deep over all.

The masts are braced together transversely by a horizontal top strut and by intersecting diagonal sleeve-nut eye-bars. The top of each mast is guyed by two adjustable back-stays made of extra strong crucible-steel wire rope, running to the end and to an intermediate point of the outside longitudinal sill. The foot of each mast is braced by a pair of inclined raking struts, which are riveted at the intersection of the longitudinal and transverse horizontal sills. The latter are braced so as to form horizontal trusses to resist the thrust of the struts. The traveler is mounted on twelve double flange 13-inch wheels, three under each longitudinal sill, and when in use is wedged up so as to release the forward wheels and give a solid bearing in the plane of the masts; it is anchored to the viaduct longitudinal girders by eight clamps.

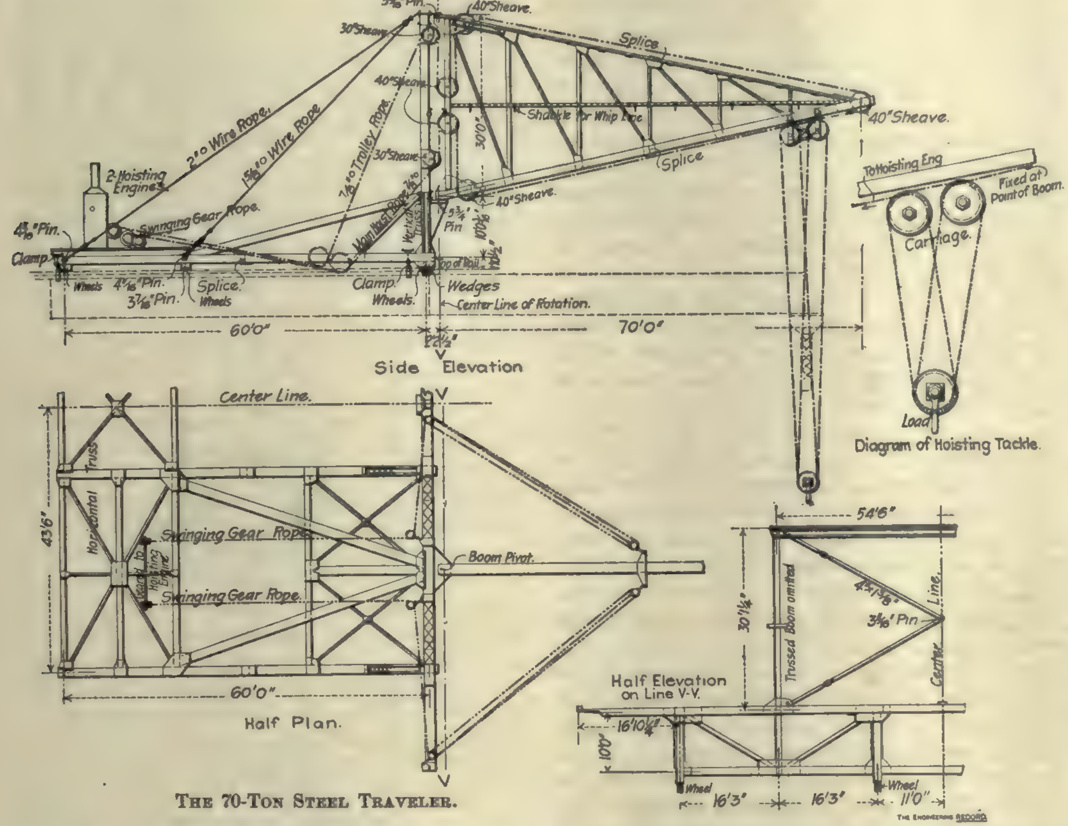
Each boom revolves 180 degrees on a vertical axis, and together the two command the whole right of way and all the lower story of the approach. Each boom is swung by pairs of three-part tackles attached to opposite sides of the lower chord at about the center point. The opposite ends of the tackles are attached to the top chord of the transverse truss at the center and at the extremity of the projecting ends. The boom is designed for a 20-ton load at its extremity and carries it on a trolley running on the lower chord. The trolley is traversed on the boom by a line attached to it and passing around a tail sheave at the end of the boom and thence back to the hoisting engine. Winding up this line draws the trolley out toward the end of the boom; releasing it allows the trolley to return by gravity down the inclined lower chord of the boom toward the mast.

Each boom is operated by four lines, the hoisting line, the traversing line and two swinging lines. The arrangement of the tackles and the leads of the fall lines are shown in the plan and side elevation of the traveler. In the plan the swinging tackles are shown and the others are omitted, and in the elevation the hoist and traversing tackles are shown and the swinging tackles are omitted. The hoist line leads along the lower chord and the traverse line leads along the upper chord of the boom to the mast, where both pass around sheaves and are deflected to the center of the boom truss. Thence they return in the vertical axis of the revolution of the truss toward the bottom and top of the mast, respectively, where they lead over sheaves to the floor of the traveler and thence up to the hoisting engine drums, thus preventing twisting when the boom is swung. All the sheaves are of extra large diameter, and the hoisting rope is a ⅞-inch steel cable.

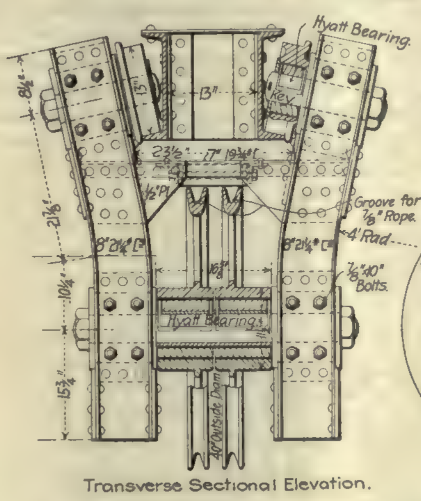
The hoist trolley has four inclined single-flange bearing wheels running on the lower flanges of the channels which form the bottom chord of the boom-truss. Suspended from them is a very heavy riveted frame with four sheaves through which the hoisting line is reeved The upper edges of the sheaves just clear 3-inch horizontal transverse maple rollers which prevent the hoisting line from jumping out of the grooves. The two-sheave block for the lower end of the hoisting tackle was made specially by the Pennsylvania Steel Company, and has a case and center diaphragm of vertical ¼-inch steel plates 40 inches square. Bolts 1½ inches in diameter and 2 feet long pass through the case-plates at each of the rounded corners and are screwed up against separators which give clearance for the sheaves. Each end of the bolt projects 6 inches beyond the side plate, so as to receive a cast-iron ballast plate if it is desired to add it to make the blocks overhaul more quickly, a necessity which has not yet arisen. At the lower corner of the block there is a cast-iron separator block between the side plates. It is slotted to receive the center diaphragm and the projecting lower end is beveled and rounded to fit the 6 x 1-inch vertical strap which takes the bearings of the 3-inch sheave-axle and forms a bottom loop receiving the pin for the shackle in which the lifting clamp is locked.

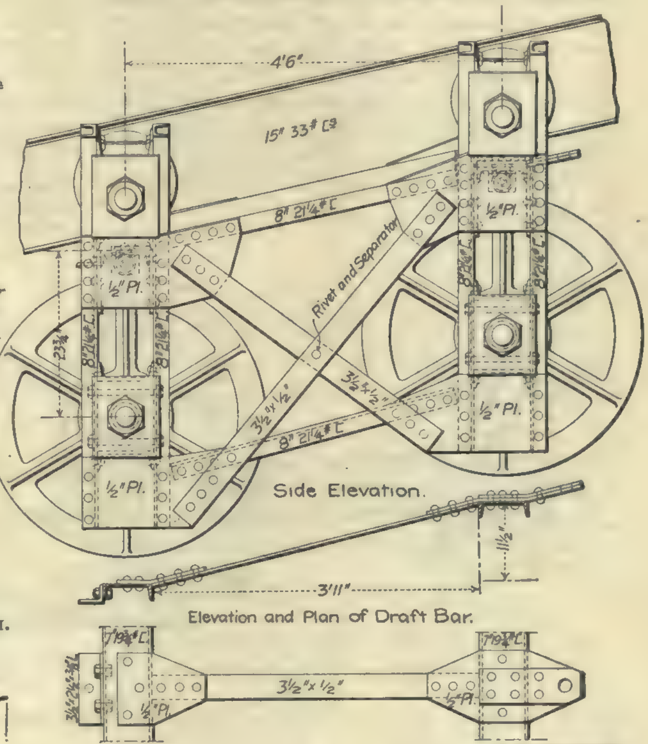
The end of the hoist line is made fast at the point of the boom; it passes to the carriage and is reeved through its sheaves and those of the load block and continues to the hoisting drum in such a manner that when the carriage is traversed, the rope renders through it without raising or lowering the load except as it follows the inclination of the boom. The rope is reeved in an ingenious manner, as indicated in the diagram, where the three sheaves in one vertical plane are shown smaller than those in the other vertical plane to separate the line, although of course all the sheaves are the same size, and one set would in reality be concealed in elevation by the others. By this arrangement the rope enters and leaves the trolley carriage in the same vertical plane, and the suspended parts are balanced so that there is no eccentric pull. All the sheaves are 40 inches in diameter and have Hyatt steel spiral bearings flooded with oil.

There are two 6 x 4 x ⅜-inch horizontal angles riveted to the center of each boom truss from end to end, and these angles have holes through them about a foot apart, through which shackles may be attached to support tackles or snatch blocks for light loads. The lower chord of the boom has a rectangular cross section with two 15-inch channels latticed top and bottom and connected by vertical transverse plate diaphragms 2 feet apart. The top chord is made of two 5 x 4 x 9/16-inch latticed angles, which

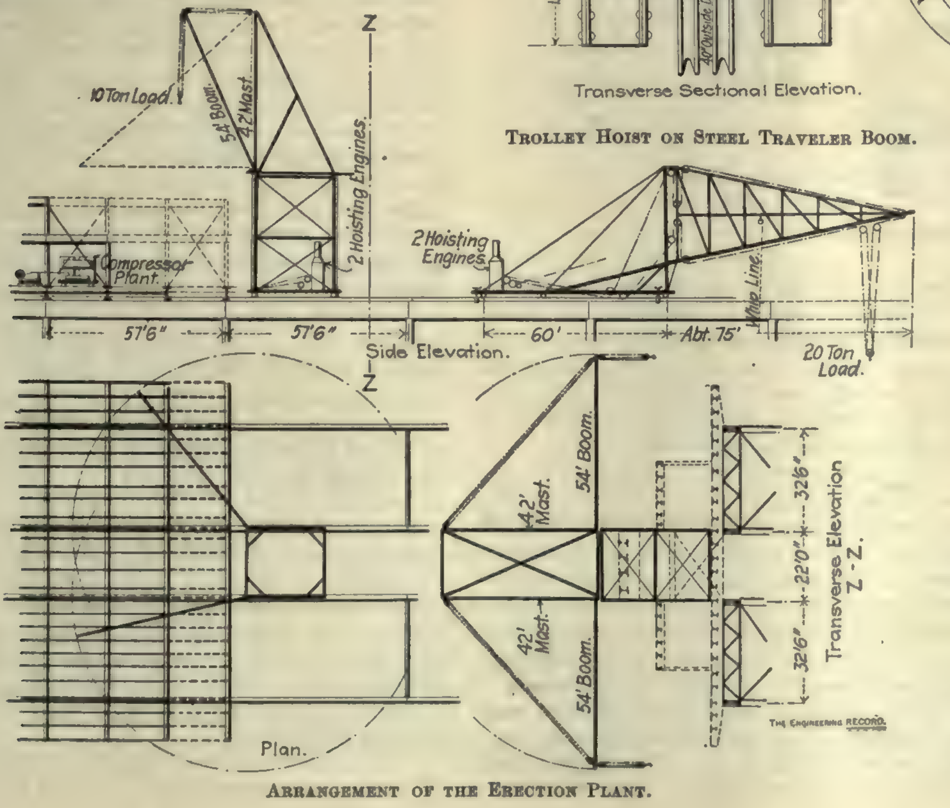


THE 70-TON STEEL TRAVELER.





TROLLEY HOIST ON STEEL TRAVELER BOOM.

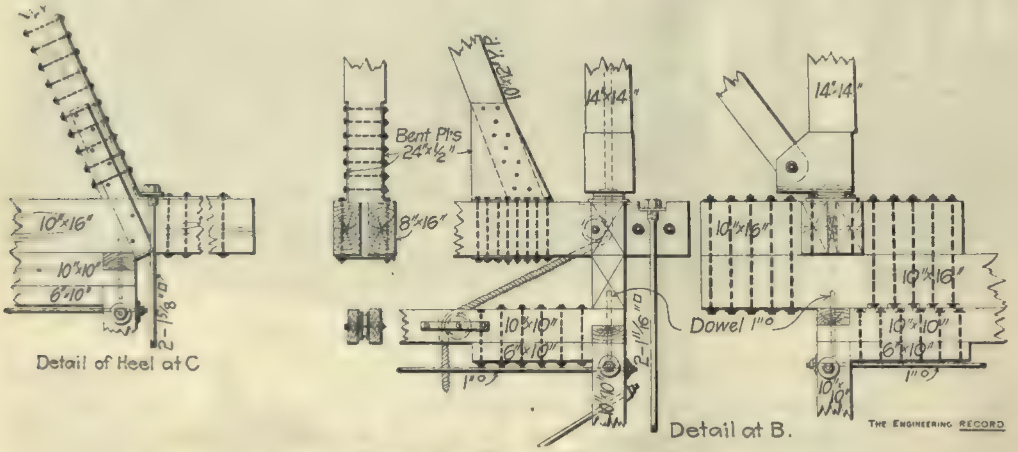


ARRANGEMENT OF THE ERECTION PLANT.

are reinforced in the panel nearest the mast by two web plates and bottom flange angles making a regular top chord section.

All the other truss members are made of pairs of angles or channels, latticed, and all connections are made with pairs of gusset plates and are riveted with countersunk holes in the bottom chord and bolted elsewhere for convenience in taking the traveler apart and reassembling it. The longitudinal sills in the traveler floor platform have rectangular top chord sections made of two built channels latticed top and bottom. They have four 3 x 3 x ⅜-inch flange angles, and the two 14¾-inch webs are stiffened by transverse vertical plate diaphragms. The chords of the transverse vertical truss are each made of four 4 x 3 or 3 x 3-inch angles, with a rectangular cross section latticed on all four sides. The floorbeams are ordinary plate girders. The other members are mostly pairs or double pairs of angles or channels latticed.

The heel of the boom-truss is seated on two 1-inch phosphor-bronze friction disks 12 inches in diameter with four spiral oil grooves in each face. All of the traveler wheels have 2¾-inch treads and phosphor-bronze bushings ¼ inch thick for their 3 7/16-inch pins. The eight rear wheels have 2½-inch hubs on both sides to give them a total thickness of 9¾ inches and fill out the space between the bearing plates. The forward wheels are 5 inches thick and the two outside ones are set between cast-steel bearing blocks which are bolted to the webs of the longitudinal struts and extend below the flanges of the wheel and top of the rail, nearly to its base on each side. Each piece has a 6 x 12-inch horizontal lower face with 2 inches clearance above a 12 x 20-inch cast-steel block, 6⅝ inches thick, grooved on the under surface to clear the rivets in the top flange of the longitudinal viaduct girder and receiving the rail bearing on its upper surface.



DETAILS OF WOODEN TRAVELER.

When the traveler is in service, a pair of 6 x 16-inch steel wedges, tapered from ¾-inch to 2 inches, is driven between the rail seat block and each casting, so as to lift the end of the traveler clear of its forward wheels. The yoke clamps often used to anchor viaduct travelers to the girders of the completed structure require considerable time for assembling and adjusting whenever the traveler is moved, and to prevent this delay they are here replaced by pairs of hook-clamps which engage the top flanges of the girders and are quickly operated and tightened or disengaged by a screw adjustment exactly similar to that shown in the details of the tower traveler. Each boom is operated by a separate 9 x 10-inch Lidgerwood hoisting engine having two main drums and four spools and two small swinging drums geared to the front main shaft, and seated on the main platform of the traveler.

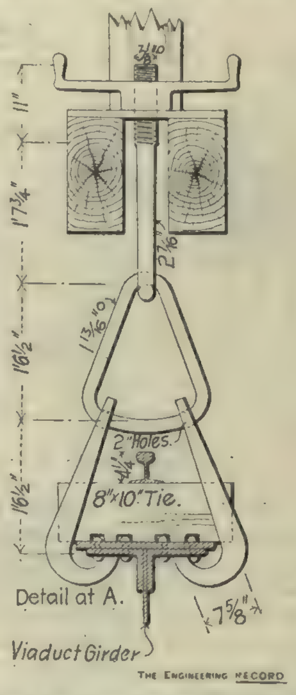
The traveler runs on four lines of rails, one on each longitudinal girder. The rails are spiked to 10 x 24-inch oak cushion blocks 8 inches thick. The blocks are dapped ⅞-inch over the flange plates and are secured to them at each end with a ¾-inch bolt with a 4-inch right angle bend at the lower end to engage the under side of the girder flange. Each block has four transverse grooves in the under side to clear the rivet heads and was cut and bored to template at the bridge shops. The traveler is operated by a total force of eleven men, including two signallers, and when it is advanced from panel to panel of the viaduct by the usual method of winding up an anchored line on the hoisting engine preventer tackles are made fast behind and paid out carefully to prevent all danger of the traveler running off from the end of the structure on the 3 per cent. down grade.

The traveler booms first set the four columns of the next transverse row in advance of the last assembled panel, and as these have wide bases and four anchor bolts (which in the case of unbraced columns are 2¼ inches in diameter and 8¼ feet long), they are temporarily secure without guys or other support. The booms are released to lift into place on them the 15-ton longitudinal girders, after which the main transverse struts are assembled and the traveler moves forward another panel, leaving the remainder of the structure to be erected by the wooden tower traveler.

The columns are lifted by chain slings and the girders by hook clamps which engage the top flanges and are shackled to the hoisting tackle. There are different size clamps; in one the 2 x 8-inch flat hooks have the points grooved so as to clear the rivet heads in the under side of the girder flanges and also engage them and prevent slipping. Another pair are about 8 x 4 inches at the bend and have their lips slotted through, so as to make forks engaging the outstanding flange of the center vertical web stiffener angle. This pair thus centers the clamp at the center of gravity of the girder, besides preventing slipping. Whip lines are operated at different points on the trussed booms, and a derrick boom operated by a Mundy engine is set on one of the viaduct columns to handle miscellaneous materials.

The second traveler is a 22 x 25-foot wooden tower 40 feet high, with two stiff-leg boom derricks on top. The derricks have 54-foot booms and their 42-foot masts are in the transverse planes of the front tower posts. Their tops are braced together by an 8 x 8-inch horizontal transverse strut with steel plate connections to the gudgeons. Each mast has a stiff leg in the longitudinal and transverse vertical planes of the tower faces; these legs are connected to the gudgeon and to the sill timbers with heavy bent plates, through-bolted. The tower is built chiefly of 10 x 10-inch timbers, with 10 x 16-inch floor-beams resting on double 10 x 16-inch sills. On opposite sides of each post there is a 1 11/16-inch or a 1⅝-inch square vertical rod clamping the top and bottom sills together. These rods have sleeve-nut adjustments and nut bearings on end washer plates which are gained into the timber.

Each face of the tower is X-braced in two vertical panels with 1¼-inch round diagonal rods passing through the timber and having nut bearings on oblique washers. The top of the tower is clamped by a 1-inch round rod in each horizontal face. The tower is mounted on four double flange 12-inch wheels which travel on the center rails, 22 feet apart, of the steel-traveler track. When in use the traveler is clamped at each wheel, by a pair of hooks which engage the under side of the top flange of the longitudinal girder and are suspended from a vertical screw bolt which is quickly operated by a nut with hand levers. This traveler carries one two-drum four-spool Lambert hoisting engine, and is operated by five men, including one signal-man. It sets the 46-foot transverse girders weighing 10 tons, and assembles all the second story members of the approach. The efficiency of the travelers is limited by the delivery of materials, but it is believed that if there were no delays both together could erect 3,000 tons of the approaches per month.



CLAMP FOR ANCHORING TRAVELERS.

The tower traveler was assembled on the surface of the ground and first erected one panel of the main columns and girders nearest the anchor pier, thus forming a platform on which it afterward erected the steel traveler at the required level. The reach of the booms sufficed to assemble nearly all the members, and the remainder were handled by tackles suspended from poles lashed to the erected framework. The boom trusses were assembled on the ground in halves which were erected separately and spliced together in position. This enabled the heavy trolley carriage to be lifted separately, but in taking the traveler down for re-erection on the New York side, the lower chord of the boom truss will probably be taken down in one piece. After the steel traveler had advanced to the next panel of the viaduct the wooden tower traveler was dismembered and re-erected on top of the lower story of the viaduct by derrick booms.

Field rivets are driven by Boyer and Philadelphia pneumatic hammers, operated by a special portable compressor plant which follows the travelers on two cars. On one car is installed a 4-foot compressed air receiver tank 10 feet long and a 2-foot cylindrical gasoline tank 6 feet long and two 44 x 59-inch water tanks 7 feet high. The other car carries a 22-horsepower gasoline engine and air compressor. It has a very heavy timber platform serving for an engine bed. The two axles have bearings movable vertically in cast guides through which they can be traversed by capstan headed screws. When the engine is to be used these screws are slacked off and lower the platform until the bearing is taken from the wheels to the under sides of four heavy longitudinal timbers, which then give it an extended base about 12 feet long and 7 feet wide on the tops of the ties of the railroad track on the promenade floor. When the car is to be moved the screws are turned down until the timbers are lifted about 3 inches clear of the ties and the bearing is restored to the four wheels. The compressor now installed operates six hammers and it is intended to add a duplicate plant.

At the New York end of the bridge a 70 x 180-foot dock has been built up to about 16 feet above street level to receive the steel directly from the lighters and store about 1,000 tons. It will be commanded by two 15-ton boom derricks, which will unload the steel and deliver it to trains of flat cars drawn by 15-ton standard-gauge locomotives. They will run on tracks along the right of way outside the structure, which will be double to the anchorage pier and single beyond that point to the end of the viaduct. From these trains the materials will be delivered directly to the erection travelers, or will be lowered to the ground and raised by the erection travelers as required.

A three-bent timber tower 48 feet high and 25 feet long will be used for the erection of the first panel of the approach at the anchorage pier. It will be made with three vertical panels and 3 x 10-inch X-bracing in every panel on each side of the four faces. The bents will be 22 feet wide on top and 40 feet wide on the bottom, with one center vertical post and two batter posts, all 10 x 12-inch. The towers will have three wheels under each of the three longitudinal sills, which will project beyond the forward bent to make a cantilever platform for the two engines. A braced gin-pole will be set on top of this tower and will erect there the wooden traveler, which will be secured with wire rope guys and will then have sufficient reach to assemble completely the steel traveler after it has erected a main span of the approach for it to rest on. The erection of the New York approach will not be commenced until after that of the Brooklyn approach is completed, when the travelers will be moved across the river and re-erected to do the work there. The steel traveler was designed to do away as much as possible with the use of nigger-heads on the hoisting engine, and the special hoisting engines now being built for use on the New York side have an extension so that the operator can stand away from the engine and control all movements for one boom from a single rack of levers.

Mr. L. L. Buck is chief engineer of the bridge and Mr. O. F. Nichols is principal assistant engineer. Mr. Kingsley L. Martin is resident engineer and Mr. F. L. Pruyn is assistant engineer on the Brooklyn approach. The Pennsylvania Steel Company is the general contractor and is erecting the work. The United Engineering Construction Company, of New York, is the sub-contractor for the Brooklyn approach foundations and grading, and the materials are delivered by the Merritt & Chapman Derrick & Wrecking Company and the Harden Brothers Trucking Company.

Stability of Small Dams.

By John H. Gregory, Assoc. M. Am. Soc. C. E., Assistant Engineer, Improvement of Water Supply, Philadelphia.

The method of determining the proper dimensions for a small masonry dam with the assumptions ordinarily made, is, probably, too well known for very much to be added to the literature on the subject. The writer, having had occasion recently to make some computations on such a structure, found, however, on looking over some of the available literature, that full explanations of the methods were given, but that few formulas were in such shape as to be readily applicable. As the design in question involved the determination of a number of sections under various assumptions as to top width and batter on the back and on the downstream face, a series of formulas was deduced which would give by the solution of one equation the width of the base, that being the dimension required. It is in the hope that these formulas may be of as much value to others as they have been to the writer that they are offered.

The trapezoidal section will first be considered and then the triangular. It is assumed that the height and top width of the dam are known, also the batter on the back or on the downstream face, and the depth of water. For the sake of simplicity all units of weight are taken in cubic feet of water. The criterion has been used throughout that the resultant of the weight of the dam and the water pressure on the back of the dam shall pass through the lower middle third point of the base. It is not the intention to discuss this criterion, but it will suffice to say that it is the one ordinarily adopted, and that with this assumption, theoretically, no tensile stress will exist on the joint at the base. Further, as these formulas are intended to be applicable only to relatively small dams, the compressive stresses at the toe will be well inside the allowable compressive stress on masonry and need not be computed. Upward water pressure on the base of the dam has been neglected.

Let $B =$ width of base of dam,
$b =$ top width of dam,
$d =$ height of dam when dam extends above water surface,
$c =$ horizontal projection of batter on back of dam,
$f =$ horizontal projection of batter on downstream face,
$h =$ depth of water; also height of dam when water is level with top,
$W =$ weight of dam,
$W_1, W_2, W_3 =$ weights of component parts of dam,
$l_1, l_2, l_3, l_4 =$ lever arms about lower middle third point,
$V =$ vertical component of water pressure on back of dam,
$H =$ horizontal component of water pressure on back of dam,
$T =$ resultant water pressure on back of dam,
$R =$ resultant of W and T,
$s =$ specific gravity of masonry,
$F =$ coefficient of friction of dam on foundation.

In all cases the horizontal component of the water pressure, H, is applied at a point 1/3 h above the base, and $H = \frac{1}{2} h^2$.

For trapezoidal sections when the top extends above the water surface, $W = \frac{1}{2} (b + B)\ ds$; and when the water is level with the top of the dam $W = \frac{1}{2} (b + B)\ hs$.

For triangular sections when the top extends above the water surface, $W = \frac{1}{2}Bds$; and when the water is level with the top of the dam, $W = \frac{1}{2}Bhs$.

Trapezoidal Sections.

Case 1.—Given the top width b, batter on the back c, height of dam d, and depth of water h, Figure 1.

In order that R shall pass through the lower middle third point, o, we have, taking moments about 0,

$$W_1l_1 + W_2l_2 - W_3l_3 + Vl_4 = 1/6h^3$$

in which

$$W_1l_1 = \frac{cds}{2}\left(\frac{2B}{3} - \frac{2c}{3}\right)$$

$$W_2l_2 = bds\left(\frac{2B}{3} - \frac{b + 2c}{3}\right)$$

$$W_3l_3 = \frac{ds(B - b - c)}{2}\left[\frac{B}{3} - \frac{2(B - b - c)}{3}\right]$$

$$V_4l_4 = \frac{ch^2}{2d}\left(\frac{2B}{3} - \frac{ch}{3d}\right)$$

Inserting these values and solving for B

$$B = \sqrt{\left[\left(\frac{b}{2} + \frac{ch^2}{d^2s} - \frac{c}{2}\right)^2 + b^2 + 2bc + \frac{c^2h^3}{d^3s} + \frac{h^3}{ds}\right]} - \left(\frac{b}{2} + \frac{ch^2}{d^2s} - \frac{c}{2}\right) \ldots\ldots(1)$$

The resultant water pressure is

$$T = \frac{h^2}{2d}\sqrt{(c^2 + d^2)} \ldots\ldots\ldots\ldots(2)$$

These equations are general and by proper substitution can be made to cover all the cases.

Case 2.—Given top width b, batter on back c, height of dam and depth of water h, Figure 2. By placing $d = h$ in equations (1) and (2):

$$B = \sqrt{\left[\left(\frac{b}{2} + \frac{c}{s} - \frac{c}{2}\right)^2 + b^2 + 2bc + \frac{c^2}{s} + \frac{h^2}{s}\right]} - \left(\frac{b}{2} + \frac{c}{s} - \frac{c}{2}\right) \ldots\ldots\ldots\ldots(3)$$

and

$$T = \tfrac{1}{2}h\sqrt{(c^2 + h^2)} \ldots\ldots\ldots(4)$$

Case 3.—Given top width b, vertical back, height of dam d, and depth of water h, Figure 3. By placing $c = o$ in equations (1) and (2):

$$B = \sqrt{\left(\frac{5b^2}{4} + \frac{h^3}{ds}\right)} - \frac{b}{2} \ldots\ldots\ldots(5)$$

and

$$T = \tfrac{1}{2}h^2 \ldots\ldots\ldots\ldots\ldots(6)$$

Case 4.—Given top width b, vertical back, height of dam and depth of water h, Figure 4. By placing $d = h$ in equations (5) and (6):

$$B = \sqrt{\left(\frac{5b^2}{4} + \frac{h^2}{s}\right)} - \frac{b}{2} \ldots\ldots\ldots(7)$$

and

$$T = \tfrac{1}{2}h^2 \ldots\ldots\ldots\ldots\ldots(8)$$

Case 5.—Given top width b, batter on back same as batter on downstream face, height of dam d and depth of water h, Figure 5. By placing $c = \frac{1}{2}(B - b)$ in equations (1) and (2) and solving for B

$$B = \sqrt{(D^2 + E)} - D \ldots\ldots\ldots(9)$$

in which

$$D = (bd^3s + bh^3 - 2bdh^2) \div (4dh^2 + 2d^3s - h^3)$$

$$E = (b^2h^3 + 4d^2h^3) \div (4dh^2 + 2d^3s - h^3)$$

and

$$T = \frac{h^2}{4d}\sqrt{[(B - b)^2 + 4d^2]} \ldots\ldots\ldots(10)$$

Case 6.—Given top width b, batter on back same as batter on downstream face, height of dam and depth of water h, Figure 6. By placing $d = h$ in equations (9) and (10):

$$B = \sqrt{\left[\left(\frac{bs - b}{8 + 2s}\right)^2 + \frac{b^2 + 4h^2}{8 + 2s}\right]} - \left(\frac{bs - b}{3 + 2s}\right) ..(11)$$

and

$$T = \tfrac{1}{4}h\sqrt{[(B - b)^2 + 4h^2]} \ldots\ldots(12)$$

Case 7.—Given top width b, batter on downstream face f, height of dam d, and depth of water h, Figure 7. By placing $c = B - f - b$ in equations (1) and (2) and solving for B

$$B = \sqrt{\tfrac{1}{4}[(b+f)M + fN - b - f]^2 + (b^2 + d^2 + f^2 + 2bf)M - (b^2 + 2bf)N} - \tfrac{1}{2}[(b + f)M + fN - b - f]..(13)$$

in which

$M = h \div (2d - h)$, $N = d^3s \div h^2(2d - h)$ and

$$T = \frac{h^2}{2d}\sqrt{[(B - f - b)^2 + d^2]} \ldots\ldots(14)$$

Case 8.—Given top width b, batter on downstream face f, height of dam and depth of water h, Figure 8. By placing $d = h$ in equations (13) and (14):

$$B = \sqrt{[(\tfrac{1}{2}fs)^2 + f^2 + h^2 - (b^2 + 2bf)(s-1)]} - \frac{fs}{2} \;..(15)$$

and

$$T = \tfrac{1}{2}h\sqrt{[(B - f - b)^2 + h^2]} \;......(16)$$

Case 9.—Given top width b, vertical downstream face, height of dam d, and depth of water h, Figure 9. By placing $f = 0$ in equations (13) and (14):

$$B = \sqrt{\left[b^2\left(\frac{h-d}{2d-h}\right)^2 + h\left(\frac{b^2+d^2}{2d-h}\right) - \frac{b^2d^2s}{h^2(2d-h)}\right]} - b\left(\frac{h-d}{2d-h}\right) \;........(17)$$

and

$$T = \frac{h^2}{2d}\sqrt{[(B - b)^2 + d^2]} \;.......(18)$$

Case 10.—Given top width b, vertical downstream face, height of dam and depth of water h, Figure 10. By placing $d = h$ in equations (17) and (18):

$$B = \sqrt{(b^2 + h^2 - b^2s)} \;.............(19)$$

and

$$T = \tfrac{1}{2}h\sqrt{[(B - b)^2 + h^2]} \;........(20)$$

Triangular Sections.

Case 11.—Given batter on back c, height of dam d, and depth of water h, Figure 11. By placing $b = o$ in equations (1) and (2):

$$B = \sqrt{\left[\left(\frac{ch^2}{d^2s} - \frac{c}{2}\right)^2 + \frac{c^2h^2}{d^2s} + \frac{h^2}{ds}\right]} - \left(\frac{ch^2}{d^2s} - \frac{c}{2}\right) \;............(21)$$

and

$$T = \frac{h^2}{2d}\sqrt{(c^2 + d^2)} \;...........(22)$$

Case 12.—Given batter on back c, height of dam and depth of water h, Figure 12. By plac- $d = h$ in equations (21) and (22):

$$B = \sqrt{\left[\left(\frac{c}{s} - \frac{c}{2}\right)^2 + \frac{c^2}{s} + \frac{h^2}{s}\right]} - \left(\frac{c}{s} - \frac{c}{2}\right) \;(23)$$

and

$$T = \tfrac{1}{2}h\sqrt{(c^2 + h^2)} \;............(24)$$

Case 13.—Given vertical back, height of dam d and depth of water h, Figure 13. By placing $c = o$ in equations (21) and (22):

$$B = h\sqrt{(h \div ds)} \;...............(25)$$

and

$$T = \tfrac{1}{2}h^2 \;.................(26)$$

Case 14.—Given vertical back, height of dam and depth of water h, Figure 14. By placing $d = h$ in equations (25) and (26):

$$B = h\sqrt{(1 \div s)} \;............(27)$$

and

$$T = \tfrac{1}{2}h^2 \;................(28)$$

Case 15.—Given batter on back same as on downstream face, height of dam d and depth of water h, Figure 15. By placing $c = \tfrac{1}{2}B$ in equations (21) and (22) and solving for B

$$B = d\sqrt{[4h^2 \div (4dh^2 + 2u^2s - h^2)]} \;....(29)$$

and

$$T = \frac{h^2}{4d}\sqrt{\left[B^2 + 4d^2\right]} \;..........(30)$$

Case 16.—Given batter on back same as on downstream face, height of dam and depth of water h, Figure 16. By placing $d = h$ in equations (29) and (30):

$$B = h\sqrt{[4 \div (3 + 2s)]} \;..........(31)$$

and

$$T = \tfrac{1}{4}h\sqrt{(B^2 + 4h^2)} \;..........(32)$$

Case 17.—Given batter on downstream face f, height of dam d and depth of water h, Figure 17. By placing $c = B - f$ in equations (21) and (22) and solving for B:

$$B = \sqrt{[\tfrac{1}{4}f^2(M + N - 1)^2 + (d^2 + f^2)M]} - \tfrac{1}{2}f(M + N - 1) \;.............(33)$$

in which

$$M = h \div (2d - h),\quad N = d^2s \div h^2(2d - h)$$

and

$$T = \frac{h^2}{2d}\sqrt{[(B - f)^2 + d^2]} \;........(34)$$

Case 18.—Given batter on downstream face f, height of dam and depth of water h, Figure 18. By placing $d = h$ in equations (33) and (34):

$$B = \sqrt{[(\tfrac{1}{2}fs)^2 + f^2 + h^2]} - \frac{fs}{2} \;.....(35)$$

and

$$T = \tfrac{1}{2}h\sqrt{[(B - f)^2 + h^2]} \;.......(36)$$

Case 19.—Given vertical downstream face, height of dam d and depth of water h, Figure 19. By placing $f = o$ in equations (33) and (34):

$$B = d\sqrt{h \div [2d - h]} \;...........(37)$$

and

$$T = \frac{h^2}{2d}\sqrt{(B^2 + d^2)} \;.........(38)$$

Case 20.—Given vertical downstream face, height of dam and depth of water h, Figure 20. By placing $d = h$ in equations (37) and (38):

$$B = h \;.......................(39)$$

and

$$T = \tfrac{1}{2}h\sqrt{(B^2 + h^2)} \;..........(40)$$

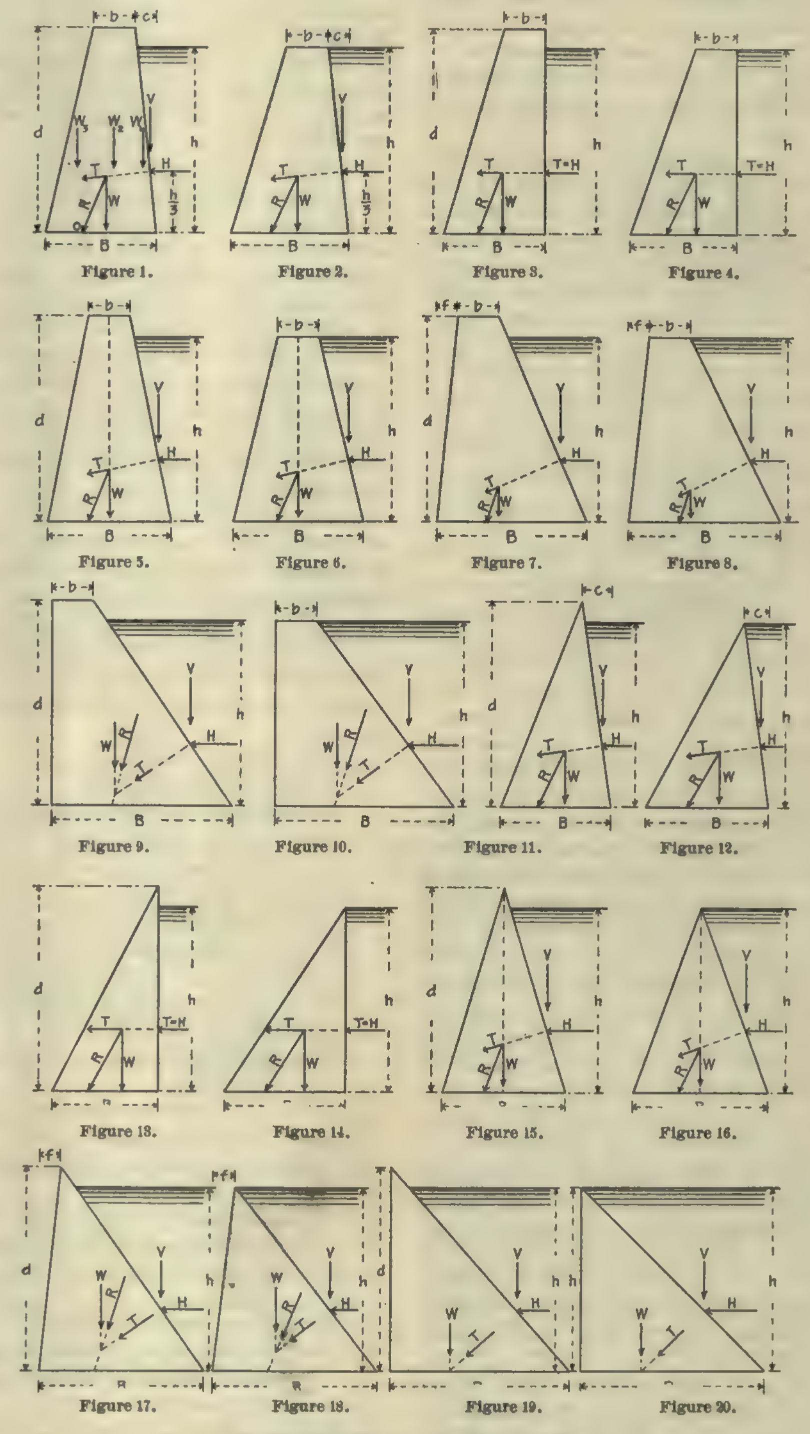


Figure 1. Figure 2. Figure 3. Figure 4.

Figure 5. Figure 6. Figure 7. Figure 8.

Figure 9. Figure 10. Figure 11. Figure 12.

Figure 13. Figure 14. Figure 15. Figure 16.

Figure 17. Figure 18. Figure 19. Figure 20.

Diagrams of Types of Small Dams.

In the preceding equations the stability about the lower middle third point has been considered. There remains still one other condition to be fulfilled in order that the dam shall be stable, namely, that the dam will not slide on its base, or that W F shall be equal to or greater than $\tfrac{1}{2}h^2$.

The formulas which have been deduced cover most of the cases ordinarily arising in practice, and afford a ready means of determining the width of the base of the dam, knowing the other dimensions. It should be noticed that in several cases the first expression under the radical is the square of the expression following the radical.

Some of the formulas are simple and others more complex, but even with the complex ones the writer has found, and he thinks others will find, that it will save time, and that is an important factor with the busy engineer, to substitute the known quantities and find the value of B directly, than to write out a moment equation and solve the resulting quadratic.

A Large Acetylene Installation is in operation in the weaving mills of Schnell Brothers, in Mühlbach, Germany. It has a capacity of supplying 1,300 burners, to allow for future extensions to the factory, the present requirement for light being 800 to 900 flames, varying from 10 to 40 candle-power. The apparatus includes a pair of carbide-to-water generators, a small holder between generators and the washers and purifiers and a storage holder of about 2,500 cubic feet capacity and loaded to give a pressure of 4.73 inches of water.

The Design of Factory Chimneys.

Abstract of a paper read before the Engineers' Club of Philadelphia by Francis Schumann.

From an engineering standpoint a chimney is a vertical flue for removing the products of combustion, for inducing combustion, or for the removal of deleterious gases. The flow of the heated air and gases is due to their rarefied condition as they pass through the flue, thus constituting a column of air of less specific gravity than that of the ambient atmosphere.

Only brick chimneys are considered in this paper, and they should be constructed to fulfill the following essential conditions:

1. The flue must be of proper height and sectional area necessary for a given velocity and volume of air for efficient combustion of the fuel burned in the furnaces.

2. Proportion and form of flue should be such as will offer the least amount of resistance to the flow of the gases.

3. Maintenance of the temperature of rarefaction by non-conduction through the walls or sides of the flue.

4. Provision for the expansion and contraction of the material composing the chimney.

5. Stability of the structure or power to safely withstand the external forces, being the combined force of wind and weight of structure.

Form and dimensions of flue.—The cross-sectional form of the flue is usually circular, octagonal, or square, the relative efficiency being 100, 97 and 90, in the order named; the area should maintain throughout the height of the flue without reductions or enlargements. The dimensions are dependent on the kind and amount of fuel burned, the form and length of the ducts leading to the base of the chimney from steam boiler or other furnaces, and in some cases it becomes necessary to adjust the height to suit local conditions, such as adjacent high ground or buildings, or for the purpose of emitting deleterious gases at higher altitudes.

An engineer designing a chimney must and does have full knowledge of one essential; this is the power to be developed, and, consequently, the amount of fuel to be burned. With these data and statistics regarding the behavior of chimneys in actual operation he is enabled to construct simple and reliable empirical formulas for his guidance. In the preparation or use of such formulas care must be observed to make due allowance for any conditions of moment varying from those upon which the formulas are based. It has been found that the far greater number of chimneys are subject to average conditions, and hence favorable to the use of empirical formulas. Some of the exceptions to these average conditions are when furnaces are distant from the base of the chimney, when they are elevated and ducts lead downward to the base, when the ducts are restricted in area, or pass through damp or wet media, or when the chimney is surrounded by high buildings or near cliffs.

The following formulas are presented by Mr. Schumann as new and giving values agreeing very closely with those confirmed by actual and satisfactory results. The only claim made in their favor over other existing similar formulas is their greater simplicity.

$K =$ total amount of coal burned per hour in pounds.

$H =$ height of chimney in feet.

$A =$ sectional area of flue in square feet.

The proper sectional area for a given amount of coal burned per hour should be:

$$A = 650\ K \div (36000 \times (650\ K \div 36000)^{1/4}$$

in which 650 is the smoke produced, in cubic feet per hour per pound of coal, and 36000 a velocity in feet per hour, or 10 feet per second, the velocity increasing with the amount of fuel burned per hour.

The area thus found may be altered to suit different heights of chimneys, but should not exceed 10 per cent. either way when used in the following formula for obtaining the height:

$$H = 250\ K \div (500\ A - K)$$

The proportions resulting from these formulas apply to circular flues, and are ample for any kind of coal, whether anthracite, coarse or fine or bituminous.

When the flue is octagonal or square, the height, H, is found above for given values of A and K, is to be increased (100 ÷ 97) and (10 ÷ 9) respectively.

The best economy in the furnaces is attained when the temperature of the gases at the base of the flue is between 550 and 600 degrees Fahr.

The amount of coal consumed per horse-power per hour is between 2.5 and 5 pounds, and burned at the rate of from 10 to 30 pounds per square foot of grate surface.

Stability.—The stability of a brick chimney depends upon the strength of the material of which it is constructed to safely resist the stresses from the external forces, being the lateral force of wind and the superimposed mass, acting as a resultant at any horizontal plane throughout the height, or at the base of the structure.

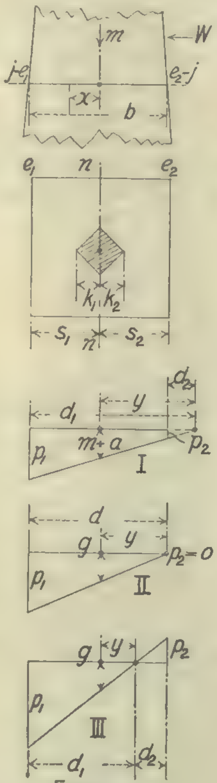


Figure 1

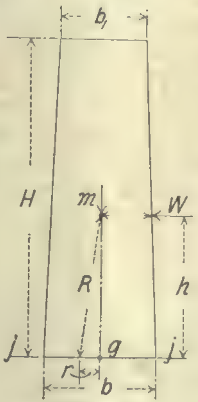


Figure 2

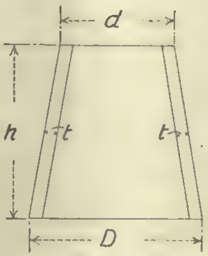


Figure 3

The proportions must be such that the axis of rotation, or neutral axis of the resultant force, never falls within the respective cross-section, thus insuring compressive stresses of uniformly varying intensity only, tensile stresses not being permissible in masonry structures.

The non-conducting inner lining of the flue, being separate from the outer shell, does not add its mass toward the stability of the chimney, but only to that of the foundation upon which it rests.

Procedure in design.—After having decided upon the dimensions of the flue, find the outside dimensions at the top by adding to the flue diameter the thickness of the lining, the space between lining and shell, and the thickness of the outer shell, at the top; the lining thickness need not exceed one-half brick, or 4 inches; the space, say 1 inch, and the shell, one brick, or 8¼ inches.

From these outer dimensions lay out the side lines of the shell with a batter of say ⅝ inch per foot down to the base of the chimney; subdivide the height into zones corresponding with the various thicknesses of the shell, resulting from the addition of brick dimensions, being respectively 4, 8¼, 12½, 15, 21 and 25 inches, and so on, each zone being of equal thickness throughout its height.

Determine the stability of each joint, commencing at the top; if deficient, add to the mass by increasing the thickness of the walls, or by increasing the outside diameter.

The maximum force of the wind which the structure should withstand with safety is: For square chimneys, 50 pounds per square foot of elevation; for octagonal and round chimneys, 25 pounds per square foot of diametrical plane.

Formulas for stability.—When a structure such as a chimney is under a compressive vertical force (mass) only, the neutral axis or axis of rotation of a sectional plane or joint, will be at infinite distance from the center of gravity of the plane; the resultant force will pass through the center of gravity of the plane, which will be subject to compressive stresses of uniform intensity throughout.

When the structure is subject to a lateral force (wind) in addition to the vertical force, the resultant will intersect the sectional plane at a point beyond the center of gravity of the cross-section with the direction of the lateral force. The neutral axis or axis of rotation will approach the center of gravity of the cross-section from the side of the lateral force.

The position of the axis of rotation in a plane is dependent of the amount of the external forces, but dependent solely upon the location of the resultant of the external forces (mass and wind).

When the axis of rotation passes through the cross-section, one side of the section, the windward, will be in tension, and the other, the lee, in compression.

When the axis of rotation passes by the section, the stresses are wholly compressive and uniformly varying in intensity, as should be the case in masonry structures in which tensile stresses are not permissible.

The resultant external force in masonry structures should never fall outside of the core of resistance of the cross-section. The quotient of any moment of inertia of a cross-section, in relation to the neutral axis passing through its center of gravity, divided by the distance of the edge of the section from the neutral axis, times the area of the section, is the distance from the neutral axis to a point in the bounds of the core of resistance. In a circular or circle ring plane the core of resistance is bounded by a circle. In a square or hollow square it is a square with its diagonal perpendicular to a side of the plane.

When the resultant of the external forces falls outside the core of resistance, the axis of rotation will pass through the cross-section.

When it falls within the core, the axis of rotation will pass by the cross-section.

When it intersects the edge of the core, the axis of rotation will be at the edge of the cross-section, resulting in null stress at the axis of rotation, or the edge through which it passes, and double the normal stress at the farthest edge.

Let Figure 2 represent a symmetrical pyramidal prism of a given mass or weight subjected to a lateral force W, j j being a joint or sectional plane.

Let $m =$ mass or weight of prism above joint j j,

$A =$ area of its diametrical plane or projection, and

b and $b_1 =$ width at base and top, respectively;

$G =$ center of gravity,

$W =$ total lateral force acting at G, and
$h =$ distance from joint to G, or lever arm for W.
$x =$ distance from center of gravity of cross-section to intersection of resultant R (of mass and wind).
$w =$ pressure of wind per square foot, 50 pounds for plane surface and 25 pounds for cylindrical or octagonal.
$w_1 =$ pressure per square foot a given cross-section will resist when the axis of rotation is at the edge of section.

$$W = w\ A;\ h = 1/3\ H\ (b + 2b_1) \div (b + b_1);$$
$$x = W\ h \div m;\ w = x\ m \div A\ h;$$
$$w_1 = k\ m \div A\ h.$$

If m and x are known, the next step is the determination of the resulting stresses, and their character, acting at the joint.

Figure 1 shows a joint, j j, and its sectional plan, a solid square being chosen, with its core of resistance cross-lined. Three diagrams are also shown giving graphically the stresses throughout the cross-section for different positions of the axis of rotation.

Let $a =$ area of section, and
$g =$ center of gravity,
$I =$ moment of inertia,
$r =$ radius of gyration,
$k =$ distance from g to core of resistance,
$n\text{-}n =$ neutral axis of cross-section through g,
$O =$ axis of rotation,
$s =$ distance from n n to edge of section, lee side,
$s_1 =$ distance from n n to edge of section, windward side,
$y =$ distance from n n to axis of rotation O,
$d =$ distance from axis of rotation to any point where stress is sought,
d_1 and $d_2 =$ distance from axis of rotation to respective edges, e_1 and e_2,
$p =$ stress per unit of area at any point distance d from O,
p_1 and $p_2 =$ maximum and minimum stresses respectively at edge e_1 and e_2.

When x exceeds k, axis of rotation falls outside of section; p_1 and p_2 compressive stresses.

When $x = k$, $y = s_2\ d_2$ and p_2 become null, and $p_1 = 2\ m \div a$.

When x is less than k, axis of rotation falls within the section; p_1 compressive and p_2 tensile stress.

$$r^2 = I \div a;\quad K = I \div s\ a;\quad y = r^2 \div x;\quad p = m\ x\ d \div I = m\ d \div a\ y;$$
$$p_1 = m \div a + Whs_1 \div I;\ p_2 = m \div a + Whs_2\ I.$$

When $m \div a$ is less than $W\ h\ s_2 \div I$, the stress is opposite in kind, or tensile.

It is interesting to compare the results given by Mr. Schumann's formulas for the diameter and height of a chimney for a given horse power with the values given by the formulas of Professor Lang, published in The Engineering Record for July 20, 1901, and the values given in Kent's "Mechanical Engineer's Pocket-book." The comparison is shown in the following table.

	Schumann.		Kent.		Lang.	
H.-P. at 5 lbs. coal per hr.	Diam., ins.	Height, ft.	Diam., ins.	Height, ft.	Diam., ins.	Height, ft.
500	57	100	57	100	55	112
1,000	74	130	72	150	78	141
1,500	86	150	86	149	97	163
2,000	96	170	96	175	111	181
2,500	103	185	102	200	124	198
3,000	111	202	108	200	138	216
4,000	127	206	127	208	158	240

It will be noticed that the results given by the Kent and Schumann formulas are practically identical, while those given by the Lang formulas are considerably larger for the same horsepower.

Concrete-Steel Construction.

In the report of the last convention of the American Society of Civil Engineers mention was made of the valuable papers on concrete-steel construction presented by Messrs. A. L. Johnson and Leonard C. Wason under circumstances which rendered it impracticable to give a satisfactory review of them. Both have been printed in the Society's "Proceedings" for August, and Mr. Johnson has also published an abstract of his paper, accompanied by useful tables, in a trade publication noticed in The Engineering Record of September 7. The following extracts from Mr. Wason's discussion give its leading features:

The speaker had devoted his whole time for nearly eight years to the Ransome system of steel-concrete construction, and, as in fireproof floors, the maximum stress in steel and concrete with minimum weight is necessary, especial attention had been given to the stresses in tension and in compression, the ratio of the steel section to the concrete section, and the proportions of cement and aggregates used. Last winter he made fourteen concrete beams for a student to test as thesis work at the Massachusetts Institute of Technology. The object of the tests was to determine accurately the strength of the combination, the position of the neutral axis of the beams, the maximum deflection at the first crack, and to see if the concrete cracked before the steel had reached its elastic limit. All beams were 12 feet long, 8 inches wide and 12 inches high, and were made as follows:

Beam.	Construction.
1st....	Plain concrete.
2d.....	With ¼-in. bar at the bottom.
3d.....	" ½-in. " " "
4th....	" ¾-in. " " "
5th....	" ⅞-in. " " "
6th....	" 1 -in. " " "
7th....	" 1¼-in. " " "
8th....	" two 1 -in. bars at the bottom.
9th....	" two 1¼-in. " " "
10th....	" two 1¼-in. " " " and one ½-in. bar at the top.
11th....	" two 1¼-in. bars at the bottom and two ¾-in. bars at the top.
12th... 13th... 14th...	These were like beams 9, 10 and 11, respectively, except that, in addition, fourteen U's of ¼-in. steel were imbedded in the beams, passing under the bars, and the ends projecting above the top of each beam.

All bars were put in straight, with the center 2 inches from the top or bottom face of the beam. The concrete in all cases consisted of one part by measure of Portland cement, three parts of sand, and six parts of broken stone. The sand was perfectly clean; practically all passed through a 20-mesh sieve and was retained on a 30-mesh sieve; the grains, however, were round and smooth. The stone was a dark-blue trap; the pieces were cubical and the fractures angular. Four parts passed a 1¼-inch ring, two parts a ¾-inch ring. The steel was of a mild quality, square section, and was twisted cold until the edges made an angle of 20 degrees with the axis of the bar. The cement was tested neat, and as 1 to 3 mortar. It developed nearly full strength in two weeks, so that there was but little increase in strength between 15 and 60 days. In the neat cement test, age 21 days, the average of five tension briquettes was 924 pounds; highest, 978 pounds; in compression, age 26 days, average of four, 8,140 pounds per square inch; highest, 10,950 pounds. Mortar, tension, age 12 days, average of four, 265 pounds; the highest, 288 pounds. Mortar taken from concrete mixed by workmen, age 28 days, average of seventeen, 307 pounds; highest, 368 pounds. Mortar by workmen, in compression, age 28 days, average of seven, 3,630 pounds; highest, 4,500 pounds. A concrete prism, 8 x 8 x 12 inches, was also tested, and developed a strength of 2,455 pounds per square inch in compression.

The average ultimate strength in tension on the steel bars of all sizes used was 83,330 pounds per square inch, the highest being the ½-inch bars, which carried 100,140 pounds. The average modulus of elasticity was 30,095,000. The elastic limit averaged 64 1/3 per cent. of the ultimate strength.

The average weight of the concrete in the beams was 148.7 pounds per cubic foot. The series was so made that the first specimen was quite weak in tension, and the others were reinforced with steel until there was an excess of strength on the tension side, when the compressive portion was reinforced with steel to assist in its resistance to compression. The beams were all made in wooden forms inside the building and left undisturbed until the time of these tests, which varied from 30 to 50 days.

The method used was to rest the ends on small iron plates on the knife-edges of the testing machine, with a clear span of 11 ft. Blocks were laid on top of the specimen, dividing the span into three equal parts, and an I-beam was placed on top of these and the load applied through it. Thus a uniform bending moment was obtained between the two blocks.

The plain concrete beam failed under a concentrated load of 2,500 pounds at the center. Adding to this half the weight of the beam, namely, 600 pounds, and solving by the usual beam formula, the outside fiber stress is found to be 533 pounds per square inch. The beam containing the ¼-inch bar failed at the same load. The bar pulled in two. If it is assumed that the bar was stressed to its limit, the concrete still had to carry 381 pounds to the square inch in tension, as a concrete beam. The beam containing the ½-inch bar carried a greater load than was possible if the bar was required to carry the entire tensional stress. The bar pulled in two. If it is assumed that the bar was loaded to its ultimate strength, the concrete, as a beam, must still have supported part of the load, and the outside fiber stress would be 303 pounds per square inch. Similarly, in the case of the ¾-inch bar, the concrete must carry 462 pounds per square inch in tension. The ⅞ and 1-inch bars were capable of carrying the entire load coming on the beam containing them. The beam containing the 1¼-inch bar was accidentally cracked in two vertically in the middle in handling it before putting it into the machine, and carried 3,000 pounds less concentrated at the center than the beam containing the 1-inch bar. As the 1-inch bar had an excess of strength on the tension side, there was no gain by the use of a 1¼-inch bar, and it is, therefore, safe to consider that the falling off in strength was due to the cracking of the concrete. On this assumption, the concrete in the beam with the 1-inch bar carried a stress of 516 pounds per square inch. In the same way, the beam containing two 1¼-inch bars can be compared with the beam containing two 1-inch bars, which was accidentally cracked in two vertically in the middle; the ultimate strength of the former being 23,000 pounds concentrated at the center, and of the latter 20,000 pounds. The 3,000 pounds concentrated at the center would have to be carried by the concrete as a beam, and this would produce an outside fiber stress in tension of 516 pounds per square inch, as in the previous case. The average of the foregoing results of maximum outside fiber stress in tension would be 466 pounds per square inch.

The neutral axis was determined for each beam, and the total compression on the area above the neutral axis was calculated. This, in some cases, was easily done.

Bar, in....................	¾	⅞	1	1¼
Age, days..................	38	50	50	41
Stress, lbs................	2,916	3,161	2,544	2,338

The beam containing two 1-inch bars, age 41 days, was cracked in two in the middle from top to bottom in handling, therefore the entire tension must have been carried by the steel, and the entire compression was in the concrete. The neutral axis in this case was 10.2 inches from the bottom, and this gave a maximum outside fiber stress of 8,588 pounds, which is very exceptional; yet, on account of being cracked in two, the stresses were more easily analyzed, and the result is correct.

In no case did a beam crack before the steel had reached its elastic limit. The average deflection in 11 feet for twelve beams was 0.47 inch, and the maximum was 0.76 inch when the first crack appeared. Every fracture was free from air holes, and showed dense, evenly-mixed concrete. In many cases the stone sheared in two without pulling from the mortar.

The formula used by the speaker for calculating concrete beams is:

$$f = W\,l \div 6\,2/3\,D$$

where W is the total load in pounds, l the span in inches, D the depth in inches from the top to the center of the bar, and f the total fiber stress in the steel.

After solving and finding the total stress on the bar, a size and spacing can be selected which is convenient, and the area of concrete can be adjusted to resist the compression. The unit which the speaker has used, 16,000 pounds per square inch in tension on steel, and for a mixture of concrete, 1:3:6, an average of 500 pounds per square inch in compression on concrete, requires 32 square inches of concrete in the upper third of the beam for each square inch of steel.

A good many pieces of actual work have been loaded with three times their calculated amount, and have shown no sign of failure whatsoever; therefore, structures calculated in this way are safe. The beams tested at the Massachusetts Institute of Technology carried from 4½ to 5 times the load they were calculated to carry, according to the foregoing formula. In these tests, with all bars 2 inches from the bottom, the neutral axis would be 7 inches from the bottom. As a result of measurements on twelve beams, although there was considerable variation in the position of the neutral axis, the highest being 10.2 inches, the lowest 4.74 inches, the average was 7.06 inches, or sufficiently near to check the assumption made in the formula. This is an extremely simple formula for every-day use, and while it may not conform to profound theory, it certainly gives safe results in the design of steel-concrete structures. The speaker believes this formula can be used for any composite construction within the safe limit of the bond of union between the steel and the concrete.

Some experiments on the bond of twisted steel have been made as follows: ½-inch bars were imbedded in blocks of concrete 6 inches square, which varied in length from 12 to 28 inches. The bars projected about 2 feet from one end of the blocks. One face of the concrete bore against a plate, the bar passing through a hole in its center. A direct pull was applied to the bar, and in each case, when the length exceeded 21 inches, the bar broke outside the concrete without pulling therefrom. In these cases the ultimate stress on the steel averaged 81,835 pounds per square inch. From the data thus obtained it is possible to determine the exact length for bars of other sizes, and when this limit is exceeded there is no danger whatever of the bars drawing, and therefore the formula can be applied. If 16,000 pounds is the working stress on the bar, it is only necessary to imbed it one-fifth of the distance above determined in order to get the safe working bond required by the formula.

This formula can be applied to proportion the section of steel in a bridge. After determining the bending moment in the usual way, insert this in the formula, and use for the depth the distance from the center of the bar to the other face of the arch; then solve, and the size of the bar which will resist this moment is found. If other stresses, such as temperature, are reduced to the proper form, the steel can be proportioned in the same way to resist these stresses.

The neutral axis for each beam was computed from theoretical grounds, as follows: Let h = height of beam; y_0 = height of neutral axis from the bottom; b = breadth of beam; c = breadth of square rod; d = height of rod from bottom

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXIV, DRESDEN, AUGUSTUS BRIDGE.

One of the handsomest and most vigorously designed bridges in Europe, built in 1727-31 toward the close of the reign of Augustus II.

of beam; a = strain at one unit distance from origin.

Beam with one rod in the bottom:

$$\tfrac{1}{2} E b (2 h y_0 - h^2) + \tfrac{1}{2} (E_1 - E) c \times [d^2 - (c + d)^2 + 2 y_0 c] = 0.$$

Two rods in the bottom:

$$\tfrac{1}{2} E b (2 h y_0 - h^2) + (E_1 - E) c \times [d^2 - (c + d)^2 + 2 y_0 c] = 0.$$

Assuming the modulus of elasticity for concrete to be 1,000,000 and for steel to be 28,000,000, the calculated neutral axis was lower in every case than the observed, the average height being 4.77 inches from the bottom. Assuming the modulus to be 2,500,000, the average height of the neutral axis, as calculated by the foregoing formula, was 5.37 inches from the bottom. These results differ too much from the observed to be reconciled with one another, and therefore the assumptions made in the deduction of the formula do not agree with practice.

Curves were plotted for each beam, using the deflections as ordinates and the bending moments as abscissas, and in every case a curve was obtained. The curve, however, as a rule, was quite flat. Nevertheless, the fact that it was a curve proves that Hooke's law does not apply exactly to a composite beam of this type.

Five years ago the speaker had a contract, in the Fall River Public Library, in which it was necessary to bring a load of 150,000 pounds upon a pier of concrete 15 inches square, and not being able to find any printed data of tests on large specimens, he made a series of experiments at the Watertown Arsenal on piers 1 foot square and varying in length from 2 to 14 feet. There were three series. In the first he used all hand-mixed concrete, 1 : 3 : 6, of the proportion given above for beams, and of practically the same quality. The second series was exactly similar, except that the concrete was machine-mixed; the third series was of leaner mixtures.

The specimens were all mixed in the open air in midwinter, and filled into vertical moulds, in an open building without heat, and were allowed to freeze and thaw, according to the weather, until tested, at an age of from 35 to 47 days. It is the opinion of the speaker, from observations and research, that had these specimens been made in midsummer and tested at the same age, they would have developed about twice the ultimate strength recorded below. The longest specimens were tested first, and were put into the Emery machine in a horizontal position. The counterweight hung from the center did not balance the weight of the specimens themselves, so that there was a bending moment producing an outside fiber stress of 40 pounds per square inch. Nevertheless, every specimen failed by direct compression, the longest ones showing the greatest strength, although they did not have as long a time to set as the short specimens. The average of the hand-mixed series was 989 pounds per square inch; of the machine-mixed, 1,098 pounds per square inch, an advantage of 11 per cent. in favor of machine-mixing.

Readings of the compression were taken on all beams 6 feet and more in length, some with repeated stress, some with a long lapse of time between stresses, and many interesting points were learned. For instance, a load of 800 pounds was put on the 12-foot column, and the compression measured immediately. After a lapse of five minutes the beam had regained a small portion of its compression. The same was true of the 14-foot column. With the 10-foot column exactly the reverse took place. The initial load in every case was 100 pounds per square inch, and was increased by 100-pound increments until the elastic limit was reached. The instruments were then removed and the specimens broken. After each application of load, it was removed, and the specimens regained their entire compression up to 500 pounds per square inch in most cases, and above this point regained over two-thirds of the amount they were compressed, showing the material to be quite resilient.

Curves were plotted with the compression as ordinates and the loads per square inch as abscissas, and these were quite flat, but still sufficiently curved to show that Hooke's law does not apply closely, except within the limit of 700 pounds per square inch. At this load the modulus of elasticity for hand-mixed concrete was 2,500,000 for an average of ten tests; on machine-mixed concrete it was 2,870,000 for an average of ten tests. The highest result of all obtained was 4,545,000. The third series, all machine-mixed, was made with specimens all 6 feet in length.

Beam	1	2	3	4	5
Mixture	1:3:5	1:4:8	1:5:10	1:6:12	1:7:13
Unit strength	1,166	849	728	483	432

A curve was plotted for these, using for ordinates a ratio of the volume of cement to the volume of concrete, and for abscissas pounds per square inch, and it was found that the points could be represented by a straight line, thus showing that, within these limits, the strength of the concrete is directly proportional to the amount of cement used.

Another test of the relative strength of hand and machine-mixed concrete might be mentioned. A contractor got into an argument with the supervising engineer on a piece of work over the quality of concrete mixed by a certain type of concrete mixer. This was settled by a test of 1-foot cubes made at the Watertown Arsenal. The concrete was composed of 1 part of Giant cement, 3 parts of sand direct from the bank, and 5 parts of broken stone passing a 2½-inch ring, with all material passing a ½-inch ring screened out. The specimens were tested at 90 days. The machine-mixed specimens averaged 4,263 pounds per square inch; the hand-mixed, which were a little better in quality than is obtained in every-day practice, averaged 3,187 pounds per square inch; an advantage of 25 per cent. in favor of machine-mixing. The machine in question was the portable gravity concrete mixer.

The speaker also made a groined vault which was as near as possible an eighth-scale model of a room 27 feet 9 inches by 33 feet 6 inches, the specimen being 52 inches long and 42 inches wide. Arch ribs sprung diagonally from one corner to the other with a rise of one-tenth of the span. The arch vault sprung between them with a rise equal to that of the ribs at the center. The ribs were 1 inch wide and 2 inches deep, the vaults ⅛ inch thick. The concrete was composed of 1 part cement, 2 parts sand and 4 parts stone grit. A load was applied at eight points near the crown, four on the ribs and four on the vault, and the specimen carried 26,605 pounds before failing.

All the foregoing figures would indicate that a somewhat higher working stress can be used in concrete than has been customary. The speaker, in his practice, has been in the habit of using for a 1 : 3 : 6 concrete (his standard), 500 pounds per square inch in compression, 80 pounds per square inch in tension, and a ratio of steel area to concrete area of 1 to 32, using 16,000 pounds as the stress in steel. While the foregoing experiments would indicate that still higher pressures are possible with safety, the speaker does not recommend any increase until these results have been checked by other experiments. With the rapid increase in the quality and uniformity of Portland cement he believes that in a short time it will be possible to use larger unit stresses than are now customary; or leaner mixtures, with the present unit stresses, without any danger whatever of exceeding safe limits of strength.

Testing Hydraulic Cements.—II.

Report of Major William L. Marshall, Major Smith S. Leach and Capt. Spencer Cosby, Corps of Engineers, U. S. A.; being Professional Paper 28 of the Corps.

Classification of tests.—The tests to be made are two classes.

(1) Purchase tests on samples furnished by bidders to ascertain whether the bidder may be held on the sample to the delivery of suitable material, should his offer be accepted.

(2) Acceptance tests on samples taken at random from deliveries, to ascertain whether the material supplied accords with the purchase sample, or is suitable for the purpose of the work, as stated in the specifications for cement supplies.

(1) Purchase tests.—Under these specifications bids for Portland cements will be restricted to brands that have been approved after at least three years' exposure in successful use under similar conditions to those of the proposed work. This specification limits proposals to manufacturers of cements of established repute, and in so far lessens the dependence to be placed upon tests of single samples of cement in determining the probable quality of the cements offered, that sample packages may not be required with the proposals when the brand is known to the purchaser. When the cement is not known to the purchasing officer by previous use, a barrel of it should be required as representing the quality of cement to be supplied. A full set of tests should be made from this sample, and subsequent deliveries be required to show quality at least equal to the sample.

In this connection it is advisable in districts where well-equipped laboratories have been established, that sample packages of the cements in use in that territory, as sold in the open market, be obtained and tested as occasion offers, to ascertain the characteristic qualities of the brands as commercial articles, the information to be used in subsequent purchases of cements.

When purchase samples are waived, acceptance tests should be based upon the known qualities of the brand, as shown by previous tests.

The sample barrel should not be broken further than to take therefrom the necessary samples for testing. Afterward it should be put away in a dry place and kept for further testing, should the results obtained be disputed.

(2) Acceptance tests.—The tests to be made on cements delivered under contract depend not only on the extent, character, and importance of the work itself, but also on the time available between the delivery and the actual use of the material.

(a) On very important and extensive works, equipped with a testing laboratory and adequate storehouses, where cement may be kept at least 30 days before being required for use, full and elaborate tests should be made, keeping in view the fact that careful tests of few samples are more valuable than hurried tests of many samples.

(b) On active works of ordinary character, when time will not permit full tests, and on small works where the expenses of a laboratory are not justified, the tests must necessarily be limited to such reasonable precautions against the acceptance and use of unfit material as may be taken in the usually short interval between the receipt and use of the material.

Such conditions were in view in formulating the specification that proposals will be received from manufacturers of such cements only as have been proved by at least three years' use under similar conditions of exposure. Of the tests named in the specifications those for fineness, activity or hydraulicity, specific gravity, weight of packages, and accelerated tests for indications as to soundness, may be made within two days after the receipt of the material and with a very small outlay for instruments.

Cement of established repute, shown by specific gravity and fineness to be properly burnt and ground, or normal for the brand, that will set hard in reasonable time, the cakes snapping with a clean fracture when broken between the fingers, and standing the tests above named, may be accepted and used with reasonable certainty of success. Nevertheless, packages taken at random from the deliveries should occasionally be set aside and samples taken therefrom sent to a testing laboratory for the more elaborate tests for tensile strength (and for soundness should the boiling tests not be conclusive). The final acceptance and payment for such cement as may not have been actually placed in the work should, by agreement, be made to depend upon such tests.

In all cases where cement has been long stored it should be carefully tested before use, to ascertain whether it has deteriorated in strength.

Should the simple tests give unsatisfactory or suspicious results, then a full series of tests should be carefully made.

When Portland cement is in question the specific gravity and fineness tests should be made to guard against adulteration, and in all cases test weighings should be made to guard against short weights.

In cases where the amount of cement or the importance of the work will not justify the purchase of the simple apparatus required for the specific gravity, fineness, and boiling tests, the cement can be accepted on the informal tests mentioned herein, which require no apparatus whatever, but in such cases cements well known to the purchaser by previous use should be selected, and purchased directly from the manufacturer or his selling agent, in order that responsibility for the cement may be fixed.

Certified tests by professional inspectors, made as prescribed herein on samples taken from the cement to be shipped to the work, in a manner analogous to that customary among engineers in the purchase of structural steel and iron, may be required in such cases.

Sampling.—The entire package from parts of which tests are to be made is to be regarded as the sample tested. It should be marked with a distinctive mark that must also be applied to any part tested. The package should be set aside and protected against deterioration until all results from tests made from it are reached and accepted by both parties to the contract for supplies.

Cement drawn from several sample packages should not be mixed or mingled, but the individuality of each sample package should be preserved.

In testing it should be borne in mind that a few tests from any sample, carefully made, are more valuable than many made with less care.

The amount of material to be taken for formal tests is indicated herein where weights of the constituents of four briquettes are given, to which should be added the amount necessary for the tests for specific gravity, activity, and soundness.

In extended tests the material should be taken from the sample package from the heads and center of barrel, and from the ends and center of bag, by such an instrument as is used by inspectors of flour. All material taken from the same sample package may be thoroughly mixed or mingled, and the tests be made therefrom as showing the true character of the contents of the sample package.

In making formal tests at the work for acceptance of cement sample packages should be taken at random from among sound packages. The number taken must depend upon the importance and character of the work, the available time, and the capacity of the permanent laboratory force. For tensile strength the tests with sand are considered the more important and should always be made. Tests neat should be made if time permits.

It is not necessary in any case on a large work to test more than 10 per cent. of the deliveries, even of doubtful cement, and a much less number of samples may be taken should no cause for distrust be revealed by the tests made. In very important work of small extent each package may be tested. A cement should be rejected if the samples show dangerous variation in quality or lack of care in manufacture and resulting lack of uniformity in the product, without regard to the proportion of failures among samples tested.

In all cases in the use of cements the informal or simple tests of the character named herein should be constantly carried on. These constitute most valuable tests. Whenever any faulty material is indicated by such tests, elaborate tests should be at once instituted and should the fault be confirmed, the cement delivered and not used should be rejected and the use of the brand be discontinued.

Tests for weight.—From time to time packages should be weighed in gross and afterward the weight of neat cement and tare of the packages determined. If short weight of neat cement is indicated, a sufficient number of packages should be weighed and the average net weight per package ascertained with sufficient certainty to afford a satisfactory basis of settlement.

Records.—For tests at professional laboratories no general requirements as to records seem to be necessary. Each laboratory has its own blanks with certificate, and if a copy of the specifications be sent with the samples, the record returned should be sufficient. For records of formal tests on the work, or in a district laboratory, blank forms should be used. It is desirable to have the specification requirements stated on the form. Notations should be adopted to show for each test that the cement passed or failed, or that the test was not made. No inference should be drawn from the lack of any entry other than that the recorder has neglected his duty.

Silica cement or sand cement.—This is a patented article manufactured by grinding together silica or clean sand with Portland cement, by which process the original cementing material is made extremely fine and its capacity to cover surfaces of concrete aggregates is much increased. The sand is an adulteration, but on account of the extreme fineness of the product it serves to make mortar or concrete containing a given proportion of pure cement much more dense, the fine material being increased in volume.

The increase in cementing capacity due to the fine grinding of the cement constituent offsets, in great degree, the effects of the sand adulteration, so that sand cement made from equal weights of cement and sand approximates in tensile strength to the neat cement and the material is sold as cement.

The extreme fine grinding also improves cement that contains expansives, but nevertheless sand cement should not be purchased in the market, but should be made on the work from approved materials, if used for other purposes than for grouting, for which it is peculiarly adapted.

Whether this material should be used in important works for mortar and concrete, the Board considers a question of cost and expediency.

Over against the saving in cement may be placed the royalty on a patented article, the cost of the plant and of manufacture, the inconvenience of attaching a manufacturing establishment to a work under construction, and other elements bearing not only on first cost of cementing material but also involving the element of time. When cement is high priced, means of transportation limited, labor, sand, and concrete materials cheap and abundant, the conditions may justify the use of sand cement on economic grounds. In any case, the cement from which the product is made should be tested precisely as other cements.

Slag cement.—This term is applied to cement made by intimately mixing by grinding together granulated blast-furnace slag of a certain quality and slaked lime, without calcination subsequent to the mixing. This is the only cement of the puzzolan class to be found in our markets (often branded as Portland), and as true Portland cement is now made having slag for its hydraulic base, the term "slag cement" should be dropped and the generic term puzzolan be used in advertisements and specifications for such cements.

Puzzolan cement made from slag is characterized physically by its light lilac color; the absence of grit attending fine grinding and the extreme subdivision of its slaked lime element; its low specific gravity (2.6 to 2.8) compared with Portland (3 to 3.5); and by the intense bluish green color in the fresh fracture after long submersion in water, due to the presence of sulphides, which color fades after exposure to dry air.

The oxidation of sulphides in dry air is destructive of puzzolan cement mortars and concretes so exposed. Puzzolan is usually very finely ground, and when not treated with soda sets more slowly than Portland. It stands storage well, but cements treated with soda to quicken setting become again very slow setting from the carbonization of the soda (as well as the lime) element after long storage.

Puzzolan cement properly made contains no free or anhydrous lime, does not warp or swell, but is liable to fail from cracking and shrinking (at the surface only) in dry air.

Mortars and concretes made from puzzolan approximate in tensile strength similar mixtures of Portland cement, but their resistance to crushing is less, the ratio of crushing to tensile strength being about 6 or 7 to 1 for puzzolan and 9 or 11 to 1 for Portland. On account of its extreme fine grinding puzzolan often gives nearly as great tensile strength in 3 to 1 mixtures as neat.

Puzzolan permanently assimilates but little water compared with Portland, its lime being already hydrated. It should be used in comparatively dry mixtures well rammed, but while requiring little water for chemical reactions, it requires for permanency in the air constant or continuous moisture.

Proper uses of puzzolan cement.—Puzzolan cement never becomes extremely hard like Portland, but puzzolan mortars and concretes are tougher or less brittle than Portland.

The cement is well adapted for use in sea water, and generally in all positions where constantly exposed to moisture, such as in foundations of buildings, sewers and drains, and underground works generally, and in the interior of heavy masses of masonry or concrete.

It is unfit for use when subjected to mechanical wear, attrition, or blows. It should never be used where it may be exposed for long periods to dry air, even after it has well set. It will turn white and disintegrate, due to the oxidation of its sulphides at the surface under such exposure.

Specifications for Portland, natural and puzzolan cement are appended hereto.

Specifications for American Portland Cement.

(1) The cement shall be an American Portland, dry and free from lumps. By a Portland cement is meant the product obtained from the heating or calcining up to incipient fusion of intimate mixtures, either natural or artificial, of argillaceous with calcareous substances, the calcined product to contain at least 1.7 times as much of lime, by weight, as of the materials which give the lime its hydraulic properties, and to be finely pulverized after said calcination, and thereafter additions or substitutions for the purpose only of regulating certain properties of technical importance to be allowable to not exceeding 2 per cent. of the calcined product.

(2) The cement shall be put up in strong, sound barrels well lined with paper, so as to be reasonably protected against moisture, or in stout cloth or canvas sacks. Each package shall be plainly labeled with the name of the brand and of the manufacturer. Any package broken or containing damaged cement may be rejected or accepted as a fractional package, at the option of the United States agent in local charge.

(3) Bidders will state the brand of cement which they propose to furnish. The right is reserved to reject a tender for any brand which has not established itself as a high-grade Portland cement and has not for three years or more given satisfaction in use under climatic or other conditions of exposure of at least equal severity to those of the work proposed.

(4) Tenders will be received only from manufacturers or their authorized agents.

(The following paragraph will be substituted for paragraphs 3 and 4 above when cement is to be furnished and placed by the contractor:

No cement will be allowed to be used except established brands of high-grade Portland cement which have been made by the same mill and in successful use under similar climatic conditions to those of the proposed work for at least three years.)

(5) The average weight per barrel shall not be less than 375 pounds net. Four sacks shall contain one barrel of cement. If the weight, as determined by test weighings, is found to be below 375 pounds per barrel, the cement may be rejected, or, at the option of the engineer officer in charge, the contractor may be required to supply, free of cost to the United States, an additional amount of cement equal to the shortage.

(6) Tests may be made of the fineness, specific gravity, soundness, time of setting and tensile strength of the cement.

(7) *Fineness.*—Ninety-two per cent. of the cement must pass through a sieve made of No. 40 wire, Stubb's gauge, having 10,000 openings per square inch.

(8) *Specific Gravity.*—The specific gravity of the cement, as determined from a sample which has been carefully dried, shall be between 3.10 and 3.25.

(9) *Soundness.*—To test the soundness of the cement, at least two pats of neat cement mixed for five minutes with 20 per cent. of water by weight shall be made on glass, each pat about 3 inches in diameter and one-half inch thick at the center, tapering thence to a thin edge. The pats are to be kept under a wet cloth until finally set, when one is to be placed in fresh water for twenty-eight days. The second pat will be placed in water which will be raised to the boiling point for six hours, then allowed to cool. Neither should show distortion or cracks. The boiling test may or may not reject, at the option of the engineer officer in charge.

(10) *Time of Setting.*—The cement shall not acquire its initial set in less than forty-five minutes and must have acquired its final set in ten hours.

(The following paragraph will be substituted for the above in case a quick-setting cement is desired:

The cement shall not acquire its initial set in less than twenty nor more than thirty minutes, and must have acquired its final set in not less than forty-five minutes, nor in more than two and one-half hours.)

The pats made to test the soundness may be used in determining the time of setting. The cement is considered to have acquired its initial set when the pat will bear, without being appreciably indented, a wire one-twelfth inch in diameter loaded to weigh one-fourth pound. The final set has been acquired when the pat will bear, without being appreciably indented, a wire one twenty-fourth inch in diameter loaded to weigh 1 pound.

(11) *Tensile Strength.*—Briquettes made of neat cement, after being kept in air for twenty-four hours under a wet cloth, and the balance of the time in water, shall develop tensile strength per square inch as follows:

After seven days, 450 pounds; after twenty-eight days, 540 pounds.

Briquettes made of 1 part cement and 3 parts standard sand, by weight, shall develop tensile strength per square inch as follows:

After seven days, 140 pounds; after twenty-eight days, 220 pounds.

(In case quick-setting cement is desired, the following tensile strengths shall be substituted for the above:

Neat briquettes: After seven days, 400 pounds; after twenty-eight days, 480 pounds.

Briquettes of 1 part cement to 3 parts standard sand: After seven days, 120 pounds; after twenty-eight days, 180 pounds.)

(12) The highest result from each set of briquettes made at any one time is to be considered the governing test. Any cement not showing an increase of strength in the twenty-eight-day tests over the seven-day tests will be rejected.

(13) When making briquettes neat cement will be mixed with 20 per cent. of water by weight, and sand and cement with 12½ per cent. of water by weight. After being thoroughly mixed and worked for five minutes, the cement or mortar will be placed in the briquette mold in four equal layers, and each layer rammed and compressed by thirty blows of a soft brass or copper rammer three-quarters of an inch in diameter (or seven-tenths of an inch square, with rounded corners), weighing 1 pound. It is to be allowed to drop on the mixture from a height of about half an inch. When the ramming has been completed, the surplus cement shall be struck off and the final layer smoothed with a trowel held almost horizontal and drawn back with sufficient pressure to make its edge follow the surface of the mold.

(14) The above are to be considered the minimum requirements. Unless a cement has been recently used on work under this office, bidders will deliver a sample barrel for test before the opening of bids. If this sample shows higher tests than those given above, the average of tests made on subsequent shipments must come up to those found with the sample.

(15) A cement may be rejected in case it fails to meet any of the above requirements. An agent of the contractor may be present at the making of the tests, or, in case of the failure of any of them, they may be repeated in his presence. If the contractor so desires, the engineer officer in charge may, if he deem it to the interest of the United States, have any or all of the tests made or repeated at some recognized standard testing laboratory in the manner herein specified. All expenses of such tests to be paid by the contractor. All such tests shall be made on samples furnished by the engineer officer from cement actually delivered to him.

Specifications for Natural Cement.

(1) The cement shall be a freshly packed natural or Rosendale, dry, and free from lumps. By natural cement is meant one made by calcining natural rock at a heat below incipient fusion, and grinding the product to powder.

(2) The cement shall be put up in strong, sound barrels, well lined with paper so as to be reasonably protected against moisture, or in stout cloth or canvas sacks. Each package shall be plainly labeled with the name of the brand and of the manufacturer. Any package broken or containing damaged cement may be rejected, or accepted as a fractional package, at the option of the United States agent in local charge.

(3) Bidders will state the brand of cement which they propose to furnish. The right is reserved to reject a tender for any brand which has not given satisfaction in use under climatic or other conditions of exposure of at least equal severity to those of the work proposed.

(4) Tenders will be received only from manufacturers or their authorized agents.

(The following paragraph will be substituted for paragraphs 3 and 4 above when cement is to be furnished and placed by the contractor:

No cement will be allowed to be used except established brands of high-grade natural cement which have been in successful use under similar climatic conditions to those of the proposed work.)

(5) The average net weight per barrel shall not be less than 300 pounds. (West of the Allegheny Mountains this may be 265 pounds.) . . . sacks of cement shall have the same weight as 1 barrel. If the average net weight, as determined by test weighings, is found to be below 300 pounds (265 pounds) per barrel, the cement may be rejected, or, at the option of the engineer officer in charge, the contractor may be required to supply free of cost to the United States an additional amount of cement equal to the shortage.

(6) Tests may be made of the fineness, time of setting, and tensile strength of the cement.

(7) *Fineness.*—At least 80 per cent. of the cement must pass through a sieve made of No. 40 wire, Stubb's gauge, having 10,000 openings per square inch.

(8) *Time of Setting.*—The cement shall not acquire its initial set in less than twenty minutes and must have acquired its final set in four hours.

(9) The time of setting is to be determined from a pat of neat cement mixed for five minutes with 30 per cent. of water by weight and kept under a wet cloth until finally set. The cement is considered to have acquired its initial set when the pat will bear, without being appreciably indented, a wire one-twelfth inch in diameter loaded to weigh one-fourth pound. The final set has been acquired when the pat will bear, without being appreciably indented, a wire one twenty-fourth inch in diameter loaded to weigh 1 pound.

(10) *Tensile Srength.*—Briquettes made of neat cement shall develop the following tensile strengths per square inch, after having been kept in air for 24 hours under a wet cloth and the balance of the time in water:

At the end of seven days, 90 pounds; at the end of twenty-eight days, 200 pounds.

Briquettes made of one part cement and one part standard sand, by weight, shall develop the following tensile strengths per square inch:

After seven days, 60 pounds; after twenty-eight days, 150 pounds.

(11) The highest result from each set of briquettes made at any one time is to be considered the governing test. Any cement not showing an increase of strength in the twenty-eight-day tests over the seven-day tests will be rejected.

(12) The neat cement for briquettes shall be mixed with 30 per cent. of water by weight, and the sand and cement with 17 per cent. of water by weight. After being thoroughly mixed and worked for five minutes the cement or mortar is to be placed in the briquette mold in four equal layers, each of which is to be rammed and compressed by thirty blows of a soft brass or copper rammer three-fourths of an inch in diameter (or seven-tenths of an inch square with rounded corners), weighing 1 pound. It is to be allowed to drop on the mixture from a height of about half an inch. Upon the completion of the ramming the surplus cement shall be struck off and the last layer smoothed with a trowel held nearly horizontal and drawn back with sufficient pressure to make its edge follow the surface of the mold.

(13) The above are to be considered the minimum requirements. Unless a cement has been recently used on work under this office, bidders will deliver a sample barrel for test before the opening of the bids. Any cement showing by sample, higher tests than those given must maintain the average so shown in subsequent deliveries.

(14) A cement may be rejected which fails to meet any of the above requirements. An agent of the contractor may be present at the making of the tests, or, in case of the failure of any of them, they may be repeated in his presence. If the contractor so desires, the engineer officer may, if he deems it to the interest of the United States, have any or all of the tests made or repeated at some recognized standard testing laboratory in the manner above specified. All expenses of such tests shall be paid by the contractor, and all such tests shall be made on samples furnished by the engineer officer from cement actually delivered to him.

Specifications for Puzzolan Cement.

(1) The cement shall be a puzzolan of uniform quality, finely and freshly ground, dry, and free from lumps, made by grinding together without subsequent calcination granulated blast-furnace slag with slaked lime.

(2) The cement shall be put up in strong sound barrels well lined with paper, so as to be reasonably protected against moisture, or in stout cloth or canvas sacks. Each package shall be plainly labeled with the name of the brand and of the manufacturer. Any package broken or containing damaged cement may be rejected, or accepted as a fractional package, at the option of the United States agent in local charge.

(3) Bidders will state the brand of cement which they propose to furnish. The right is reserved to reject a tender for any brand which has not given satisfaction in use under climatic or other conditions of exposure of at least equal severity to those of the work proposed, and for any brand from cement works that do not make and test the slag used in the cement.

(4) Tenders will be received only from manufacturers or their authorized agents.

(The following paragraph will be substituted for paragraphs 3 and 4 above when cement is to be furnished and placed by the contractor:

No cement will be allowed to be used except established brands of high-grade puzzolan cement which have been in successful use under similar climatic conditions to those of the proposed work and which come from cement works that make the slag used in the cement.)

(5) The average weight per barrel shall not be less

than 330 pounds net. Four sacks shall contain 1 barrel of cement. If the weight as determined by test weighings is found to be below 330 pounds per barrel, the cement may be rejected or, at the option of the engineer officer in charge, the contractor may be required to supply, free of cost to the United States, an additional amount of cement equal to the shortage.

(6) Tests may be made of the fineness, specific gravity, soundness, time of setting, and tensile strength of the cement.

(7) *Fineness.*—Ninety-seven per cent. of the cement must pass through a sieve made of No. 40 wire, Stubb's gauge, having 10,000 openings per square inch.

(8) *Specific Gravity.*—The specific gravity of the cement, as determined from a sample which has been carefully dried, shall be between 2.7 and 2.8.

(9) *Soundness.*—To test the soundness of cement, pats of neat cement mixed for five minutes with 18 per cent. of water by weight shall be made on glass, each pat about 3 inches in diameter and one-half inch thick at the center, tapering thence to a thin edge. The pats are to be kept under wet cloths until finally set, when they are to be placed in fresh water. They should not show distortion or cracks at the end of twenty-eight days.

(10) *Time of Setting.*—The cement shall not acquire its initial set in less than forty-five minutes and shall acquire its final set in ten hours. The pats made to test the soundness may be used in determining the time of setting. The cement is considered to have acquired its initial set when the pat will bear, without being appreciably indented, a wire one-twelfth inch in diameter loaded to one-fourth pound weight. The final set has been acquired when the pat will bear, without being appreciably indented, a wire one twenty-fourth inch in diameter loaded to 1 pound weight.

(11) *Tensile Strength.*—Briquettes made of neat cement, after being kept in air under a wet cloth for twenty-four hours and the balance of the time in water, shall develop tensile strengths per square inch as follows:

After seven days, 350 pounds; after twenty-eight days, 500 pounds.

Briquettes made of one part cement and three parts standard sand by weight shall develop tensile strength per square inch as follows:

After seven days, 140 pounds; after twenty-eight days, 220 pounds.

(12) The highest result from each set of briquettes made at any one time is to be considered the governing test. Any cement not showing an increase of strength in the twenty-eight-day tests over the seven-day tests will be rejected.

(13) When making briquettes neat cement will be mixed with 18 per cent. of water by weight, and sand and cement with 10 per cent. of water by weight. After being thoroughly mixed and worked for five minutes the cement or mortar will be placed in the briquette mold in four equal layers and each layer rammed and compressed by thirty blows of a soft brass or copper rammer, three-quarters of an inch in diameter or seven-tenths of an inch square, with rounded corners, weighing 1 pound. It is to be allowed to drop on the mixture from a height of about half an inch. When the ramming has been completed the surplus cement shall be struck off and the final layer smoothed with a trowel held almost horizontal and drawn back with sufficient pressure to make its edge follow the surface of the mold.

(14) The above are to be considered the minimum requirements. Unless a cement has been recently used on work under this office, bidders will deliver a sample barrel for test before the opening of bids. If this sample shows higher tests than those given above, the average of tests made on subsequent shipments must come up to those found with the sample.

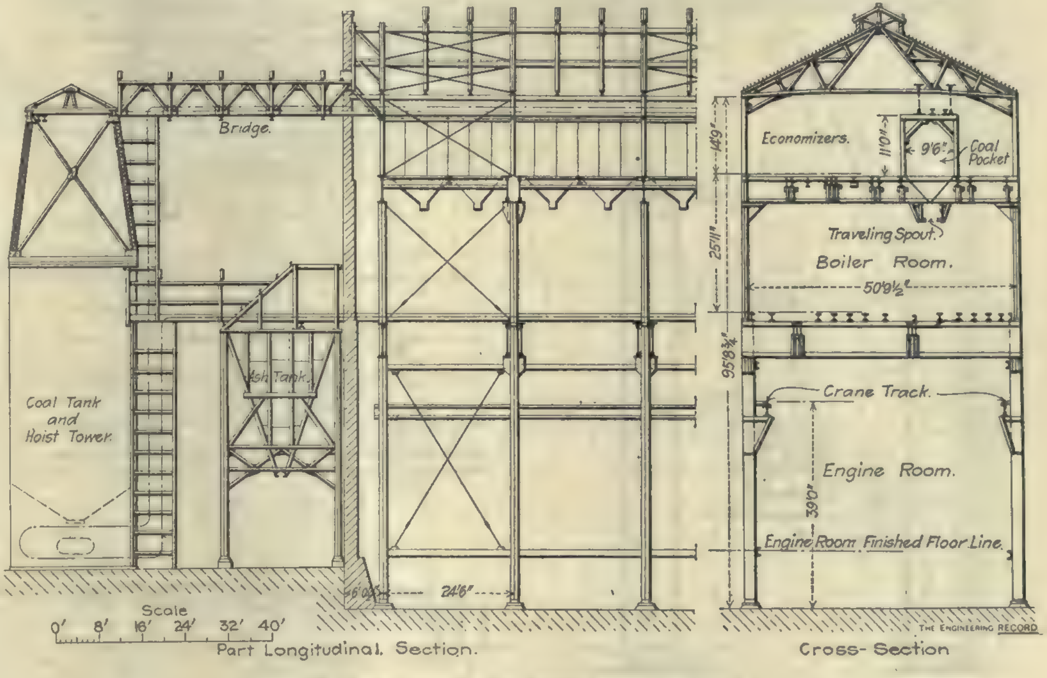
(15) A cement may be rejected in case it fails to meet any of the above requirements. An agent of the contractor may be present at the making of the tests, or, in case of the failure of any of them, they may be repeated in his presence. If the contractor so desires the engineer officer in charge may, if he deems it to the interest of the United States, have any or all of the tests made or repeated at some recognized testing laboratory in the manner herein specified, all expenses of such tests to be paid by the contractor. All such tests shall be made on samples furnished by the engineer officer from cement actually delivered to him.

The American Society of Civil Engineers has issued to members an index of the "Transactions" from 1867 to 1901, including volumes I to XLV. Extra copies can probably be procured for $2 each by addressing the secretary of the Society, 220 West Fifty-seventh Street, New York City.

The Power House of the Bristol Railway.

The power house for the Bristol Tramways & Carriage Company, Bristol, England, is a fireproof steel building 140 feet long, 50 feet wide and about 116 feet high. The entire structure, with its coal and ash-tower extensions and tall steel smokestack, was constructed by the Riter-Conley Manufacturing Company, of Pittsburg, shipped complete to England, and erected there by employees sent for the purpose from Pittsburg. The building is in the heart of the business district of Bristol, where space is very valuable, and on that account was made three stories high, with the engines on the first floor, the boiler on the second floor and the coal pocket and economizers on the third floor.

The walls are of brick and self-sustaining, and carry the ends of some of the floorbeams; although the columns are enclosed within them they do not support the walls. In the framework there are six main bents which divide the building into five 24½-foot intermediate panels and two short end panels. Each bent consists of two columns, two floor girders and a roof truss, and is braced longitudinally by the lantern, five lines of purlins, three lines of channels in each row of columns and by X-brace rods in the end panels of the columns and in the end and center panels of the roof.



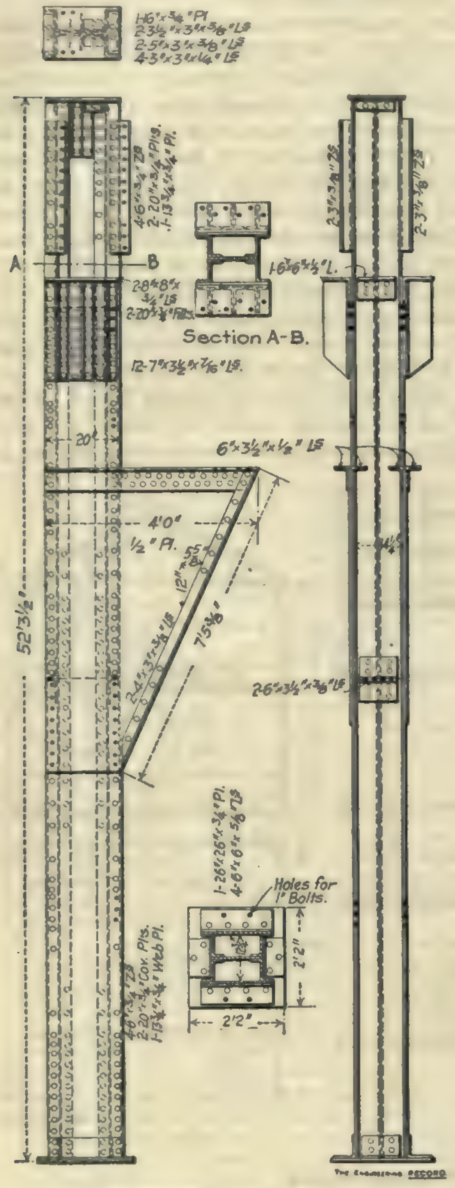
MAIN FRAMEWORK OF BRISTOL POWER HOUSE.

The columns are made in three sections, the lower one having the cross section and dimensions shown in the detail drawing. A ½-inch bracket plate 5 feet deep is riveted across each face of the column and projects 3 feet on the inside, where its T-shape top flanges form separate seats for the adjacent ends of the crane track girders. Vertical flange angles on the upper end take the connections of the double transverse girders for the boiler room floor, which have their webs field riveted across both side of the column. The upper end of the column has a cap plate which serves as a horizontal flange for the connection of the base plate of the second section of the column. This has an H-shape section made up of four 5-inch Z-bars and one 6⅞-inch plate, and has cap and base plates at the top and bottom.

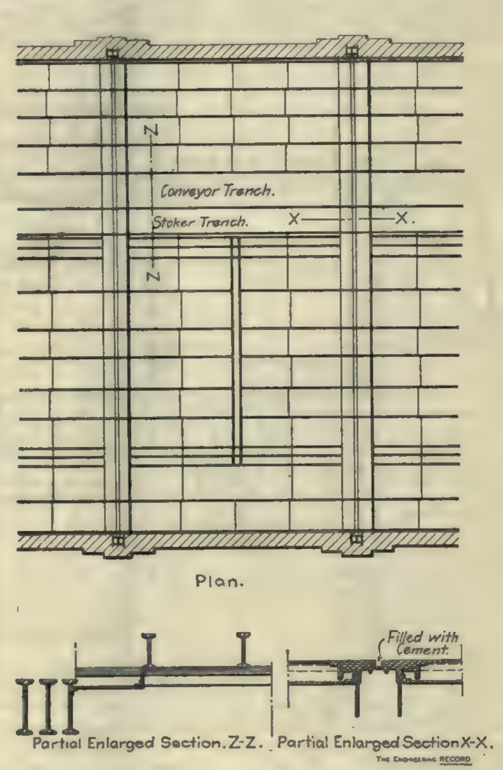
The third-story floorbeams are seated on top of the columns and extended across their cap plates. Their webs are connected at each end by a line of longitudinal channel struts. At the extremities of their top flanges are seated the upper sections of the columns, which consist of 9-inch I-beams, about 15 feet long, with their webs in the planes of the roof trusses. The tops of these columns are connected by lines of 12-inch channels with vertical webs which carry on their upper flanges the ends of the intermediate roof trusses. The building is braced transversely by knee-brace angles at the ends of the roof trusses, by solid web knee-brace brackets at the ends of the third-story floor girders and by the deep rigid connections of the columns between the double transverse girders in the boiler-room floor.

The engine-room floor is supported on short span beams and girders carried by the walls and by the masonry foundation piers for the engines. The boiler-room floor, 44 feet above it, is carried wholly on pairs of plate girders, which are rigidly connected to the lower sections of the columns just below their caps. These girders support two triple rows of 24-inch longitudinal I-beams carrying an intermediate transverse girder in the center of each panel. The main and intermediate girders carry the longitudinal floorbeams about 4 feet apart, with brick floor arches built on their lower flanges. A solid plate trough 21 inches deep and about 34 inches wide forms a stoker's trench in front of the boilers and runs from end to end of the building, as indicated in the diagram of one panel of the second-floor beams. The conveyor trench, adjacent and parallel to it, is included between the webs of two lines of 15-inch I-beams 3½ feet apart, which are seated across the upper flanges of the floor girders. The main girders have 63 x 9/16-inch webs and in each flange two 6 x 6 x 11/16-inch angles and three 16 x 11/16-inch flange cover plates, one of which is full length. Besides being riveted to the columns with 20 rivets through each end of the web, the girders are seated on horizontal shelf angles which are 8 inches wide and have three pairs of 7 x 3½-inch vertical reinforcement angles riveted to the column to support their horizontal flanges. Each of the longitudinal I-beams is connected to the girder web with six field rivets and is seated on a 6 x 6-inch shelf angle which has its horizontal flange bearing on the upper ends of four 5 x 3-inch vertical web stiffener angles. On account of the limited shipping facilities of the steamship company, the large double girders could not be made as box girders and could not be shipped full length; each one was therefore spliced in the middle where the flange strains were maximum. The flange angles were staggered past the splice, and the joint in each flange was made with two side plates nearly 9 feet long, one cover plate and 114 field rivets, besides those in the web cover plates.

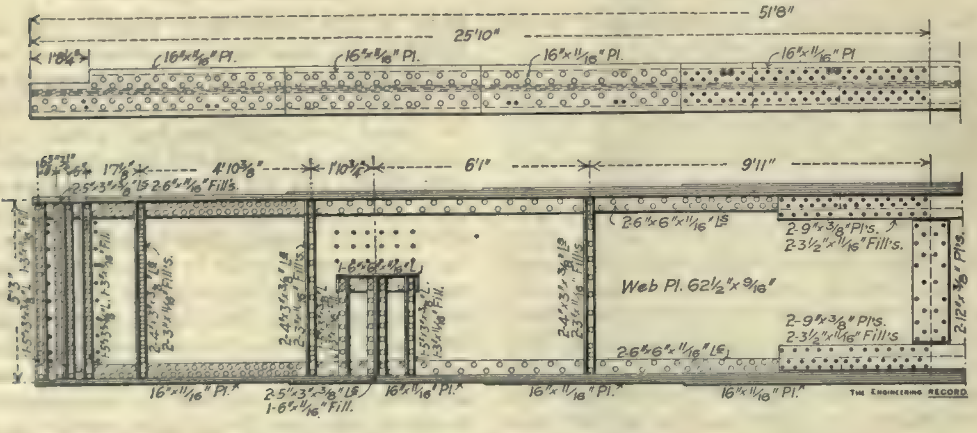
The third-floor main transverse girders have 58 x ⅜-inch web plates and in each flange two 6 x 6-inch angles and two 16-inch cover plates, one of the latter being full length. They carry the coal pocket on two lines of longitudinal plate girders 10 feet apart on centers, with a 30 x ⅜-inch web plate and four 5 x 3½ x ½-inch flange angles. Two lines of deep longitudinal I-beams are web connected to the floor girders from end to end of the building and there are besides additional longitudinal I-beams for two panels of the floor at one end, as shown in the general cross section of the building.



One of the Main Columns.



Part of Boiler-Room Floor.



Double Girder in Boiler-Room Floor.

The roof trusses are of ordinary riveted construction, made up chiefly of pairs of small angles, back to back, making T-shape cross sections. The top chord is composed of two 3½ x 3 x ⅜-inch angles and one 10 x ⅜-inch plate. The bottom chord is two 3½ x 3 x 7/16-inch angles and most of the web members are pairs of 3 x 2-inch angles. The trusses are about 8 feet 2 inches apart and support 2 x 2-inch purlin angles about 10 inches on centers, which carry the slate roofing. The open sides of the louvre afford ventilation between galvanized sheet iron slats.

The coal pocket, with a capacity of 300 tons, is 122½ feet long and 9½ feet wide, with vertical sides 11 feet high and a bottom divided into ten approximately square hoppers nearly 6 feet deep. The vertical sides and ends of the pocket are made of ¼-inch steel plates riveted to the flanges of 7-inch 15-pound I-beams outside columns 6 feet apart. The tops of these are riveted to 9-inch longitudinal channels with the web horizontal and the flanges down. The channels are connected by ten transverse 8-inch I-beams in the planes of every third pair of the wall columns and are connected to them by bent angle knee-braces at each end. These cross beams carry the longitudinal girders for the overhead conveying apparatus. Under the center of the pocket there is a pair of brackets on the lower flange of each main girder which carry the track for a traveling spout to serve the different hoppers.

The coal-conveyor track passes through the gable wall at one end of the building and is carried on a light lattice girder bridge of about 50 feet span to the top of a tower. In this there is a cylindrical steel tank 24 feet in diameter and 57 feet high, with a hopper bottom and spout 7½ feet above the surface of the ground. Coal is delivered into this tank and discharged through the hopper spout into the conveying apparatus, which lifts it to the top of the tower and carries it to the opposite end of the pocket. Between this tower and the end of the building there is a smaller tower supporting the ash tank, which is a pyramidal hopper about 20 feet square at the top and 26 feet deep. It has a framework of beams and angles and the sides are made of brick arches to protect the steel from corrosion from the ashes. The spout is closed by a balanced plunger valve, which is operated from below by a lever, and discharges the contents through a hinged chute into a scow.

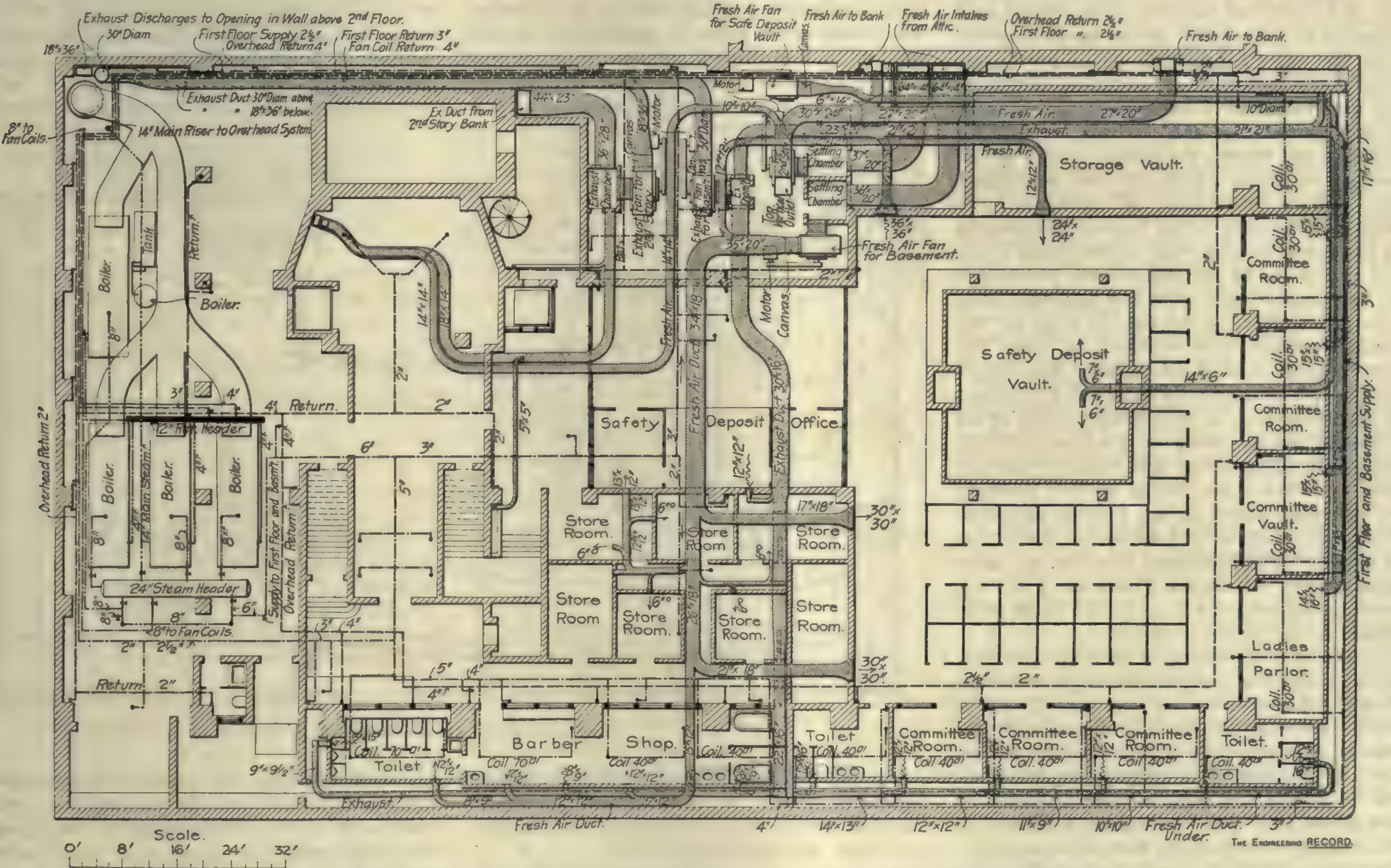
The steel smokestack, which is 200 feet high, is lined with brick and is seated on top of a brick foundation 22 feet in diameter and 60 feet high. It is made of 6-foot courses of plates, ⅜ inch thick at the base and ¼ inch thick at the top. It is 10¾ feet in diameter at the top and tapers uniformly to about 14 feet at the top of the fourth course from the base, below which it flares out to a bottom width of about 20 feet. The first nine horizontal seams from the bottom are double riveted; all other joints are single riveted. The lower edge of the first course is riveted to the vertical flange of a sectional annular base casting 21½ feet in diameter outside and 12 1/3 feet in diameter inside, anchored to the masonry with eight 3-inch vertical bolts 60 feet long.

The whole plant is considered complete and up-to-date and is equipped with standard improved apparatus, including stoker and ash conveying machinery. The building and stack were erected by ordinary American methods, which attracted quite some attention. The power house has been in operation since last October. The steelwork was furnished and erected, as stated, by the Riter-Conley Manufacturing Company, of Pittsburg, in accordance with the requirements of Mr. H. F. Parshall, M. Inst. C. E., chief engineer for the Bristol Tramways & Carriage Company. The boilers were furnished by the Babcock & Wilcox Company; the conveying apparatus by the C. W. Hunt Company, of New York, and the engines by the Edward P. Allis Company, of Milwaukee.

Some Melan Highway Bridges over double-track railways in Bavaria, described in the "Nouvelles Annales de la Construction," were erected in an interesting manner. They all have a clear span of about 48 feet and a clear height of 17¾ feet. The soffit has a radius of 30½ feet at the crown and 20¾ feet at the haunches, the curve having three centers. The arch is 8 inches thick at the crown and 6¼ feet thick at the springing line, where it rests on a concrete foundation; it is reinforced at the crown by 6-inch I-beams about 20 feet long, held 20 inches apart by tie-bolts and separators and fitted with 8 x 10-inch base plates at each end. The haunches were first built up about 6 feet above the footings, and a frame of triangular cross-section was then set up to carry the lagging for each side of the arch, which was laid up to within 20 inches of the ends of the I-beams forming the Melan reinforcement. These supports had a framework of angles, and their dimensions were so chosen that there was just clearance between them for cars on the two tracks. When the concrete had been carried up to the height mentioned, the I-beams were put in place and their shoes blocked against the finished concrete. The light angle-iron supports for the lagging were hung from these ribs, which thus held up the centering for the concrete that was rammed about them. The span of the lagging thus supported was about 26 feet.

Ventilation and Heating in the Merchants' Loan & Trust Building, Chicago.

The Merchants' Loan & Trust Building is one of the latest of Chicago's office buildings. It is 12 stories in height above the sidewalk, about 78 x 177 feet in ground plan, and is located on the northwest corner of Clark and Adams Streets. It is warmed by steam, distributed throughout the offices by means of the downward system of piping—a type of plant in considerable favor in Chicago—with gravity return, a vacuum system of circulation and automatic temperature regulation, and is ventilated in the banking rooms in the lower stories by a plenum and exhaust system of air distribution, this portion of the plant being a very interesting feature of the building's equipment. Steam boilers are located in the basement and the building is independent as regards its apparatus for heating. Dynamos were not, however, installed, and lighting and power is obtained by electricity from a street service connection.



BASEMENT PLAN OF MERCHANTS' LOAN AND TRUST BUILDING.

A plan of the basement and one of the attic are reproduced in the accompanying drawings. The first floor is occupied for broker and ticket offices, the second floor is given up for the greater part to the Merchants' Loan & Trust Bank, the remainder for the Chicago Clearing House; and a large part of the basement is occupied by the bank. The upper floors are partitioned off for general offices, served from a corridor which takes the form of a letter E, the elevator hall taking the central projection of the letter. The offices are arranged on both sides of the corridor, the inner set of offices having windows which open on a comparatively large court. Six passenger elevators serve all floors, and a seventh runs from the basement to the bank on the second floor.

The ventilating apparatus comprises three centrifugal fans for blowing air into the parts of the building more or less densely peopled and requiring a positive supply of air, two exhaust fans for removing this air after more or less vitiation, and two disk fans in the attic at the head of two shafts carrying wires and pipes. A feature of particular interest in the connection is the fact that the fresh air is admitted through the roof, a point being selected as far as practicable from the smokestack for that purpose, so that as clean a supply as possible could be obtained, and the heater coils for warming the cold air are located near the inlet in a room partitioned off in the attic. This is built of 4-inch tile on a concrete floor and extending to the ceiling, plastered two coats inside and outside. The fresh-air inlets are provided with dampers of sheet iron counterweighted and fitted with chains so that they can be operated and closed when the fans are not running.

The heating coils are arranged in three groups or separate heaters, one for each fresh-air fan; and the sheet iron casing around each is continued as a short duct which connects with a flue dropping down to the basement, where a duct in each case leads to each fan. The heaters are set on a flooring of 6-inch tile arches sprung between I-beams supported on brick foundations, and the space underneath the heaters is utilized as a cold-air by-pass; and each duct at its connection with the coil is provided with a damper operated by means of a thermostat, one in the main banking room, one in the vault room and one in the vault itself. One of the fans in the basement supplies the basement rooms and another the bank and second-story rooms, while the third fan supplies the vault proper and may be shut off when desired without affecting the rest of the plant. The heaters consist of 1-inch pipe coils, of the ordinary type; the two larger heaters are divided into five sections each, connected in one battery in each case and contain about 2,200 lineal feet of pipe, which is designed to warm the air when admitted as low as 10 degrees Fahrenheit below zero to 130 degrees above. The smaller heater, that for the vault proper, is divided into three sections, and contains about 375 lineal feet of pipe. Cheese-cloth air filters are provided in the fresh-air chamber in the attic, four in number, with six extra ones for replacing the dirty ones when removed for cleaning. The cheese-cloth is stretched on a 1/16-inch mesh painted-iron netting fitted in iron frames. The four filters are arranged so that the air can be forced to pass them in series if necessary.

The quantity of air required to be delivered by the fan supplying the second story—that is, the banking rooms, is about 8,500 cubic feet per minute, 7,500 cubic feet going to the main banking room; that by the fan supplying the basement rooms about 7,500 cubic feet per minute, including 4,900 to the main vault room, and that by the fan for the vault proper 300 cubic feet per minute. On this basis the velocity of flow through the vertical ducts dropping from the heating chamber in the attic to the basement, which are necessarily long and narrow in cross-section to accommodate their location at the walls, is in the three cases about 1,360, 1,315 and 530 feet per minute, respectively. These flues are connected at their bases by short duct connections into brick chambers, constructed similarly to the attic heating chamber, except that I-beam and book-tile roofs are provided short of the basement ceiling to allow the passage of ducts across overhead. These chambers are equivalent to a considerable enlargement of the area of cross-section of flow, the largest being 6 x 6 feet in inside plan dimensions, so that they serve as settling chambers, tending to allay dust so that as little may be carried farther as possible.

The fans are connected directly to the settling chambers, and, as stated, are of the centrifugal type, made by the American Blower Company, of Detroit. They are arranged with the single inlet; two have blast wheels 54 inches in diameter and 21 inches wide at the periphery and one has a blast wheel 42 inches in diameter by 6 inches wide. Each is driven by belt from its own electric motor, made by the Northern Electric Manufacturing Co., of Madison, Wis., and at speeds of 245, 240 and 210 revolutions per minute for the three systems in the order named, and motors of 4½, 4½ and ¾ horse-power capacity, respectively. The fans are mounted on a brick foundation, laid in Portland cement, of pressed brick above the floor line laid with tinted joints, and the whole capped with 6-inch stone. The motor foundations are hardwood on brick.

The specifications required that the total friction losses in forced air ducts under normal speed of the fans should not exceed the following values: Basement system, 0.33 ounce per square inch; vault system, 0.15 ounce per square inch; second-floor system, 0.34 ounce. The requirements for the exhaust fans may also be mentioned. The friction loss in the exhaust air ducts from the basement, the fan exhausting under normal speed, was limited to 0.25 ounce; that in the exhaust ducts from the second-floor system, 0.20 ounce; that in the exhaust system from the toilet rooms, 0.11 ounce per square inch.

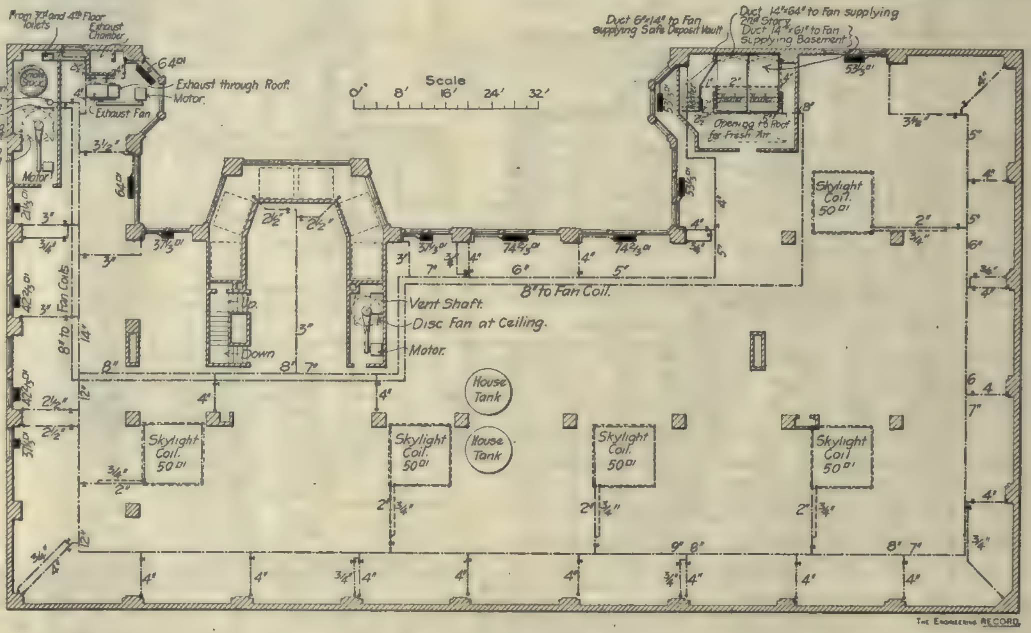
In general the air is forced into the rooms at or near the ceiling and is exhausted at the floor line, the warm air delivered to the second floor rooms being introduced for ventilation only, being supplemented by radiators. The ducts are connected to the fans as indicated in the basement drawing, with canvas joints, 2 feet long. They are of galvanized iron throughout and are proportioned from the diagrams computed and plotted by Mr. Carl S. Fogh in The Engineering Record of February 16, 1895. The whole system is designed so that the loss of pressure due to friction is equalized throughout the system so as to produce a distribution of air as desired; and the idea is to avoid using volume dampers to bring about this result at the expense of added resistance in the air passages and increased power at the fan for the same result. At every junction of branch ducts with the main or sub-main ducts, however, air splits are hinged to ensure the diversion of the desired amount into the branch, but these point against the air current edge on.

The mechanical removal of air from the building is obtained in part, as stated, by two centrifugal exhausters in the basement, designed to take somewhat less air than delivered by the plenum blowers. The outlets of the exhaust fans are provided with hinged dampers operated by chains and weights from the floor of the exhaust chambers, these being provided, as in the case of the fresh-air blowers, on the suction side of the fan, forming a chamber into which the ducts empty. The discharge from each of these fans is carried up alongside the smokestack to an opening in the wall above the second floor. Each toilet room adjacent to the vent shaft is ventilated through a register opening into the shaft, behind which is a hood extending upward to prevent back drafts. The bottom of the shaft is closed so as to prevent air other than that through the registers provided from getting into it. Each disk fan is designed to exhaust 14,000 cubic feet of air per minute when run at 200 revolutions per minute.

A test was required before acceptance, of six hours' duration under normal conditions. It was specified that the velocities should be the average of five one-minute readings taken at the four corners and at the center and anemometer held 1 inch away from the register face.

The steam end of the plant represents a low-pressure gravity heating apparatus, with an overhead distribution in the attic over the twelfth story, and all radiators, amounting all told to 32,000 square feet of surface, connected on the one-pipe system. Besides this the heater coils in the attic, amounting in surface to about 1,600 square feet, are maintained as well on the gravity system, that is, with a direct return to the boilers without mechanical means. No steam engines, such as are frequently installed in the modern office-building plant having as yet been put in, the boilers can thus be operated at comparatively low pressure, the house and fire pumps and such machinery being of the power type and driven by electric motors.

There are four boilers all told, of 125 horse-power capacity each, and of the locomotive fire-box type, made by the Kewanee Boiler Company, the use of these boilers requiring comparatively less head-room and avoiding the excavation and construction of boiler pits otherwise necessary. The diameter of the shell is 72 inches, firebox 62 inches long and 66 inches wide, water leg 14 inches; each boiler contains 80 4-inch tubes, 14 feet long, and the smoke extension is 16 inches long. The shells are ⅜-inch flange steel; head and firebox, ½ inch thick. An arched baffle plate is attached to the inside of the boiler shell, to take the place of a dome. The arch is sprung from the shell of the boiler at water level and rolled to such a radius that there is a space of about 8 inches between the crown of the arch and the top of the shell of the boiler; it extends 3 feet each way from the openings on top.



PLAN OF THE ATTIC.

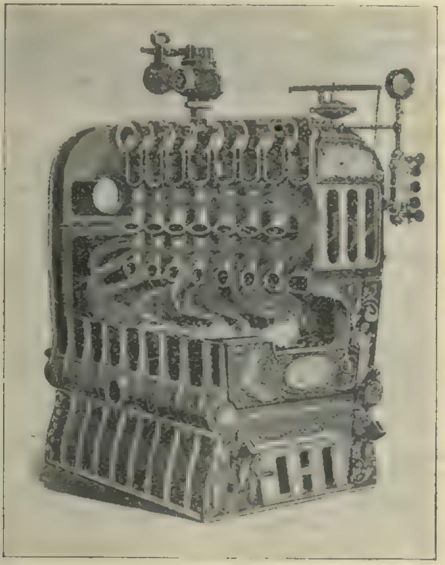
Each boiler is provided with a forged steel flange for an 8-inch steam supply and all supply pipes are brought forward and connected into a 24-inch steam drum, suspended overhead from the ceiling I-beams and at a height sufficient to take the boiler connections at the bottom so that they may carry condensation back into the boilers. The drum is of 5/16-inch steel with head ⅜ inch thick. Three of the boilers, as indicated on the basement plan, are located side by side, while the fourth is located in the rear. The connection from this is not brought into the header or drum directly, but may instead be run to supply the main for the basement and first floor, these having a separate system of mains, not being connected on the overhead system mentioned. Besides a 6-inch connection for this basement and first floor steam main, there are also two steam mains taken from the header, one 14 inches in diameter, being the main heating supply riser which is carried that size through the shaft containing the smokestack, and the other 8 inches in size, the latter main for the indirect heating coils in the attic and passing alongside the smokestack. The run of the mains in the attic is shown in the attic plan. The 14-inch pipe for a short distance remains that size and then subdivides into two mains, passing along near the opposite sides of the building and supplying comparatively short horizontal branches to the dropping lines of supply risers, but long enough to provide for expansion. The 8-inch main runs the full size to the heaters which it supplies. The attic mains are supported from the roof beams by hangers.

The dropping lines of pipes, as stated, are used both to supply the radiators and to carry the condensation to the basement, and each pipe is controlled by a valve near the attic main and at the base before connecting into the basement return main. The two main supply risers are supported at the bottom on a pipe standard resting on a concrete foundation, so that expansion is upward throughout the entire length; the pipes are secured to the beams at every floor to maintain a vertical alignment. The distributing risers are anchored at the third and seventh floors. The water of condensation is returned by gravity to a steel header similar to the steam header and set on cast-iron saddles a few feet above the basement floor so that it may be drained into the boiler through the return connections taken from the under side to the boilers. Each main from the steam header has a return to this header, and as the rear boiler has an independent steam connection to the basement and first-floor heating system, so it has a direct connection with the return from that system. The radiators are equipped with the Paul system of removing air from them and the radiators in general are controlled automatically by Power's thermostats. The piping is covered with the Chicago Fire-Proof Covering Co.'s high-pressure asbestos moulded sectional covering. The boilers are covered with 2-inch moulded asbestos blocks, laid on wire netting supported 1½ inches from the shells and the blocks are coated with ½ inch of asbestos cement felting. Air cell covering 1½ inches thick is used instead of blocks on the breeching, and the air space is 1 inch.

The building was erected from the plans of Messrs. D. H. Burnham & Company, of Chicago, and the heating and ventilation was designed by Mr. C. M. Wilkes, engineer for the architects. The L. H. Prentice Company, of Chicago, installed the apparatus. The cost of the work described was about $60,000.

The New Walker Boilers.

The accompanying illustration shows the new Walker boilers, for steam and water heating, now being made by the Walker & Pratt Manufacturing Company, 31-35 Union Street, Boston, Mass. While this firm has made boilers for over thirty years, it is believed that the new boilers are in advance of their earlier types in design. They are made in three widths of firebox, viz., 17, 22 and 32 inches, and almost any capacity can be had by varying the number of sections. They are numbered in three series, viz., 15, 20 and 30, and are made in nineteen sizes, ranging in capacity from 400 to 3,650 square feet of direct radiation, for water; and 240 to 2,200 square feet of radiation, for steam.

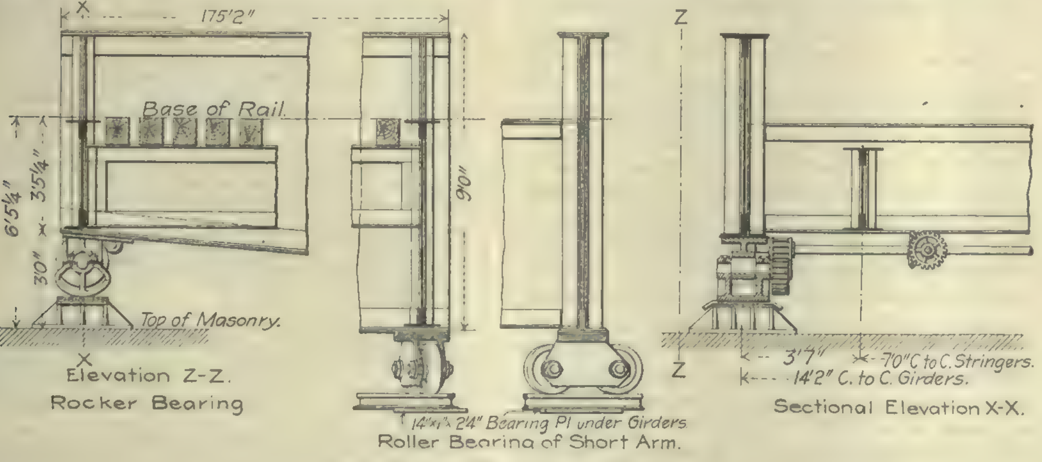


The fireboxes are of sufficient depth to carry fire from 14 to 16 inches thick, if desired, so that the fire can be kept uniform during the night. The boilers are strong and will be found durable and economical in the use of fuel. The sections are connected together by the use of push-nipple joints. Triangular grates are supplied in the 15 and 20 series, and rocking or triangular grates in the 30 series. When the boilers are used for steam they are supplied with the usual trimmings, and all types have ornamental and well-designed fronts.

Plate-Girder Draw-Bridge Details.

A plate-girder draw-bridge on the line of the Chicago, Milwaukee & St. Paul Railway, illustrated in The Engineering Record of July 6, 1901, has 175-foot plate girders, which, at one end, are counter-balanced and travel on two-wheel trucks on a segmental track rail and at the other end take bearing on suspended rockers resting on fixed pedestals and raising the bridge enough to develop abutment reactions for an unloaded structure. Power from the motor is transmitted through a 2¼-inch longitudinal shaft and a miter gear to drive an end transverse shaft. At each end of this shaft there is a pinion with ten teeth engaging another with thirty teeth which is keyed to a short shaft with bearing in a casting on the under side of the end of the main girder. Outside the bearing there are two crank arms with 1-inch eccentricity, from which the rocker casting is suspended. This casting is U-shaped in cross-section, with half holes in the top and caps which bolt on to lock it to the shaft. The lower surface of the rocker is part of a cylinder with a horizontal transverse axis, and takes bearing on a thick horizontal plate with its ends bent down on each side of the pedestal to guide the rocker up if necessary in coming to the closed position. The height of this plate is adjusted by shim plates between it and the top of the cast-iron pedestals.

The opposite or counterbalanced end of each main girder has, on the end of the lower flange, a beveled shoe plate with an adjustable shim plate bearing on the top of a pedestal mounted on two coned wheels which roll on the segmental rail. The end transverse shaft which operates the rocker bearing is geared 1:3 to a parallel shaft which operates at each end, a 1¾-inch eccentric, with a vertical arm carrying, above the tops of the girders, a horizontal transverse angle with seats which engage and lift the ends of the track rails. This bridge was designed under the direction of Mr. Onward Bates, while engineer of bridges of the railway, and Mr. Albert Reichmann, assistant engineer.



Elevation Z-Z.
Rocker Bearing

Roller Bearing of Short Arm.

Sectional Elevation X-X.

Plate Girder Draw-Bridge Details.

The Collapse of a Long Plate-Girder Bridge.

On July 3, 1897, a masonry arch bridge of five 29½-foot spans across the Adour River, at Tarbes, France, on the Toulouse & Bayonne Railroad, was partly destroyed by a flood and about 138 feet of the structure was washed away. The French army engineer corps has provided adjustable emergency bridge spans of different lengths which are kept in stock in order to quickly re-establish train service when bridges are destroyed in war time. One of these spans, of 147½ feet, was requested for temporary service, and official arrangements at Versailles having been completed by July 9, it was shipped to the site, assembled and erected by protrusion, so that it was ready for traffic July 16. On July 17, while being subjected to the second of a series of static load tests, it suddenly collapsed and fell to the bottom of the river, one of the girders breaking in two, and both being badly twisted.

The bridge was of the Marcille type, with two plate girders 7.2 feet deep and 147½ feet long, each made in five sections, one of about 33 feet in the middle, two of 24½ feet on each side, and one of 8¼ feet at each end. The ⅜-inch web was made in two longitudinal strips spliced in the center of its height with two horizontal longitudinal cover plates. Each flange had a 24 x 1½-inch section made up of two 5 x 5 x 9/16-inch angles and several cover plates. At every 8¼ feet the web was stiffened on each side by a vertical angle riveted to it with the ends curved 90 degrees and connected to the top and bottom flange cover plates outside the flange angles, by two 9/16-inch rivets each. To these angles were riveted transverse vertical diaphragm plates about 11 inches wide, with a light vertical flange angle on the outer edge. The space between these main stiffeners was divided into three equal panels by single T-bars riveted to the web and having bent ends riveted to the flanges. The sections of the girder were field spliced by turned horizontal longitudinal bolts through the reinforced end vertical web stiffeners, and by horizontal cover plates on both sides of each flange.

The girders were spaced 5 feet apart on centers and were connected only by horizonal transverse struts 8 feet apart, with no sway-braces or lateral diagonals whatever. The upper struts had 20-inch webs and were connected to the girder webs and top flanges respectively with ten and four bolts at each end. The lower line of struts were in the vertical planes of the upper ones, and were each composed of a pair of angles bolted to the bottom flanges of the girders. The total weight of the span was 208,000 pounds, of which 14,000 pounds was track weight. The rails were laid directly over the centers of the girders, which had bearings 145.3 feet apart on centers. Just before the test the girders showed a center vertical deflection of 2.322 inches under dead load alone, and a lateral deflection upstream of 1.693 inches in the total length. On the previous afternoon the lateral deflection had been 2.283 inches.

The tests were made with two locomotives and their tenders and a loaded car. Each locomotive weighed 59,525 pounds on four axles, each tender weighed 20,062 pounds on two axles, and the car weighed 33,000 pounds on two axles. Four Manet instruments were attached to the girders to measure the vertical deflections under the test loads, and two observers were stationed between the girders in the middle of the span to record their indications.

In the first test the train advanced very slowly until the first axle of the first locomotive was in the center of the span, and after remaining stationary there for 30 minutes, backed off, leaving the span just 38 minutes after having entered it. This train load caused an additional deflection of 2.28 inches in the axis of the bridge, an amount which was constant during the time of the test and which did not entirely disappear after the locomotives were withdrawn, but caused a permanent set of 2.79 inches, or an increase of 0.47 inch more than the dead load deflection at the commencement of the test. The track was observed to be 0.98 inches lower over the upstream girder than over the downstream girder in the middle of the span, thus indicating unequal deflections in the girders. These results were considered normal and the irregularity of deflections was attributed to variations in bolting up the sections of the girders.

The second static test, which was to cover the whole length of the span with the train load, was then immediately commenced. One minute after passing the first abutment, and when the forward axle of the front locomotive was within about 25 feet of the opposite abutment, the upper parts of the girders buckled upstream and they turned over, falling to the bottom of the river and carrying the train with them. The girders tipped over and twisted so as to fall on their sides in the center. They fell upstream, the upstream girder falling on the bottom and the other one nearly on top of it. The forward locomotive fell clear of the span upstream, and the other locomotive fell partly on the span, near the center. The girders were broken and bent so as to make a sharp angle, pointing upstream, near the middle of the span. At this point the webs of the girders were in a nearly horizontal plane; at the ends they remained near the tops of the abutments in planes inclined about 45 degrees to the vertical, thus making warped surfaces. At the moment of failure the deflection instruments were working regularly and had not indicated any abnormal action in the girders. The observers heard two snapping noises like the sound of pebbles thrown against glass, followed immediately by a succession of similar rapid snaps, and the span collapsed, leaving the abutments and timber seats uninjured.

The upstream girder was broken entirely across in a direction nearly perpendicular to its length, at a point about 8 feet from the center on the loaded side. The adjacent section of the loaded side of the girder was torn and buckled and the vertical web stiffener at the point of fracture was torn apart from end to end; partly through one flange, and partly through the other. The downstream girder fell on top of the other and was not so badly injured, though the center section was torn and buckled, but was not entirely broken across. The cross struts between the girders were bent and their connections injured.

In the upstream girder the three cover plates of the top flange were broken through in the line of five rivets and the fracture extended through the chord angles and web, following the lines of rivets first on one and then the other side of the vertical web stiffener. In the lower flange the fracture extended about 2 feet longitudinally and included twelve headless rivets. The downstream girder had the top flange broken half way across, and the other side of it was buckled at the connection of the horizontal strut from the point of rupture of the other girder. The web was bent but not broken and the lower flange was injured but not broken through.

The conclusion of the engineers present was that the top flange of the upstream girder began to buckle at the point of maximum flexure about 65 feet from the loaded end, and first snapped the heads off the two rivets through it and the vertical web stiffener there, and the increasing lateral deflection broke the rivets in the web stiffener and transverse struts and warped the girder till it buckled out and collapsed, bringing the downstream girder with it.

It is said that lateral and sway-bracing in these military emergency bridges was omitted to simplify erection and reduce weight, and that it was intended to stiffen them with wooden bracing or by some other convenient expedient. A special committee was appointed to investigate this accident and recommended changes in the designs of such spans, which have been made, resulting in structures which have satisfactorily withstood severe wind and traffic tests.

An account of the accident, together with a description of the bridge, calculations of its strength and views of the girders, is published in the June "Bulletin" of the Society of Civil Engineers of France.

Personal Notes.

Mr. W. A. Foster, of San Pedro, has been appointed city engineer of Long Beach, Cal.

Messrs. Waddell & Hedrick have removed their consulting engineering offices to the new Nelson Building, Kansas City, Mo.

Mr. E. L. Masqueray, of New York, has been appointed by Chief Architect Taylor as chief designer for the Louisiana Purchase Exposition at St. Louis. He was born 40 years ago in France, where he studied and practiced until he came to New York, at the age of 27 years, and for the last nine years has conducted a French atelier in New York for the study of architecture.

Mr. Robert T. Creighton has been appointed by the Executive Committee of the Tennessee Good Roads Association to take charge of the building of a stretch of model road in Nashville for the Good Roads Convention, to be held there early in October.

Mr. J. I. Lyle, who for the past five years has been connected with the home office of the Buffalo Forge Company, and later as New York State representative, with headquarters at Syracuse, has been appointed manager of the New York office at 39-41 Cortlandt Street.

Maj. W. H. Bixby, Corps of Engineers, U. S. A., Mr. Howard A. Carson, M. Am. Soc. C. E., of Boston, and Mr. Alfred Noble, M. Am. Soc. C. E., of Chicago, have been chosen by the Cincinnati Water-Works Commission to investigate the kind of materials to be excavated at the California settling reservoirs in connection with a controversy over a contract with Mr. August J. Henkel.

The Central States Water-Works Association will hold its fifth annual convention at Evansville, Ind., October 1-3. Mr. Fred Baker, Evansville, is president of the local committee in charge of exhibits.

An Unusual Pumping System used at Winchester, Ind., was described by Mr. D. W. Mead at the last meeting of the Iowa Engineering Society. There are two 45-horse-power gas engines, one belted to a suction pump connected with a battery of driven wells and the other direct-connected to a triplex pump. There is no water tower, the system being direct-pumping with the engines running continuously. The gas engine runs at a uniform velocity, so to compensate for the fluctuating draft on the mains, there is a pneumatic tank 14 feet long and 4 feet in diameter, connected with the pump by a large by-pass and special valve. This valve is set so that when the pressure at the pump reaches 45 pounds, it will open and allow the water to pass around through the pump again. A check valve holds back the water in the main, which is fed from the tank until the pressure again falls below 45 pounds, when direct pumping is again resumed. Mr. Mead says he has seen the valve open and close as many as 120 times in a minute.

Boiler Proportions in Marine Engineering have undergone a remarkable change in the last thirty years. The average ratio of heating surface to grate area in the case of a number of forced-draft steamers built within recent months is 42 to 43, while the average from 30 steamers with natural draft is 38.3. Ten years ago the mean for 28 steamers was 31 and 20 years ago the mean for 39 steamers was 30.43, so that the modern cylindrical boiler has 30 per cent. more heating surface per square foot of grate. Mr. James McKechnie, who gave the foregoing figures, in a paper before the Institution of Mechanical Engineers reviewing marine engineering for the last ten years, said that the amount of coal burned per square foot of grate per hour in 1881 was 13.80 pounds, in 1891, 15 pounds, and at the present time, with natural draft, 18 pounds, and with forced draft, 28 pounds. The heating surface allowed per unit of power is, he said, 3 square feet, as compared with 3.275 pounds ten years ago and 3.91 pounds 20 years ago. He figured that the increase in steam pressure and other changes has enabled the power per ton of boiler to be considerably increased, 23 indicated horse-power per ton including fittings, now being attainable in Atlantic liners and 30 indicated horse-power in high-speed steamers crossing the English Channel.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Greenwood, Miss.—Bids are wanted Nov. 1 for the construction of a system of water-works and sewers, as advertised in The Engineering Record.

Madison, Minn.—Village Recorder Jas. H. Chalmers writes that this village is in need of water-works and the probabilities are that steps to construct same will be taken within the year.

Dublin, Ga.—See "Schools."

Allegan, Mich.—Township Clk. Henry L. Green writes that on Sept. 11 it was voted to construct a new pumping station at the water-works plant.

Thorold, Ont.—James Battle, Thorold, has submitted to the Town Council a proposition to construct a system of water-works, estimated to cost about $40,000.

Windsor, Mo.—City Clk. A. L. Duff writes that the question of constructing water-works next spring is under consideration. F. C. Livingston is interested.

Ft. Plain, N. Y.—F. K. Baxter, of Utica, is making surveys looking forward to the extension of Ft. Plain water-works.

Atchison, Kan.—The Atchison Water Co. contemplates enlarging its works. E. S. Wills, Supt.; John D. Davis, of St. Louis, Mo., President.

Sacramento, Cal.—The Water Committee appointed by the Mayor nearly two years ago has just reported. The majority report favors filtration of Sacramento River water, while the minority report favors procuring water from wells east of the city. The choice will be made by the people at municipal election in November next; when the question will be submitted to vote.

Los Angeles, Cal.—Bids will be received, according to local press reports, until Oct. 21 for $2,000,000 water bonds.

Litchfield, Conn.—Bids are wanted for constructing a side hill ditch, 2,500 ft. long, averaging 15 ft. wide at top, 3 ft. at bottom and 4½ ft. deep. Address Henry S. Munroe, Engr., Litchfield Water Co., Litchfield.

Breese, Ill.—J. O. Koch, Chmn. of The Breese Water & Improvement Co., writes that bids will be opened Sept. 28 for the construction of water-works extensions estimated to cost $12,000. Address, Henry W. Schroeder, Sec'y of Co.

Pittsfield, Mass.—Bids will be received by the Board of Public Works, at Pittsfield, until Sept. 27, for completing the dam at Ashley Lake, in the town of Washington. Estimated quantities: 1,450 cu. yds. concrete, 441 cu. yds. stone masonry, 3,340 sq. ft. stone coping 8 in. thick, 292 cu. yds. earth excavation, 3,000 cu. yds. earth embankment, 540 sq. yds. cobblestone paving, gate house superstructure, etc. The contractors to whom this contract was awarded last January gave up the contract recently. Jas. L. Bacon, Chmn. Bd. Pub. Wks.

Seattle, Wash.—The Council is stated to have passed a resolution for a water main on 19th Ave., to cost about $12,500.

Charlotte, Mich.—An election will be held Sept. 30 to vote on issuing $30,000 bonds for a sewerage system and $20,000 for improving the pumping facilities at the water-works.

Whitehall, Pa.—The Township Commissioners have granted the Whitehall Crane Water Co. the right to lay water mains throughout that township.

Gilboa, N. Y.—The Gilboa Water Co. has been incorporated with a capital of $15,000 to supply Gilboa with a wholesome water supply. The directors are: H. Louie Reed, Daniel V. Chichester, Frank R. Thomas, of Gilboa, and others.

Kokomo, Ind.—The City Council on Sept. 13 is stated to have contracted with the Wayne Eng. & Constn. Co., of Ft. Wayne, for the construction of a municipal water plant at a cost of $177,000, with 200 public hydrants.

Kansas City, Mo.—The Board of Public Works has recommended an appropriation of $4,400 for a new boiler at Quindaro.

Marlin, Tex.—An election will be held Oct. 8 to vote on the issue of $18,000 bonds for water-works and $20,000 bonds for a public school.

Lexington, Mass.—The citizens are stated to have voted Sept. 12 to issue $10,000 bonds to extend the water-works and secure an additional supply.

Sardis, Miss.—G. Jackson, of Nashville, Tenn., has been selected as the engineer in charge of constructing water-works, for which $15,000 bonds have been voted.

Atlanta, Ga.—The Board of Water Commissioners has under consideration a proposition for the purchase of land at a cost of $32,400, on which to locate a new reservoir.

Whitney Point, N. Y.—The Whitney Point Water-Works Co. is reported to have been organized to supply the village with water. F. C. Reynolds is reported interested.

Brownsville, Tex.—The Brownsville Irrigation Co. has been incorporated, with a capital of $10,000. Incorporators: Jose Celaya, M. H. Cross and F. Y. Furria.

Dowagiac, Mich.—The Board of Public Works recommends the purchase of a 3,000,000-gal. high-duty compound, surface-condensing, horizontal, crank and fly-wheel pump. Estimated cost, $12,000.

Nineveh, Pa.—A charter has been granted to the Seward Water Co., of Johnstown, capitalized at $5,000. Incorporators: George H. Brown, Frank W. Otto, John A. Grazier and others. It is proposed to construct water-works in the vicinity of Nineveh.

Kankakee, Ill.—The Kankakee Water Supply Co. is reported to have awarded a contract to the Norwood Engineering Co., of Florence, Mass., for the construction of a filter, to cost $30,000 to $40,000.

Dillon, Mont.—In a recent communication to the City Council Mayor White urges the installation of a system of water-works.

Sydney, N. S.—Press reports state that an appropriation of $250,000 has been voted for water-works, sewerage, street and school purposes.

Berwick, Me.—The Berwick Water Co. has been organized to supply Berwick with water for domestic, sanitary and municipal purposes, including the extinguishment of fires. Capital, $50,000. Pres., Casper E. Marshall; Treas., Wm. G. Spencer, both of Berwick.

Lemoore, Cal.—City Clk. W. F. Holser writes that a vote will be taken Oct. 1 on the issue of $22,000 bonds for water-works and an electric light plant.

Elwyn, Pa.—The contract for constructing a half million gallon reservoir for the Penna. Training School for Feeble-Minded Children at Elwyn was awarded Sept. 12 to Geo. S. Cheyney, 1217 Filbert St., Philadelphia. The American Pipe Mfg. Co., of Philadelphia, are engineers.

La Harpe, Kan.—City Clerk E. L. Runyan writes that an election will be held Oct. 7 to vote on the question of constructing water-works at a cost of $14,000.

Auburn, N. Y.—The contract for a new pump house is stated to have been awarded to D. W. Barnes & Son for $14,344.

Winthrop, Minn.—Prof. John J. Flather, University of Minnesota, Minneapolis, has prepared plans for the proposed $10,000 water-works and electric light plant. Bids are wanted Sept. 25 for drilling a well. C. E. Larson, Village Recorder.

Lakewood, O.—Bids are wanted by the Hamlet Board of Trustees until Oct. 5 for furnishing material and laying a water main in a portion of Clifton Boulevard. John French, Hamlet Clk.

Grand Rapids, Mich.—City Engr. L. W. Anderson writes that approximate estimates are being made of the cost of extending the intake about 4 miles up the river, with pumping station at that point, the extension of city distribution and the construction of a new standpipe.

Whatcom, Wash.—City Clk. Wm. H. Hildebrand writes that it is proposed to construct a new water main from Lake Whatcom to the city, but that the appropriation for same has not yet been made. E. C. Lyle, City Engr.

Juneau, Wis.—Bids are wanted Sept. 27 for drilling a well of sufficient depth and capacity to furnish at least 7,000 gals. per hour. W. A. Sanborn, City Clk.

Colorado Springs, Colo.—The Sub-Committee of ten appointed to investigate the various water proposals which have been presented to the City Council, has reported in favor of accepting the Seven Lakes proposal.

Spokane, Wash.—Press reports state that the Colorado Fuel & Iron Co., of Denver, has secured the contract to furnish 8,050 ft. of 16-in. pipe and 2,750 ft. of 12-in. pipe, at $36 per ton. Holley, Mason, Marks & Co., received the contract for 4,150 ft. of 14-in. pipe at $1.90 per ft.

Southington,- Conn.—The Southington Water Co. is said to be considering the construction of a new filter dam at the reservoir, estimated cost $25,000.

Niles, O.—Press reports state that $5,000 water-works improvement bonds were voted at the recent election.

Bloomfield, Neb.—Bonds to the amount of $3,900 have been voted for extending the water-works.

Denison, Tex.—Press reports state that the Missouri, Kansas & Texas R. R. has purchased ground in this city and will erect a 3,250,000-gal. reservoir. Probable cost, $70,000. S. B. Fisher, Ch. Engr., St. Louis, Mo.

Gas City, Ind.—The Water & Light Committee has been directed to present plans and specifications and probable cost of the necessary addition to the water and light plant.

Anthon, Ia.—The construction of a water-works system is said to be under consideration.

Cambridge, Wis.—W. G. Kirchoffer, of Baraboo, Wis., is stated to have been engaged to prepare plans and specifications for a water-works plant.

Centralia, Ill.—Local press reports state that bids received Sept. 9 for constructing an earthen dam for a reservoir have been rejected and that new bids will be opened Oct. 4. Wm. Hahn, Chmn. Water Com.

Midland, Ont.—Bids will be received Sept. 30 for $60,000 water-works bonds. D. L. White, Jr., Chmn. Com.

Trenton, O.—The Village Council has under consideration the question of building water-works.

Sandy Hill, N. Y.—H. M. Geer, of Ballston Spa, is stated to have prepared plans for the enlargement of the village water supply. J. J. Cunningham, Chmn. of Water Com.

McRae, Ga.—A vote of the citizens will soon be taken on the question of constructing water-works and an electric light plant.

Webster, S. D.—Prof. John J. Flather, University of Minnesota, Minneapolis, is preparing plans for water-works and electric lights, $25,000 bonds for the construction of same having been voted recently.

SEWERAGE AND SEWAGE DISPOSAL.

Havana, Cuba.—The date for receiving bids for the sewerage system and street paving has been extended from Sept. 25 to Oct. 23, as advertised in The Engineering Record.

Boston, Mass.—Bids are wanted by the Metropolitan Water & Sewerage Board until Oct. 8 for building part of Section 75 of the high-level sewer in Roxbury, as advertised in The Engineering Record.

Kansas City, Mo.—Plans have been prepared for following sewers: Roanoke Joint District sewers, 8,000 ft., ranging from 24 in. to 7 ft. 6 in. interior diameter; cost, about $65,000. Westport Joint District sewer, 8,000 ft. brick sewers, ranging from 24 in. to 7 ft. 8 in. interior diameter; cost, $75,000.

Barberton, O.—Bids are wanted Oct. 7 for constructing a storm sewer in Dist. No. 1 with the necessary appurtenances. W. A. Witner, Clk. Village Council.

Duquesne, Pa.—Bids are wanted Sept. 23 for constructing a terra cotta pipe sewer in Ravine and Parallel alleys and Matlack St. S. A. Taylor, Boro. Engr., 339 5th Ave., Pittsburg.

Anaconda, Mont.—Bids will be received Oct. 7 for sewers in several alleys. G. S. E. Wisner, City Clk.

Akron, O.—Bids are wanted Sept. 28 for a local sewer in Payne and Byers Aves. Chas. H. Isbell, Clk. Bd. City Commrs.

Greenwood, Miss.—See "Water."

Stockton, Cal.—Bonds have been sold for a 16-in. cast iron pipe outfall sewer to cost $22,000 and rain water sewers to cost $30,000.

Marysville, Kan.—Bids are wanted Sept. 23 for the construction of sewers. D. P. Armstrong, City Clk.

Milwaukee, Wis.—West Side sewerage bonds, amounting to $50,000, have been sold.

Lockport, N. Y.—City Engr. Julius F. Frehsee is preparing plans for about 3,000 ft. of sewer to be built in Lock St. and Richmond Ave.

Westboro, Mass.—J. J. Van Valkenburg is reported to have prepared for the State authorities a plan for the disposal of the sewage at Westboro Insane Hospital.

Charlotte, Mich.—See "Water."

St. Joseph, Mo.—The Finance and the Street & Alleys Committees have agreed to favor the appropriation of $4,000 for 24th St. and $6,000 for Blacksnake sewers.

Zanesville, O.—The Council is stated to have passed a resolution providing for the establishment of Northwestern Sewer District No. 4.

Fowler, Ind.—Wm. F. Frey is stated to have received the contract for constructing sewers for $8,495.

Riverton, N. J.—Plans for the proposed sewerage system, estimated to cost $3,000, have been accepted by the Borough Council.

Houston, Tex.—The bid of H. Shurter, of Houston, for the Hardy St. sewer, at the approximate cost of $32,970, has been accepted by the City Council.

Syracuse, N. Y.—Bids are wanted Sept. 23 for a 12-in. pipe sewer in Clover St. and a 15-in. pipe sewer in Renwick Ave. Jos. H. Saunders, City Clk.

Dorrancetown, Pa.—Boro. Engr. W. B. Alleger, Luzerne, Pa., writes that the proposed sewerage system will cost ultimately $75,000, and that work to be done at once will cost $40,000. C. B. Johnson, Chmn. Sewer Com.

Lakewood, O.—Bids are wanted by the Hamlet Board of Trustees until Oct. 5 for constructing part of section 3 of the general sewer system. John French, Hamlet Clk.

New Castle, Pa.—The Council has passed bills for the construction of local or lateral sewers in Logan St. and Moody Ave., and Sycamore St.

Xenia, O.—Bids are wanted Oct. 17 for furnishing the necessary sewer pipe, catch basins, flush tanks and other accessories and constructing lateral sanitary sewers in Sewer Dist. No. 1. Henry J. Farrell, Sec'y Bd. Sewer Commrs.

Buffalo, N. Y.—Bids are wanted Sept. 27 for a 12-in. tile sewer in a portion of Marilla St. and Woodside Ave. R. G. Parsons, Sec'y Bd. Pub. Wks.

Dayton, O.—Bids are wanted Sept. 27 for 600 lin. ft. of 36-in. brick, and 1,450 lin. ft. of 12, 18, 24 and 30-in. pipe sewer, 7 manholes and 16 catchbasins. G. F. Kuhns, President Bd. City Affairs.

New Orleans, La.—The Board of Drainage Commissioners has adopted a resolution directing the engineer to prepare plans and specifications for the improvement of the drainage on portions of Clarborne and Orleans Sts.

Lachine, Que.—A by-law has been passed by the Council, authorizing a loan of $37,000 to drain Dominion Park and the factories in that neighborhood, and to complete the general system of sewers.

Thief River Falls, Minn.—Press reports state that plans and specifications for a sewer system, prepared by City Engr. D. F. Stacy, have been accepted by the City Council.

Rome, N. Y.—Paving Inspector John L. Plunkett writes that the contract for sewer construction in South James St. has been awarded to John H. Cramond, of Rome, N. Y., for $1,950; the work includes 1,760 ft. of 10 to 18-in. pipe sewers, 5 manholes, 10 catch basins and 2 inlets; trench to average 6 ft. in depth.

Moorestown, N. J.—Sewer bonds to the amount of $45,000 have been sold.

Denver, Colo.—An ordinance has been passed creating sub-district No. 17 of Capitol Hill Storm Sewer District No. 1 and authorizing the construction of a sewer in said district. Frank Kratzer, City Clk.

Du Bois, Pa.—The Town Council has passed an ordinance providing for the construction of a sewer on West Scribner Ave. J. A. Vasbinder, Ch. Burgess.

Coldwater, Mich.—H. E. Riggs, of Toledo, O., is reported to have been engaged as engineer in charge of the construction of sewers.

Butte, Mont.—The City Council has passed a resolution for the construction of a district sewer on Maryland Ave.

Sydney, N. S.—See "Water."

Plainfield, N. J.—Bids are wanted Oct. 7 for furnishing material and constructing an addition to the present sewer system. Geo. B. Wean, City Clk. pro tem.

Torrington, Conn.—Bids are wanted Sept. 23 for constructing about 3,500 lin. ft. storm water sewers in several streets. W. H. Dayton, Chmn. Sewer Com.

St. Johnsville, N. Y.—The total estimated cost of constructing a sewer system is $16,000.

Marlboro, Mass.—The estimated cost of a new system of surface drainage is $20,000 aside from land damages. Jas. F. Bigelow, City Engr.; C. Coffin, of Boston, Consulting Engr.

Wausau, Wis.—Bids are wanted Oct. 7 for sewers in Warren and 7th Sts. John R. Patzer, City Clk.

Hartford, Conn.—The following bids were opened Sept. 11 by the Board of Street Commissioners for the S. W. extension of the intercepting sewer, the work to include 2,465 ft. of 30-in. brick sewer, 200 ft. of 18-in. tile storm drain, 30 ft. of 12-in. tile storm drain, 7 manholes, 60 yds. concrete, 10 cu. yds. extra excavation, 400 cu. yds. embankment. Time, 60 days. Engineer's estimate, $8,994: A, Michael O'Neil, Hartford $7,906 (awarded); B, Chas. H. Slocomb, $9,491; C, E. R. Patteson, $11,094; C, Robt. D. Maynard, $13,116. For detail bids see accompanying table.

Bidders.	30-in. brick.	18-in. tile.	12-in. tile.	Manholes.	Concrete.	Embank.	Excav.
A...........	$2.70	$1.23	$.85	$36	$6	$.38	$.45
B...........	3.30	1.50	1.00	30	8	.30	.60
C...........	4.00	1.00	.30	30	8	.30	.50
D...........	4.80	.80	.80	35	6	.70	.50

BRIDGES.

Peoria, Ill.—The construction of a viaduct or subway at Sanger St., in the south end of the city, is being considered.

Milwaukee, Wis.—An ordinance has been introduced by Alderman Grogan, providing for the issue of $250,000 bonds for the purpose of building a viaduct at Washington Ave.

Wysox, Pa.—The Owego Bridge Co., Owego, N. Y., is stated to have secured the contract for constructing the stone work and superstructure of the bridge across Susquehanna River for $36,300.

Ferndale, Pa.—The Grand Jury has recommended the construction of a county bridge, having a 200-ft. span, across Lehigh River, at Ferndale; also the construction of a bridge in Blacklick Township.

Seneca Falls, N. Y.—An election is to be held Sept. 24, to vote on the question of borrowing $11,000 bonds for the construction of the Rumsey St. bridge.

Beloit, Wis.—Local press reports state that bids will be received by the Board of Public Works, for the construction of a steel bridge.

Spokane, Wash.—The high-level bridge across Latah Creek has been condemned by the City Commissioners.

Kansas City, Mo.—Plans have been prepared by George E. Kessler, Engr. of the Park Board, for a steel plate girder bridge to be constructed at Benton Boulevard, at a probable cost of $24,000. The bridge is to be constructed jointly by the Belt Line Co. and the city.

Mansfield, O.—A resolution has been adopted by the City Council authorizing the City Engineer to prepare plans and an estimate of the cost of constructing a viaduct, either of steel and iron, or of brick and stone, at S. Mulberry St.

Long Island City, L. I.—Press reports state that the Long Island R. R. Co. has decided to spend $100,000 in the construction of bridges, particularly on the Wading River branch.

Passaic, N. J.—It is stated that the F. R. Long Co. submitted the lowest bid for the construction of Monroe St. bridge, at $29,912.

San Francisco, Cal.—The Southern Pacific Co. is reported to be contemplating the rebuilding of nearly all the bridges on the system. W. Hood, Ch. Engr., San Francisco.

Duluth, Minn.—Mayor Hugo has received permission from the War Department to construct an aerial bridge across the Duluth Ship Canal. The bridge, which is to be built by the American Bridge Co., will consist of a car, propelled by electricity, suspended on cables from a suspension bridge 140 ft. high, and will probably cost $150,000.

Chicago, Ill.—The contract for constructing a granite faced bridge in Jackson Park has been awarded to Page & Shnable, Security Bldg., Chicago, for $47,420.

Mankato, Kan.—Plans, specifications and bids will be received by the County Commissioners until Oct. 7 for furnishing material and constructing 2 stone arches, one across Plum Creek, the other across Disappointment Creek.

Ft. Worth, Tex.—City Engr. John B. Hawley is about to ask for bids to repair the wire bridge on Cemetery Road. Estimated cost, $3,200.

Boise, Idaho.—The County Commissioners have approved plans and specifications prepared by the County Surveyor for a bridge to cross Boise River, at Eagle Island.

Revere, Mass.—A bridge, 100 ft. wide, is to be built by the Metropolitan Park Board, the town of Revere and the Boston & Maine R. R., at Revere Station, to carry the parkway over the railroad tracks.

Port Perry, Pa.—W. H. Brown, C. E., writes that the Pennsylvania R. R. Co. proposes to rebuild the Port Perry bridge, but bids have not yet been asked.

Lampasas, Tex.—The counties of Lampasas and San Saba have voted in favor of building an iron bridge across Colorado River, connecting the two counties.

Milwaukee, Wis.—The City Engineer has been instructed to prepare plans for a bascule bridge at W. Water St.

Old Monroe, Mo.—It is stated that the K line will build a $145,000 bridge across Cuivre River, at Old Monroe. The bridge is to have 3 spans, 2 about 115 ft. long and one about 150 ft. long.

Watseka, Ill.—A $12,000 bridge is to be constructed across Iroquois River, at Sugar Island.

Detroit, Mich.—Plans have been prepared by E. A. Schilling for a bridge to cross Lake Tacoma. The bridge is to be constructed of sandstone and vitrified paving brick, and will cost about $3,200.

Miles City, Mont.—Bids are wanted, with plans and specifications, until Sept. 25, for furnishing material and constructing a 2-span steel bridge across Yellowstone River, on the Fort Leogh Military Reservation. Appropriation, $50,000. J. E. Farnum, Chmn. Bd. Co. Commrs.

St. Petersburg, Russia.—Competitive plans will be received by the Town Council until Sept. 1, 1902, Russian calendar (Sept. 14 our calendar) for 2 bridges to be constructed across Great Neva River. Address St. Petersburg Gorodskaja Uprawa, St. Petersburg.

PAVING AND ROADMAKING.

Toledo, O.—It is stated that C. W. Ryan has received the contract for constructing Dorr St. stone road at $17.50 a rod; total bid, $20,000.

Buffalo, N. Y.—Local press reports state that the following are the lowest bids received for repairing East, Hamilton and Ryan Sts.: H. P. Burgard, with asphalt, at $13,700, $4,800 and $10,300 respectively; L. H. Gripp, with brick, $17,500, $6,400 and $10,400 respectively.

South Norwalk, Conn.—The citizens have decided to repave E. Washington St. with vitrified brick, at a cost of $14,500.

Erie, Pa.—Paving bonds amounting to $70,000 have been sold.

Murphysboro, Ill.—The citizens are considering the need and cost of paving the streets of this city.

Findlay, O.—C. B. Metcalf is stated to have received the contract for paving 2d St., from Main St. to Washington Ave., with block, at $6,132.

Havana, Cuba.—See "Sewerage and Sewage Disposal."

Helena, Mont.—The paving of E. Park St. is contemplated.

Sharpsburg, Pa.—Local press reports state that bids will be received for grading and paving on Davidson St. and Linden Ave.; also for constructing a bridge at Bridge St. and a retaining wall from Main St. to the water-works. Address Borough Clerk.

White Plains, N. Y.—Paving contracts are stated to have been awarded as follows: To Bellew & Merritt, Westchester Ave., $18,153.54; North St., $12,309.20; Lake St., $3,138.60; Orawaupum St., $49,052.60; Battle Ave., $4,558; Tarrytown Road, $2,227.05. To Erbeck Bros., William St., $9,958.54; Cottage Pl., $2,845.96; Martine Ave., $19,451.55; Brookfield St., $14,460.80.

Upper Sandusky, O.—Bids will be received by E. N. Halbedel, Co. Aud., until Sept. 26 for grading and stoning roads in Pitt, Mifflin and Marseilles Townships, in all about 3 miles.

Kenosha, Wis.—Harding & Nelson, Racine, Wis., are stated to have submitted the lowest bid for 4,385 lin. ft. of brick pavement with crushed stone foundation, on Milwaukee Ave., at $1.34 per ft. Total estimated cost of pavement is about $50,000.

Newark, N. J.—The paving of Avon Ave. with granite block on a sand foundation is being agitated.

Toronto, Ont.—The Barber Asphalt Paving Co. is stated to have secured the contract for asphalt pavement on a portion of Euclid Ave. for $14,000. Contracts for macadamizing portions of Smith and De Grassi Sts. have been awarded, according to local press reports, to the Dominion Paving & Construction Co., at $3,699 and $4,624 respectively.

Seattle, Wash.—Stirratt & Goetz, of Seattle, have, according to local press reports, received the contract for macadamizing Madison St., from Broadway to 23d Ave., at $28,823.

Braddock, Pa.—At the November election the question of issuing $100,000 street improvement bonds will be voted upon.

Cambridge, Mass.—The Committee on Roads and Bridges has recommended to the Board of Aldermen that Bridge St., a distance of about 1,800 ft., be widened to 75 ft. Estimated cost of construction, $37,195.

Cleveland, O.—Bids will be received by the Board of County Commissioners until Oct. 16 for the grading, draining, curbing, concrete foundation, brick paving and asphalt paving on Detroit St. Wm. H. Evers, Co. Surveyor.

Mobile, Ala.—Bids are wanted Oct. 10 for $65,000 paving bonds. R. B. Owen, Jr., City Clk.

Ashtabula, O.—City Clk. Frank W. Wanger writes that the contract for improving High St., about 2,388 sq. yds., has been awarded to E. G. Pulman and H. Starkweather, of Ashtabula, as follows: Excavation, 770 cu. yds. at 30 cts.; furnishing and laying 6-in. concrete at 85 cts. per sq. yd.; 1½-in. sand cushion at 3 cts.; Metropolitan block at 76 cts.; laying and filling with sand at 20 cts.; total, $5,672.

Sydney, N. S.—See "Water."

Manistee, Mich.—The Common Council has passed an ordinance to encourage the construction of concrete sidewalks by contributing out of the city treasury 5 cts. per ft. toward the cost of same.

Atchison, Kan.—City Engr. Fred. Giddings has been instructed to prepare estimates of the cost of paving, curbing and culverting Atchison St. from 4th to 12th Sts., and bids for work will be received by the City Clk.

Chelsea, Mass.—The Commonwealth of Massachusetts has ordered the construction of 3-5 of a mile of State highway through Chelsea, at a cost of $12,400. Alfred L. Maggie, City Engr.

Grosse Point, Mich.—Bids are wanted Sept. 27 for paving and macadamizing the Mack road. Chas. A. Poupard, Jr., Highway Commr.

Farmington, Conn.—The Borough Council has voted to macadamize Main St.

Irwin, Pa.—Paving bonds amounting to $50,000 have been sold. The Borough Council intends paving the remainder of Main St. and Pennsylvania Ave. this fall, and as much more as the weather will permit, continuing in the spring until every street is paved.

Albany, N. Y.—The extension of Manning Boulevard, at a cost of $40,000, is being considered.

St. Paul, Minn.—City Engineer Claussen is preparing specification, on which bids will probably be asked this fall, for asphalt pavement on S. Wabash St. and Shelby Ave.

St. Joseph, Mo.—Local press reports state that bids will be received by the City Engineer for paving with brick on King Hill Ave., from 6th St. to Illinois Ave.

Indianapolis, Ind.—Paving contracts, for which bids were opened Sept. 16, have been awarded as follows: To Capitol Paving & Construction Co., Indianapolis, brick roadway in a portion of Adelaide St. at $1.28 per sq. yd.: To W. K. Cooper & Co., Indianapolis, brick roadway and oak margin in the first alley north of 30th St., at $1.21 per sq. yd.

Woburn, Mass.—Appropriations have been made as follows: $27,000 for macadam streets and $3,000 for new edgestone and concrete sidewalks.

Great Falls, Mont.—L. J. Creswell is stated to have received the contract for boulevarding 5th Ave., N., from Park drive to 12th St., at $6,546.

Sullivan, Ind.—Bids are wanted Oct. 14 for constructing 27,856 ft. of free gravel roads in Curry Township. J. M. Lang, Co. Aud.

Springfield, Mass.—A. A. Adams, Supt. of Streets, writes that there has as yet been no decisive action taken in regard to the proposed construction of a boulevard on the river front.

Kansas City, Mo.—The Barber Asphalt Paving Co. is stated to have secured the contract for repairing asphalt pavement on portions of 5 streets, on which the 5-year maintenance guarantee has expired, at $1.50 per sq. yd.; also the contract for asphalt pavement on 11th Ave., from Agnes to Indiana Sts., at $2.12 per sq. yd., total $8,020.

The contract for asphalt pavement on Penn St., from 31st to 33d St., is reported awarded to the Parker-Washington Co., at $2.15 per sq. yd.; total, $7,949.

Cincinnati, O.—Bids are wanted Oct. 18 for $35,000 bonds to be used to widen and improve streets over trunk sewers and bottom lands, for the purpose of providing against overflow from high water. Bids will also be received Sept. 30 for grading, curbing and paving the roadway with brick in Rider Alley. Geo. F. Holmes, Clk. Bd. Public Service.

Roseburg, Ore.—Bids are wanted Nov. 4 for grading and improving with crushed rock on certain streets. D. S. West, City Recorder.

Toronto, Ont.—Bids are wanted Sept. 24 for paving on portions of several streets as follows: with asphalt on 6 streets, with brick on May St., and macadam on Hayden and Balmuto Sts.; also for concrete sidewalks on several streets. O. A. Howland (Mayor), Chmn. Bd. of Control.

Barberton, O.—Local press reports state that bids will be received Oct. 7 for paving 2d and Tuscarawas Sts. and for putting in the storm sewer.

Bradford, Pa.—Bids are wanted Sept. 23 for paving, with brick, on Morrow Ave. and Washington St. E. C. Charlton, City Clk.

Edgewood, Pa.—Bids are wanted Sept. 24 for grading, paving and curbing a portion of Savannah Ave. R. L. Smith, Boro. Engr., 1011 Park Bldg., Pittsburg.

Council Bluffs, Ia.—The City Council has approved the contract awarded to E. A. Wickham for brick paving in the Fourth Ward. The contract calls for 35,260 yds. of paving, with Galesburg block top and Council Bluffs bottom, the contract price said to be $1.745 per yd.

Omaha, Neb.—The City Engineer has been instructed to begin at once the necessary repairs to asphalt pavements, the cost not to exceed $1.25 per yd. for asphalt and $4.50 per cu. yd. for concrete.

Reading, Pa.—Bids are wanted Sept. 26 for paving with vitrified block on a portion of Perkiomen Ave., estimated to cost about $14,000. Alex. Murdock, City Engr.

Houston, Tex.—Local press reports state that contracts for paving on portions of numerous streets have been awarded as follows:

To Hipp & Key, of Houston, sheet asphalt pavement on 5-in. concrete foundation of Portland cement and broken stone (with 5 years' guarantee); Congress Ave., Caroline to Milam Sts., cost $24,801; Congress Ave., Caroline to Chartres Sts., $34.292; Preston Ave., $38,397; Prairie Ave., cost $9,157; Travis St., $18,649; Franklin Ave., $22,837; Preston Ave., $13,286; Leland Ave., cost about $20,000.

To T. J. Shea, vitrified brick pavement on 5-in. concrete foundation of Portland cement and broken stone, with 5-year guarantee: Commerce Ave., cost $13,083.

To T. J. Shea, for vitrified brick pavement, on 6-in. gravel foundation, with 5-year guarantee, width of roadway to be 30 ft.: Odin and Lyons Aves., $24,770; Hardy St., cost $21,915.

POWER PLANTS, GAS AND ELECTRICITY.

Manistee, Mich.—The Common Council has awarded to Louis Sands the contract for the electric lighting for 10 years of 105 street lamps, at $70 per lamp per annum.

Baltimore, Md.—Supt. of Lamps & Lighting McCuen has prepared his estimate for lighting the city next year and will ask for an appropriation of $348,169. He proposes establishing 250 more electric lamps.

New Orleans, La.—Local press reports state the committee, consisting of City Engr. W. J. Hardee, City Electrician F. Olroyd and City Mgr. of Drainage A. Raymond, appointed to investigate the feasibility of establishing a municipal electric light plant, report the estimated cost of construction at $880,971, and the yearly cost of operating $124,250, or $88.76 per lamp per year. Present contract expires Dec. 31, 1902.

Willimantic, Conn.—It is stated taht the Willimantic Gas & Electric Light Co. will expend about $40,000 on improvements to the gas plant.

Fullerton, Neb.—The Fullerton Electric Light & Power Co. is reported organized, to construct a canal 229 ft. in length and a power plant with a capacity of 1,200 electric lights. I. I. Bennett, of Hastings, is reported interested.

Dublin, Ga.—See "Schools."

Easton, Pa.—The People's Steam Htg. & Power Co. has petitioned the Council for a steam-heating franchise. C. H. Bishop is a member of the new company.

Fortville, Ind.—The Town Council is stated to have granted I. N. Stabler, of Fairmount, a 25-year contract to furnish electric lights.

Topeka, Kan.—I. B. Roby, of Amherst, N. H., is reported interested in the construction of a $100,000 electric light plant at Topeka.

New Martinsville, W. Va.—The Council is stated to have granted a franchise to the Mountain State Electric Co., of Wheeling.

Conneaut, O.—Bids are wanted by the Board of Electric Light Trustees until Oct. 5 for an addition to the electric light plant. W. O. Hall, Secy.

Gloucester, Mass.—The New England Telephone & Telegraph Co. has been granted permission to lay and maintain about 9 miles of conduits for underground lines in the streets of Gloucester.

McRae, Ga.—See "Water."

Watonga, Okla. Ter.—The Watonga Electrical & Mfg. Co. is stated to have been incorporated, with a capital of $50,000, by Edw. S. Wheeler, E. L. Hotchkiss and others, all of Watonga, to operate an ice plant, electrical plant and telephone lines.

St. Paul, Minn.—The Board of Aldermen Committee on Streets, on Sept. 12 recommended for passage the ordinance granting to the Imperial Mfg. Co. a franchise for furnishing light, heat and power. The company proposes to expend $100,000 within one year from passage of franchise. J. C. Michaels is the attorney.

Hyattsville, Md.—Robt. Wells is reported interested in the construction of an electric light plant.

Ingham Mills, N. Y.—C. E. Snyder, a legal representative of the New York Central R. R., is stated to have purchased extensive water rights located here. It is reported that an electric plant will shortly be constructed here. W. J. Wilgus, Ch. Engr., New York, N. Y.

Gas City, Ind.—See "Water."

Rochester, Minn.—J. G. Robertson, of St. Paul, is stated to have secured the contract to furnish an Ideal engine and two furnace boilers, at $7,150, and the Ft. Wayne Electric Works, of Ft. Wayne, Ind., secured the contract for 2 dynamos at $4,168.

Washington, Ia.—The city is reported to have voted to install a municipal electric light plant to cost $17,500.

Denison, Tex.—The Council is stated to have granted the Denison Light & Power Co. a franchise to own and operate an electric light plant in this city.

Sandy Hill, N. Y.—The United Gas Co., of Sandy Hill, is stated to have increased its capital stock from $150,000 to $200,000. Improvements and enlargement of its plants, which will be concentrated at Ft. Edward, are contemplated.

Manson, Ia.—G. E. Haney is stated to have received a franchise for an electric light plant.

Monaca, Pa.—The Monaca Electric Co. is stated to have secured right of way over the streets and alleys of Monaca, and will shortly begin the construction of an electric light system.

McIntosh, Minn.—Deputy Recorder T. R. Brownlee writes that a permit to place poles in the streets and public grounds has been given to Anton Jensen, of McIntosh, who will at once put in an electric light plant.

Poughkeepsie, N. Y.—Superintendent Chas. W. Pilgrim writes that the contract for installing engines and dynamos at the Hudson River State Hospital has been awarded to F. L. Frost, of Albany, at $7,440 for complete work.

Gloversville, N. Y.—Local press reports state that bids will be received by the F., J. & G. R. R. Co., J. Ledlie Hees, Pres., until Sept. 23 for furnishing material and erecting a power house at Tribes Hill; also for engines, section marine boilers, steel water tower and hot wells, economizers, cast iron pipe and special castings, 2 boiler feeders, 2 jet condensers and all electrical apparatus. J. N. Shannahan, Ch. Engr.

Mechanicsburg, O.—G. W. Shortle, of Osborn, O., is president of a company which proposes soon to construct an electric light plant in this city, at an estimated cost of $17,000.

Webster. S. D.—See "Water."

Saginaw, Mich.—The Common Council has directed the Board of Public Works to prepare and submit plans and specifications for a municipal lighting plant.

Winthrop. Minn.—See "Water."

Detroit. Mich.—The City & Suburban Light, Heat & Power Co. has been incorporated, with a capital of $1,000,000, to furnish electric light and power to the towns of Dearborn, Wayne, Ypsilanti, Saline. Ann Arbor and Chelsea, Jackson and the towns between Jackson and Coldwater and Jackson and Lansing, including the latter. Principal office to be at Detroit. Jas. D. Hawkes, Pres., S. F. Angus, Sec'y, both of Detroit.

Columbus, O.—Bids are wanted Sept. 27 for lighting the streets, alleys, avenues and other public highways and places, for a period of one year, by electric arc lamps, on a basis of from 650 to 700 lamps. Clarence M. Addison. Clk. Bd. Pub. Wks.

Boonville, N. Y.—City Clk. H. R. Tubbs writes that it is proposed to construct an electric light plant.

Lemoore, Cal.—See "Water."

Marion, Ky.—The Marion Electric Light & Ice Co. is now in the market for a small quantity of incandescent light transformers. Communications should be addressed to the company at Marion. Sturtevant & Todd, Consulting Engrs., Chicago, Ill.

Thomaston, Ga.—Bids will be received by the Electric Light Committee until Oct. 1 for furnishing and erecting a 75-H.-P. automatic high-speed engine, a boiler feed pump, an exhaust steam feed water heater and all steam and water pipes in the electric light plant; also bids for furnishing transformers, lamps and all necessary electrical supplies. Address Collier & Brown, Engrs., Atlanta.

Delmar, Del.—A committee is reported to have been appointed to investigate the matter of constructing an electric light plant.

ELECTRIC RAILWAYS.

Mobile, Ala.—The County Commissioners are stated to have granted to J. Howard Wilson, representing the Consolidated Street Car Co., a franchise to extend the line to Whistler, a distance of 5 miles from the city, and also for some distance out both Government St. and Dauphin way.

Schenectady. N. Y.—The Schenectady Ry. Co. is stated to have received a franchise to run cars over the Troy and Schenectady turnpike in Colonie. R. H. Fraser, Mgr.

Moline, Ill.—The Council has granted a franchise to the Moline, East Moline & Watertown Suburban Ry. Co.

South Haven, Mich.—The Michigan & West Shore Traction Co. is stated to have been incorporated with a capital of $1,350,000 to construct and equip an electric railway from South Haven through Covert, with a loop around Paw Paw Lake through Watervliet, Coloma, and Riverside, terminating at Benton Harbor. S. B. Downer is one of the incorporators.

Fairfield, Cal.—The Supervisors of Salano County are stated to have granted a franchise to H. F. and J. W. Hartzell to construct and operate an electric railroad between Vallejo and Benicia.

San Bernardino. Cal.—It is stated that the Directors of the San Bernardino Valley Traction Co. have decided to issue $250,000 bonds, to be used in constructing an electric road between this city, Colton and Redlands.

Huron; N. Y.—Chas. A. Lux, of Clyde, is stated to have received a franchise through the town.

Kansas City, Kan.—The Missouri River Shore R. R. Co. is stated to have been incorporated, with a capital of $50,000, to construct an electric railway from this place to Kansas City, Mo. Directors: Herbert W. Wolcott, Leavenworth; Willard Merriam, Kansas City, Kan., and others.

Grass Lake, Mich.—The Detroit, Ypsilanti, Ann Arbor & Jackson Electric Ry. Co. is stated to have received a franchise on Lake St. F. E. Merrill, Mgr., Ypsilanti.

Lowell, Mass.—The Lowell & Pelham St. Ry. Co. has been incorporated, with a capital of $40,000, to construct a railway about 4 miles in length. Directors: Wm. H. Anderson, Lowell; Wallace D. Lovell, West Newton, and others.

The Council is stated to have granted the Boston & Northern St. Ry. Co. a franchise for extensive extensions in Lowell.

Detroit, Mich.—The Detroit, Pontiac, Lapeer & Northern Ry. Co. has been incorporated, with a capital of $1,000,000. Incorporators: Jas. Dean, Detroit; L. F. Morehouse, Ann Arbor; D. R. Curry, of Rochester, and others.

Benton Harbor, Mich.—The City Council is stated to have granted franchises to the West Michigan Traction Co., and to the Benton Harbor Terminal Ry. Co. to construct, operate and maintain railways within the city limits.

Murphysboro, Ill.—L. L. Harper and Wm. Jenns, of St. Louis, Mo., are reported interested in the construction of an electric railway between this city and Carbondale.

Winchester, Ind.—The County Commissioners are stated to have granted the Eastern Indiana Traction Co. a right of way through Randolph County for its proposed line between Richmond and Portland.

Dover, N. H.—The Dover, Eliot & York Beach Ry. Co. is stated to have been incorporated, with a capital of $25,000, to construct an electric railway from Dover to York Beach, Me. Gov. Hill, of Maine, is reported interested.

Garrettsville, O.—The Council is stated to have granted a franchise to the Cleveland & Eastern Ry. Co. R. L. Andrews, Gen. Mgr., Cleveland.

Sheboygan, Wis.—The Northwestern Interurban Ry. Co. is stated to have been incorporated, with a capital of $2,500, to construct an electric railway to connect Sheboygan and Manitowoc. Incorporators: Chas. A. McGee, Wm. J. Scanlan, and others.

Easton, Pa.—The Council has granted franchises to the Easton, Nazareth & Bangor, the Easton & Belvidere, and the Northampton & Lehigh St. Ry. companies.

Augusta, Me.—The Augusta & Warren Ry. Co. has been incorporated, with a capital of $300,000, to construct an electric railway from Augusta to Warren, a distance of about 27 miles. Incorporators: John F. Hill, Geo. E. Macomber, and others, all of Augusta.

Swissvale, Pa.—The Council is stated to have granted the Second Ave. Traction Co. a right of way over several streets.

Hillsdale, Mich.—A. Milnes, of Coldwater, and Geo. D. Harding, of Hillsdale, are stated to have secured franchises through Hillsdale and Hudson.

Westfield, Mass.—Bids will be received by the Woronoco St. Ry. Co., Construction Dept., at Westfield, until Sept. 25 for constructing extension to the railway.

San Francisco, Cal.—The Supervisors are stated to have employed Engineer Stut to prepare plans and specifications for the construction of an electric railway to take the place of the Geary St. road, the franchise for which is about to expire.

Lawrenceburg, Ind.—The Cincinnati & Indianapolis Traction Co. has been organized, with a capital of $10,000, to construct an electric railway from Lawrenceburg to Shelbyville. Incorporators: J. C. Hoover, Stanley Shaffer and others, all of Hamilton, O.

Salt Lake City, Utah.—The power plant of the Rapid Transit Co. is reported to have been seriously damaged by fire, Sept. 6. J. S. Cameron, Pres. and Mgr., Salt Lake City.

Ouray, Colo.—G. A. Taft and J. A. Barclay are reported to have petitioned the City Council for a franchise and terminal facilities for an electric line to Ridgway, and to the Cow Creek coal fields.

Newcastle, Ind.—Albert D. Ogborn, of Newcastle, and L. P. Newby, of Knightstown, are reported interested in the construction of an electric railway from Newcastle to Knightstown.

Clinton, Ill.—The Supervisors of DeWitt County are stated to have granted Griffin and Knight, of the Bloomington & Decatur Electric Interurban R. R., a franchise through the county.

Kent, Wash.—The Council is stated to have granted the Seattle & Tacoma Interurban Ry. Co. a franchise through the city.

Leadville, Colo.—W. J. Best, representing an eastern syndicate, is stated to have petitioned the Council for a franchise to construct a railway over the principal streets of the city.

Hamilton, O.—The Hamilton & Glendale Electric Railway Co. is stated to have received permission to enter the city.

Shickshinny, Pa.—The Shickshinny & Huntington Valley R. R. Co. is reported organized, to construct an electric railway from Shickshinny to Harveyville, a distance of about 7 miles. R. P. Robinson, Pres.; R. M. Tubbs, Secy.

Millville, Pa.—The Council is stated to have granted the Bloomsburg & Millville Electric Ry. Co. a right of way through the borough.

Danville, Ill.—The Supervisors of Vermilion County are stated to have granted a franchise to the Covington Electric Ry. Co.

Grafton, W. Va.—The Council is reported to have granted E. M. Wilkins, of Fairmont, W. Va., a franchise for a street railway.

Janesville, Wis.—Geo. H. Hurd, Supt. of the Janesville St. Ry. Co., is stated to have secured a franchise for the proposed interurban railroad from Geneva Lake to Janesville.

Columbus Grove, O.—The Toledo & Lima Traction Co. is about to petition the Village Council for a franchise.

Brooklyn, N. Y.—Plans have been filed for a 2-story brick power house to be erected on 2d St. and 3d Ave. by the Brooklyn Heights R. R. Co. Architect, T. E. Murray, 827 St. Marks Ave.

Elkhorn, Wis.—The Council is stated to have granted a franchise to the Janesville, Lake Geneva & Elkhorn Electric Ry. Co.

H. H. Clough, of the Beloit, Janesville & Delavan line, is reported to have petitioned for a franchise.

RAILROADS

Duluth, Minn.—M. S. Cook, Engr. of the Duluth, Virginia & Rainy Lake R. R., writes that the contract for constructing the road has been awarded to the Minnesota Land & Construction Co., 410 Palladio, Duluth.

Pendleton, Ore.—It is stated that the Washington & Columbia River Ry. Co. will expend about $100,000 in improving its line between Pendleton and Hunts Junction. J. G. Cutler, Ch. Engr., Walla Walla, Wash.

Springfield, Mo.—The Springfield, Boonville & Northern R. R. Co. is stated to have been formed to construct a railroad from Springfield to Chicago, by way of Boonville, Mo., and Des Moines, Ia. Dr. W. M. Woodburn, Pres., Des Moines, Ia.

Elrick, Ia.—It is stated that the Muscatine North & South R. R. Co. intends extending its line from Elrick to Burlington. Chas. Howard, Gen. Mgr., Muscatine, Ia.

Pueblo, Colo.—The Pueblo, Gunnison & San Juan R. R. Co. is reported incorporated; capital, $100,000. Incorporators: Thos. F. Walsh, Geo. R. Hurlburt and others. Principal office to be at Ouray, Colo.

New York, N. Y.—Bids are wanted by the Board of Rapid Transit R. R. Commissioners until Sept. 26 for making diamond drill borings in the East River, as advertised in The Engineering Record.

Mountain City, Tenn.—The Virginia & Southwestern Ry. Co. is stated to have decided to extend its line from Maymead, Tenn., to Mountain City, a distance of 5 miles. Jas. L. Brass, Mgr., Bristol, Tenn.

Shreveport, La.—The Council is stated to have granted a franchise to the Peoples Belt R. R. Co.

Corpus Christi, Tex.—J. J. Sparrow, of Windsor, Ont., is reported interested in the construction of a railroad from Corpus Christi to Brownsville.

Laramie, Wyo.—The Directors of the Laramie, Hahn's Peak & Pacific R. R. Co. are stated to have decided to construct a line from Laramie to Hahn's Peak, Colo.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Durant, Mich.—The Christian Association of Durant is about to build a $10,000 church.

Pine Bluff, Ark.—The contract for constructing deaf mute buildings has been awarded to Casey & Powers for $64,990. The contract for plumbing and heating for said buildings has been awarded to Arkansas Pump & Pipe Co. at $9,275. Both firms of Duluth, Minn.

Riverside, Cal.—The contract for erecting the Riverside County jail is stated to have been awarded to W. E. Thornton, of Los Angeles, for $15,287. The Pauly Jail Co., of St. Louis, secured the contract for 8 cells for the same at $17,960.

Lake Charles, La.—R. W. Abright, of Shreveport, La., is reported to have received the contract for repairs and additions to the court house, at $50,165.

Olympia, Wash.—The W. B. Coffee Plumbing Co., of Tacoma, is stated to have received the contract for plumbing in the Capitol annex, at $5,434.

Tacoma, Wash.—The Board of Public Works are stated to have on Sept. 3 rejected all bids for the proposed $75,000 library. New bids will be received.

Council Bluffs, Ia.—Wickham Bros. are stated to have received the contract for erecting the new Mercy Hospital to be erected by the Sisters of Mercy; to cost $60,000.

Rankin, Pa.—The Croatian Catholics of Rankin are reported to have decided to erect a $40,000 brick church next spring.

Minneapolis, Minn.—Elliott Bros., Lumber Exchange, are stated to have secured the contract for erecting the Swedish Hospital on 10th Ave., S and 8th Sts., for $24,000, not including heating and plumbing.

Chicago, Ill.—J. F. and J. P. Doerr, 138 Washington St., are stated to have prepared plans for a structure to contain church and school for St. Raphael's R. C. Church, to be erected on Justine St. near 60th St., at a cost of $25,000. A parsonage to cost $9,000 is to be built adjoining the church.

J. E. O. Pridmore, Champlain Bldg., is state to be preparing plans for the Catholic Apostolic Church to be built at 311 and 313 La Salle Ave.; cost, $35,000. Dr. Blackstock, Pastor.

New York, N. Y.—Welch, Smith & Provot, 11 E. 42d St., are stated to have secured the contract for erecting the hospital for the French Benevolent Society on 34th St., between 9th and 10th Aves., to cost about $200,000.

Jacksonville, Fla.—Bids will be received by the Board of Bond Trustees until Oct. 4 for erecting a police headquarters. B. F. Dillon, Chmn.

Springfield, Ill.—Henry V. Crawford is stated to have secured the contract for erecting an addition to the county poor farm, for $14,138.

Richmond, Va.—Jas. Fox, Richmond, Va., is stated to have received the contract for erecting the Methodist Orphanage buildings in this city. Architect, J. K. Peebles, Norfolk, Va. Cost, $46,000.

Little Rock, Ark.—The State Capitol Commission has ordered Geo. R. Mann to remodel plans for the proposed Capitol so as to come within the legislative appropriation of $1,000,000.

Mankato, Minn.—Plans and site have been accepted for the proposed Carnegie Library.

Richmond, Va.—Chas. Hutzler, Broad St. bet. 3d and 4th, is Chairman of Bldg. Com. to procure drawings for the new Beth Ahaba Synagogue. Probably $50,000 will be expended.

St. Cloud, Minn.—The contract for erecting the Carnegie Library is reported to have been awarded to Carl Kropp, for $21,696.

Sioux City, Ia.—The Grace M. E. Church Building Committee (Morningside) is reported to have decided to erect a $30,000 edifice in the spring. Rev. J. B. Walker, Pastor.

Verona, N. J.—Bids will be received by the Board of Trustees of the Newark City Home in Newark, until Sept. 23, for the mason, cut stone and iron work required in the erection of the brick stack for the proposed boiler house building in the Township of Verona. C. M. Harrison, Sec'y.

Lake Providence, La.—Geo. Blackburn, Clk. of the District Court, writes that on Sept. 10 it was voted to issue $16,500 bonds for the erection of a courthouse.

Los Angeles, Cal.—The plans of Frank D. Hudson, 165 E. 36th St., are stated to have been accepted for the Los Angeles County jail, to be erected on Temple and Buena Vista Sts., to cost about $135,000.

Crowley, La.—Plans and specifications will be received by the Police Jury of Acadia parish until Nov. 11 for a court house; cost not to exceed $75,000. G. Howard Brooks, Sec'y, Crowley.

Ellisville, Miss.—Bids are wanted by the County Commissioners until Oct. 7 for placing 2 steel cells in the county jail.

BUSINESS BUILDINGS.

New Britain, Conn.—Thomas J. O'Dell will build a brick block, 3½ stories high, 40 x 70, on Park St. Cost, $13,000. Architect, W. H. Cadwell, 213 Main St.

Nashua, N. H.—The contract for constructing the O'Donnell Memorial Building has been awarded to the Nashua Building Co., of Nashua. The block is to be 3 stories, brick, and contain hall, lodge rooms and stores. Cost, $25,000.

Saginaw, Mich.—W. T. Cooper & Son, 305 Hayden St., E. S., have prepared plans for a 3-story office building to be erected for Michael Jeffers, of Saginaw. Probable cost, $12,000.

Boston, Mass.—Architects Wheelwright & Haven, Colonial Bldg., have filed plans for the building of the New England Conservatory of Music, to be erected at Huntington Ave. and Gainsboro St. Builders, Thompson, Starratt & Co.; cost, about $250,000.

St. Paul, Minn.—The Town City Telephone Co. is about to construct a $17,000 building at 8th and Cedar Sts. Architect, Clarence Johnston, Manhattan Bldg.

Greeley, Colo.—E. H. Dyer & Co., of Cleveland, O., are stated to have secured the contract for erecting the sugar plant for the Greeley Sugar Co., for about $710,000.

Oshkosh, Wis.—Frost & Granger, 806 "The Temple," Chicago, Ill., are stated to be preparing plans for a passenger station which the Chicago & Northwestern R. R. will erect here, to cost $25,000.

Allenhurst, N. J.—The Allenhurst Inn & Cottage Co. is reported to be preparing to erect a hotel, to cost $300,000, on the site of the old Allenhurst Inn, which was destroyed by fire on July 1st. W. Johnston Quinn, proprietor of the Empire Hotel, New York City, is the president of the company.

Birmingham, Ala.—Stone Bros. & Weston are stated to be preparing plans for a 10-story office building, to be erected on 20th St. and 1st Ave., for W. H. Woodward, of Weld, Me.

Butte, Mont.—Dr. J. W. Alexander and Paul Ozane are about to erect a 5-story building on Academy St. Cost, $30,000. O. N. Nelson, Architect.

Seattle, Wash.—S. S. Bailey, proprietor of the Hotel Northern, is reported interested in the construction of a hotel on 1st Ave., S and Charles Sts., to cost about $50,000.

Racine, Wis.—F. W. Perkins, Montauk Blk., Chicago, Ill., is stated to be preparing plans for an enlargement of the J. I. Case plow works, to consist of a 3-story machine shop, 60 x 205 ft.; a 3-story warehouse, 120 x 350 ft., and a 2-story office, 50 x 100 ft.; total cost, $150,000.

Chicago, Ill.—W. M. Crilly, 167 Dearborn St., is stated to have secured the contract for erecting a car storage house at Wentworth Ave. for the Chicago City Ry. Co., to cost $75,000.

Salt Lake City, Utah.—The Oregon Short Line building is reported to have been destroyed by fire Sept. 10. W. H. Bancroft, Gen. Mgr., Salt Lake City.

Houghton, Mich.—Charlton, Gilbert & Demar, of Marquette, are stated to have prepared plans for a $40,000 bank building for the Citizens' Bank.

Dickerson, N. D.—It is stated that the Northern Pacific R. R. Co. is to erect a brick depot here. E. H. McHenry, Ch. Engr., St. Paul, Minn.

Richmond, Va.—Lockwood, Green & Co., 93 Federal St., Boston, Mass., are reported to be preparing plans for a 5-story fireproof building for the American Cigar Co., to cost about $90,000.

Omaha, Neb.—John Latenser, 414 Karbach Blk., has been selected to prepare plans for the proposed Auditorium building. Cost, $150,000.

Syracuse, N. Y.—The wax candle works, owned by the Will-Baumer Candle Co., of this city, also large silk mill owned by same parties, have been destroyed by fire. Estimated loss about $150,000. The company contemplates rebuilding the candle works, but have not definitely decided as to rebuilding the silk mill.

Appleton, Wis.—The citizens, at a mass meeting Sept. 14, are reported to have decided to erect a $30,000 theater.

Escanaba, Mich.—T. F. Lohff, of Escanaba, is stated to have prepared plans for a 2-story brick business block for Chas. M. Thatcher, to cost $15,000.

Macon, Mo.—The Burlington is to erect a depot here to cost about $15,000. E. J. Blake, Consulting Engr., Chicago, Ill.

Columbia, Mo.—F. W. Poor is reported interested in the erection of a hotel here, to cost about $50,000, to be known as the Athens Hotel.

Pittsfield, Mass.—Bids are wanted Sept. 25 for the erection and completion of the car barns and offices for the Berkshire Electric St. Ry. Co. at Pittsfield. H. Neill, Archt., Pittsfield.

Brooklyn, N. Y.—Plans have been filed for a 5-story brick extension to the factory at St. Marks and Underhill Aves., owned by H. L. Inich. Architect, J. L. Davis, 315 St. Marks Ave.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

159th St & St Nicholas Ave, br stable; c, $30,000; o, T J McGuire; a, Edwin Wilbur.

Southern Boulevard & Willis Ave, br hotel; c, $30,000; o, John & Matthias Haffen; a, A F A Schmitt.

56 Wall St, 5-story extension; c, $30,000; o, Geo P Wetmore; a, Henry Palmer; b, Sam'l I Acken & Sons.

DWELLINGS.

Poughkeepsie, N. Y.—Plans have been prepared by Percival M. Lloyd, 35 Market St., for a $12,000 stone and frame residence, to be built for Wm. T. Bolles at 109 S. Hamilton St.

St. Paul, Minn.—Clarence Johnston, Manhattan Bldg., has prepared plans for a $15,000 residence to be erected at Portland Ave. and Mackubin St., for W. C. Winter.

Pittsburg, Pa.—MacClure & Spahr are stated to be preparing plans for a $25,000 residence to be erected on Shady Ave., near 5th Ave., East End, for I. Chalmers Darsie, of the Hecla Coke Co.

Chicago, Ill.—Fred'k W. Perkins, Montauk Blk., is stated to have completed plans for a residence which L. Klein will erect on Grand Boulevard at 44th St.; cost, $50,000.

Memphis, Tenn.—Wilson & Marshall, 218 La Salle St., Chicago, Ill., have completed plans for a 3-story residence for R. W. Harris, of Memphis; cost, $40,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

42-44 W 120th St, br tenement; c, $75,000; o, James Everard; a, Jas W Cole.

Union Ave & 163d St, br and stone flat; c, $25,000; o, Mrs Serena Clark; a, Geo B Clark.

21 W 34th St, 1-story extension; c, $20,000; o, Bessie Leggett; a, Lord & Hewlett.

SCHOOLS.

Duquesne, Pa.—The School Board is stated to have selected John Long as architect for a $12,000 high school.

San Bernardino, Cal.—Local press reports state that bids will be received by the Board of Education until Oct. 7 for erecting 2 schools.

Akron, O.—The plans of F. O. Weary, Savings Bank Bldg., are stated to have been accepted for the Lane School, to cost about $35,000.

Dublin, Ga.—The citizens are stated to have voted Sept. 9 to issue $20,000 bonds for a school, and $5,000 bonds for improving and enlarging the electric light and water plant.

Sydney, N. S.—See "Water."

Pittsburg, Kan.—The plans of J. W. Gaddes, of Vincennes, Ind., are stated to have been accepted for a 3-story high school, to cost about $35,000.

Detroit, Mich.—The Detroit Board of Education is about to build a $30,000 brick school, with terra cotta trimmings, steam blower system of heating and ventilating.

Irvington, N. J.—The Board of Education on Sept. 16 is stated to have adopted the plans of Architect Moll for the proposed 2d Ward School, to cost about $20,000.

Woburn, Mass.—There is some talk in City Council of appropriating $100,000 for a new school.

Lakeland, Fla.—The City Clerk writes that $10,000 bonds have been voted for a school.

Marlin, Tex.—See "Water."

Los Angeles, Cal.—Dawson & Eldridge are stated to have received the contract for erecting the 6th Ward school on 20th St. and Central Ave., for $20,975.

Chicago, Ill.—Egan & Prindiville, 85 Dearborn St., are stated to be completing plans for an addition to St. Joseph's School in 13th St. near Loomis; cost, $15,000.

Buffalo, N. D.—Bids will be received Sept. 25 for erecting a 4-room brick school in School Dist. No. 38; also bids for a steam heating plant. H. E. Brown, Pres. of the district.

Racine, Wis.—The School Board is stated to have accepted the plans of Guilbert & Pugh for 2d Ward School, to cost $30,000.

Tomah, Wis.—The plans of Van Ryn & De Gelleke, of Milwaukee, are stated to have been accepted for a $20,000 high school.

New York, N. Y.—The following bids were opened Sept. 16 by the Committee on Buildings, Bd. of Education, for heating and ventilating apparatus in school 184, Boro. of Manhattan: John Neal's Sons, $37,124; Blake & Williams, $36,818; Francis Bros. & Jellett, Inc., $41,000; the United Engineering & Contracting Co., $37,458; the Baldwin Engineering Co., $44,430; James Curran Mfg. Co., $39,600; E. Rutzler, $36,500; Williams & Gerstle, $37,810; N. Y. Steam Fitting Co., $36,593; Evans, Almirall & Co., $41,105; Frank Dobson, 218 E. 42d St., $34,968 (awarded); John Hankin & Brother, $43,000; Walker & Chambers, $36,189.

Other contracts, for which bids were opened at the same time, have been awarded as follows: To Frank Dobson, installing, heating and ventilating apparatus in schools 136 and 137, Boro. of Brooklyn, for $18,543 and $18,568 respectively: To W. Y. Jack & Co., 730 Lexington Ave., sanitary work of addition to and alterations in school 22, Boro. of Manhattan, for $7,837; to the United Engineering & Contracting Co., 13 Park Row, installing electric light wiring, fixtures and electric bell system for schools 136 and 137, Boro. of Brooklyn, for $4,211 each.

STREET CLEANING AND GARBAGE DISPOSAL.

Easton, Pa.—City Engr. L. A. Francisco writes that the question of installing a garbage crematory has been talked of for some time, but nothing definite has yet been done.

Lowell, Mass.—A special committee on garbage collection and disposal has inspected certain plants and reported, but no action has yet been taken by the Council.

Columbia, S. C.—The Common Council has decided to build a crematory for the consumption of dry garbage.

Topeka, Kan.—The Council on Sept. 9 granted a 7-year franchise to Frank Zingheim, manager of the Topeka Dessicating Co., which has been organized for the purpose of building a $6,000 crematory and dessicating works on the Ennis tract in North Topeka.

New Castle, Pa.—The following bids were opened Sept. 9 for the proposed new garbage furnace: The Dixon Garbage Crematory Co., 25-ton double furnace, with iron stack, $5,000; with building, $8,800; 30-ton, iron stack, double furnace, $6,000; with building, $10,300; 30-ton, brick stack, double furnace, $7,100; with building, $11,400; 30-ton, single furnace, with double brick stack, $7,100, with brick building, $11,400; 25-ton single furace, with double brick stack, $6,300; with building, $10,100. The Bridgeport Boiler Co. bid for a crib of 25-ton capacity Smith improved garbage furnace and crematory, with a stack 100 ft. high and 36 in. in diameter, $6,000; with building, $2,500 additional. With cribs so as to increase the capacity to 50 tons, $4,500 additional.

GOVERNMENT WORK.

Omaha, Neb.—Bids are wanted Oct. 4 at the Treasury Dept., Washington, D. C., for resetting 5 horizontal tubular steam boilers and installing smokeless furnaces at the U. S. Court House and Post Office Building, as advertised in The Engineering Record.

Stockton, Cal.—Bids are wanted Oct. 22 at the Treasury Dept., Washington, D. C., for the installation of a conduit and wiring system for the U. S. Post-Office, Stockton, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted at the U. S. Engineer Office until Oct. 16 for furnishing and installing electric elevators for the new building for Government Printing Office, as advertised in The Engineering Record.

Norfolk, Va.—The contract for furnishing a floating derrick of a capacity of 120 gross tons for the Norfolk Navy Yard has been awarded to Snare & Triest, of New York, for $64,950.

Butte, Mont.—The following bids were opened Sept. 16 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post Office at Butte: James Welsh, Butte, $219,855; Angus & Gindele, Chicago, $248,800; Congress Construction Co., Chicago, $222,817.

Philadelphia, Pa.—Bids are wanted Oct. 14 for erecting an addition to office building at Schuylkill Arsenal. Address Col. John V. Furey, Asst. Q. M. Gen., U. S. A.

St. Louis, Mo.—Bids are wanted Sept. 27 for furnishing material and labor required for reconstructing and repairing old road leading from post roads to National Cemetery, and for repairing retaining wall, etc., at Jefferson Barracks, Mo. Address Lieut.-Col. D. D. Wheeler, Depot Q. M., St. Louis.

Philadelphia, Pa.—The contract to erect a brick and steel building at League Island Navy Yard has been awarded by the Bureau of Yards and Docks, Washington, to Henderson & Co., Philadelphia, for $107,206.

Chilocco, Okla. Ter.—Bids will be received by W. A. Jones, Commr. of Indian Affairs, Washington, D. C., until Oct. 7, for furnishing material and erecting a stone addition, with steam heat and electric light, to the school at Chilocco. Address Chas. W. Goodman, Supt. Indian School, Chilocco.

Washington, D. C.—Bids are wanted Sept. 23 for valves, pipes, fittings, etc.; also electric light fixtures, for the Interior Department Buildings, Washington. E. A. Hitchcock, Sec'y Dept. of Interior.

Keshena, Wis.—Bids will be received by W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C., until Oct. 8, for furnishing material and constructing an extension to the water system at the Menominee School, Wis.

Port Penn, Del.—Bids are wanted Sept. 25 for erecting a workshop at Reedy Island quarantine. T. F. Richardson, Asst. Surgeon, M. H. S., Reedy Is. Quarantine, Port Penn.

Washington, D. C.—Bids are wanted Oct. 26 for constructing a plant for receiving, storing and delivering coal at the Navy Yard, Washington. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept.

New York, N. Y.—Bids are wanted Oct. 12 for erecting a 3-story brick and steel fireproof building, 275 x 65, at the Navy Yard, New York. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Washington, D. C.

Annapolis, Md.—Bids are wanted Oct. 1 for furnishing and erecting heating apparatus and for furnishing models and castings for ornamental plaster work at the Naval Academy, Annapolis. A. S. Kenny, Paymaster Gen., Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.

Norfolk, Va.—Bids are wanted Oct. 1 for furnishing one battery of boilers; also a quantity of steel structural work at the Navy Yard, Norfolk. A. S. Kenny, Paymaster Gen., Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.

Ft. H. G. Wright, N. Y.—The following bids for erecting building, heating, plumbing and wiring same, at Fort H. G. Wright for barrack purposes, are stated to have been opened Sept. 12 at the office of the Quartermaster, New London, Conn.: James H. Coster, Baltimore, building, $31,750; H. R. Gillingham, New York, building, $28,195; Wheatin Building Co., Putnam, building, $27,293; plumbing, $4,200; heating, $3,384; electric wiring, $556; H. C. Clark, Delaware City, Del., building, $27,683; plumbing, $3,679; heating, $3,250; electric wiring, $875.

Bids are wanted Oct. 1 for constructing a sewer at Ft. H. G. Wright. Address Constructing Quartermaster, 27 Granite St., New London, Conn.

MISCELLANEOUS.

Stamford, Conn.—Chas. F. Waterbury, of Stamford, writes that estimates are being secured for the construction of about 800 ft. of dock on Stamford Canal.

Toronto, Ont.—Drainage work, involving the reclamation of many thousands of acres, is proposed under the recent provincial legislation. The cost of drainage works, for the construction of which Government assistance has already been asked, will be over $200,000.

Jersey City, N. J.—The Street and Water Board on Sept. 10 adopted Chief Engineer Van Keuren's revised plans for the improvement of the eastern half of the South Cove. The revised plans call for the construction of a straight bulkhead along the eastern side of Henderson St.

Kansas City, Mo.—City Engineer Waddell and Engineer Goodwin, of the water-works, have estimated the total cost of constructing a retaining wall along West Prospect Place near Holly St. reservoir at $17,000.

Philadelphia, Pa.—The following bids (per yd.) for deepening the channels of the Delaware and Schuylkill Rivers were opened Sept. 17 by the Department of Public Works. The appropriation for this work is $250,000.

Bidders.	Dredging.					
	Delaware R.	Schuylkill R.	Removing ledge rock.	Rem. mat'ls other than ledge rock.	Removing wreck.	Time—months.
Bowers Hydr'lic Dredg. Co., Camden, N. J.	28c.	30c.	$15	55c.	$2	12
Virginia Dredg. Co., Richmond, Va.	29	29	15	41	15	11
Amer. Dredg. Co., Philadelphia	23	26.9	10	44½	1	10

Tallulah, La.—A. T. Lane, Sec'y Commrs., 5th Louisiana Levee Bd., writes that the following bids for levee work were opened Sept. 10:

Bidders: A, Helgason Bros. & Garbish, Vicksburg, Miss.; B, Donovan & Daly, Odenburg, La.; C, R. T. Clarke, Elba, La.; D, B. O'Brien, Natchez, Miss.; E, Robt. Nicholson, Villa Vista, La.:

Bidders.	Harpers to Stockridge, 75,000 yds.	Carters to Vidalia, 75,000 yds.	Vidalia to Moro, 175,000 yds.	Upper Green, 100,000 yds.	Pecan Grove to Henderson, 55,000 yds.
A	39¾c.	15.45c.	12.78c.	20c.	.....
B	....	13.40c.	12⅓c.	16.70c.	17.90c.
C	41c.	*12c.	*11c.	*15.40c.	.....
D	....	13.23c.	12c.	15.73c.	.....
E	....	.....	.....	.....	*12.97c.

All bids on Harpers to Stockridge Levee were rejected. *Contract awarded.

NEW INDUSTRIAL PLANTS.

The Duplex Mfg. Co., South Superior, Wis., has purchased a new plant which it will equip with an electric power plant of 50 to 100 H.-P.

The Crescent Carriage Co., Pontiac, Mich., will build a 4-story 80 x 160-ft. factory and install a power plant of 75 to 100 H.-P.

Beare Bros., Humboldt, Tenn., will add a 50-ton refrigerating machine to their plant.

The Getchell & Martin Lumber & Mfg. Co., Des Moines, Ia., expects to erect a 3-story and basement 80 x 132-ft. building next spring.

The Clinic Publishing Co., 1410 East Ravenswood Park, Chicago, is erecting a 4-story, 60 x 160-ft. building, and will install two 30-H.-P. boiler, a 30 or 40-H.-P. engine and generators.

The Fort Smith, Ark., Ice & Cold-Storage Co. expects to add a 20-ton ice machine and enlarge its cold-storage capacity.

L. A. McCord, Laurens, S. C., is interested in the erection of a new yarn mill.

The Henry Rose Mercantile & Mfg. Co., Ltd., Shreveport, La., contemplates erecting a 3-story 120 x 150-ft. factory and installing two 30-ton ice machines.

The Sherman, Tex., Ice Co. will add a 75-ton ice machine to its plant.

The Simmons Milling Co., Red Wing, Minn., is building a 1,000-bbl. flour mill and will install a 350-H.-P. engine.

The Canadian Dressed Poultry Co., Ltd., 9 Toronto St., Toronto, Ont., will establish two warehouses, one at Quebec and one at Halifax, and ten stations distributed over the eastern provinces of Canada, some as pork-packing factories and others as abattoirs only.

The Rhodes-Carmean Buggy Co., Marshalltown, Ia., expects to build a 4-story 90 x 120-ft. brick addition.

Ira B. Smith, 70 Main St., Bristol, Conn., will erect a 2-story 38 x 40-ft. machine shop.

The Johnson City, Tenn., Foundry & Machine Co. will install a 15-ton ice-making plant.

The Palestine, Tex., Ice Co. will want a 60-ton ice plant and a 70-ton brine tank.

The Elkins, W. Va., Milling Co. wants bids and plans for a 60 or 75-bbl. flour mill. N. I. Hall is interested.

The Superior Shipbuilding Co., West Superior, Wis., will build a new power plant to furnish electric current and compressed air and install six horizontal tubular boilers, aggregating about 400 H.-P., a belt-driven generator and a direct-connected generating set. An 85-ft. steel stack will be erected.

The Worden Mfg. Co., Scranton, Pa., makers of door hangers, recently incorporated, will soon erect a new factory.

John H. Prince and J. N. Chandler, Weatherford, Tex., are interested in building a 40-ton ice plant.

L. C. & J. W. Register, Trio, S. C., want plans and prices of lime-kilns.

BUSINESS NOTES.

The American Blower Co., Detroit, is doing a very extensive business in the line of mechanical draft. Among other large orders recently received are those from the New Amsterdam Gas Co., Ravenswood, L. I., and the Wilkes-Barre, Pa., Heat, Light & Motor Co. Each of these outfits embraces two 180-in. steel-plate fans with direct-connected engines.

The Wayne Engineering & Construction Co., Fort Wayne, Ind., was awarded the contract for new municipal water-works at Kokomo, Ind., including two 3,000,000-gal. pumps and fittings; two 200-H.-P. water-tube boilers, heaters and feed pumps; 23 miles of pipe and 40 tons of specials; 200 hydrants; valves and boxes, and a 140,000-gal. steel tower and tank.

The Watertown, N. Y., Engine Co., after a strike of fourteen weeks, has just completed an installation of 1,000 H.-P. for the Oxford Paper Co., Rumford Falls, Me., and is now at work on an 800-H.-P. plant for the Remington-Martin Co., Norfolk; 400 H.-P. for the Eastern Lumber Co., Tonawanda; 300 H.-P. for the Raymondville Paper Co.; 400 H.-P. vertical cross-compound high-speed engine for the Mare Island Navy Yard; 250 H.-P. horizontal tandem compound engine for the Ohio State University and a considerable number of other smaller high-speed engines.

The Groton Bridge Co., Groton, N. Y., has begun the construction of a bridge shop which will comprise a 600 x 120-ft. main building equipped with the latest machinery, including electrical traveling cranes, electrically operated tools, pneumatic tools, etc. It will be of 15,000 tons annual capacity. Over $500,000 has been subscribed. The village of Groton will furnish electric light and water for a period of 20 years, during which time the company is exempt from taxation. The land for the plant and electric power for about six months, until the new plant can be completed, have been donated by the Conger Manufacturing Co. The directors of the company include Messrs. Arthur Walpool, Andrew Campbell, Frederick Mackay, Edwin Dye, William Bartenshaw, E. W. Watrous and Clarence Thompson, all of Groton. Most of these men have had long experience in bridge building and have recently returned from a tour of inspection of other plants.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Sept. 24.	Tullahoma, Tenn	Sept. 14
Sept. 25.	Philadelphia, Pa	Sept. 14
Sept. 25.	Well, Winthrop, Minn	Sept. 21
Sept. 27.	Well, Juneau, Wis	Sept. 21
Sept. 27.	Minneapolis, Minn	Sept. 14
Sept. 27.	Pittsfield, Mass	Sept. 21
Sept. 28.	Breese, Ill	Sept. 21
Sept. 30.	Ft. Yates, N. D	Sept. 7
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29	June 29
Oct. 1.	New York, N. Y	Sept. 14
Oct. 3.	Tunnel, Newark, N. J	Sept. 14
Oct. 4.	Dam, Centralia, Ill	Sept. 21
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
Oct. 5.	Lakewood, O	Sept. 21
Nov. 1.	Greenwood, Miss Adv., Eng. Record. Sept. 21.	Sept. 21
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
——	Ditch, Litchfield, Conn	Sept. 21
	SEWERAGE AND SEWAGE DISPOSAL.	
Sept. 23.	Greenville, Pa Adv., Eng. Record, Sept. 7, 14.	Sept. 7
Sept. 23.	Toledo, O	Sept. 7
Sept. 23.	Yonkers, N. Y	Sept. 7
Sept. 23.	St. Paul, Minn	Sept. 14
Sept. 23.	Greenville, Pa	Sept. 14
Sept. 23.	Duquesne, Pa	Sept. 21
Sept. 23.	Marysville, Kan	Sept. 21
Sept. 23.	Syracuse, N. Y	Sept. 21
Sept. 23.	Torrington, Conn	Sept. 21
Sept. 24.	Huntington, Ind	Sept. 14
Sept. 23.	St. Paul, Minn	Sept. 14
Sept. 27.	Boston, Mass Adv., Eng. Record, Aug. 31 to Sept. 21.	Aug. 31
Sept. 27.	Wooster, O	Sept. 14
Sept. 27.	Buffalo, N. Y	Sept. 21
Sept. 27.	Dayton, O	Sept. 21
Sept. 28.	Akron, O	Sept. 21
Sept. 30.	Rochester, Ind Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 1.	Kankakee, Ill	Sept. 14
Oct. 1.	Columbia, Mo Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 1.	Canyon City, Colo	Aug. 24
Oct. 1.	Leicester, England	Sept. 7
Oct. 1.	Hartford, Conn	Sept. 7
Oct. 1.	Bedford, Ind	Sept. 14
Oct. 1.	Elizabeth, N. J	Sept. 14
Oct. 5.	Washington, D. C Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 5.	Lakewood, O	Sept. 21
Oct. 7.	Anaconda, Montana	Sept. 21
Oct. 7.	Barberton, O	Sept. 21
Oct. 7.	Plainfield, N. J	Sept. 21
Oct. 7.	Wausau, Wis	Sept. 21
Oct. 8.	Conneaut, O	Sept 14
Oct. 8.	Cleveland, O	Sept. 14
Oct. 8.	Boston, Mass Adv., Eng. Record, Sept. 21.	Sept. 21
Oct. 16.	Logansport, Ind	Sept 14
Oct. 17.	Xenia, O	Sept. 21
Oct. 21.	Santiago, Cuba Adv., Eng. Record, Sept. 14, 21.	Sept. 14
Oct. 23.	Havana, Cuba Adv., Eng. Record. June 29 to July 20, Sept. 21.	June 29
Nov. 1.	Greenwood, Miss Adv., Eng. Record. Sept. 21.	Sept. 21
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
	BRIDGES.	
Sept. 25.	Miles City, Mont	Sept. 21
Sept. 30.	Fredericton, N. B Adv., Eng. Record, Aug. 17 to Sept. 21.	Aug. 17
Oct. 1.	San Mateo, Cal	Sept. 14
Oct. 1.	Morton, Minn	Sept. 14
Oct. 5.	Iron City, Tenn	Sept. 14
Oct. 7.	Roswell, New Mex	Sept. 14
Oct. 7.	Mankato, Kan	Sept. 21
Oct. 9.	Vicksburg, Miss	Sept. 14
Nov. 1	Milwaukee, Wis	Sept. 7
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Sept. 23.	Bradford, Pa	Sept. 21
Sept. 24.	Rome, N. Y	Sept. 14
Sept. 24.	Huntington, Ind	Sept. 14
Sept. 24.	Toronto, Ont	Sept. 21
Sept. 24.	Edgewood, Pa	Sept. 21
Sept. 25.	Hoboken, N. J	Sept. 14
Sept. 25.	Reno, Nev	Sept. 14
Sept. 26.	Rye, N. H	Sept. 14
Sept. 26.	Upper Sandusky, O	Sept. 21
Sept. 26.	Reading, Pa	Sept. 21
Sept. 27.	Grosse Point, Mich	Sept. 21
Sept. 30.	Cincinnati, O	Sept 21
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Municipal Accounting from an Accountant's Point of View.

For many years city officials have expressed dissatisfaction with methods of municipal accounting and recently the lack of uniformity and frequently of clearness has been attracting the attention of students of municipal affairs. Unfortunately the criticisms of the latter class have so frequently shown such a lack of knowledge of accounting and of legal requirements governing official accounts that those best able to assist in improving the defective methods have been repelled by the very men seeking to interest them. It has sometimes happened that, for self-protection, the head of a city department has been forced to give up all reliance on the regular accounting force of the city and keep a complete set of books for himself, unofficial but clear. The trouble arises from the fact that the official accounts must often contain items which are so tied up by legal requirements that the complication is too great for the department head to strive to untangle it. Where this confusion is necessary in the complete system of books, it is advisable to adopt clear accounts for the departments and let the city treasurer and the corporation counsel struggle with the task imposed upon them by the State laws and city ordinances. In this way the commendable cause of uniform municipal accounting will be most rapidly advanced.

It is unfortunate that many advocates of municipal accounts have shown little appreciation of the fundamental principles of book-keeping. Some of them have spoken of the summary of annual accounts of the New England Water-Works Association as an accounting system, others have referred to similar schedules advanced for other classes of work in a like manner. These forms are no more book-keeping than a final estimate is an engineering report. A system of accounts must show every item of receipts and expenditures down to the last cent, arranged in a manner that is free from the slightest ambiguity. A good book-keeper would be astonished at the incomplete and sketchy systems put forward in sober earnest by some of the leading advocates of uniform accounting, systems which would inevitably result in unsatisfactory accounts if followed for a few years. Any system which does not provide with absolute lack of question for every pound of waste, every lead pencil and every carfare is unnecessarily imperfect. It is no longer possible to say that such minute schedules are too complicated, because they have been in operation all over the country for some years with great satisfaction to all concerned. The accounts of most street railway companies are now kept in accordance with a uniform system of great interest. Not only is it clear in its smallest details, but its classification is such that the summarized results are immediately available for study as soon as they are made public. If the summary is preceded by the statement that it follows the street railway accountants' schedule, its items are open to no question as to what receipts or expenditures are included in any of them.

Some such schedule is required in municipal departments, and until men of experience are willing to undertake its preparation it is desirable to keep in the background the entirely inadequate schemes of inexperienced enthusiasts. These hurt the cause of uniform accounting, because the men who have kept accounts or managed departments see how many small things are not provided for. A few of these little items will cause just as much, or more, trouble to the book-keeper as the larger items, and a system of accounts which does not provide for them must inevitably be a failure. About ten years ago The Engineering Record made an investigation of water-works accounts, which demonstrated clearly that no successful scheme of summarizing returns was possible until the method of entering every item was definitely understood. At that time it seemed that a complete system applicable for a large department would be too complicated for a small one, but the experience with the street railway accounting system has proved this view to be incorrect.

While the accounts for individual departments are thus open to immediate improvement, the general accounts, in which provision must be made for every legalized vagary, offer a problem of the greatest perplexity. Anyone unfamiliar with the subject will find an interesting account of one feature of it in a report recently made by Mr. Harvey S. Chase to Mayor Hart of Boston, on the books and accounts of the collector's department of that city. It refers particularly to the results of the numerous acts and judicial decisions relating to special assessments for laying out and constructing streets during the past ten years. As law followed law the accounting system of seven municipal bureaus had to be changed, while the Supreme Court's decisions also introduced great complications. The trouble was greatest in the collector's office, where the books eventually became a mystery of cross-entries, items squeezed in, and charges crossed out and re-entered. This confusion is due in no part, Mr. Chase states, to any neglect of the financial officers, who, on the contrary, have been exceptionally careful, accurate and persistent in following up these accounts. "The only sufficient and practical method to straighten out these tangles of the laws and the finances," he reports, "will be through the appointment of an efficient commission of experts, upon which there must be representatives for the law, for accountancy and for real estate interests, who shall thoroughly study all the questions involved and be prepared to submit to the next Legislature a complete and comprehensive act which shall put the whole matter of special assessments upon a clearly defined, equitably arranged and financially well-based enactment, which should stand for many years without serious conflict with the courts and without requiring any vital amendment." The careful report of this well-known public accountant is commended to the attention of those critics who believe they can settle in a day or so all the difficulties at the root of municipal accounting, and that the professional reformer or, let it be whispered, the engineer out of a job, is sufficiently equipped to solve in a trice the complications that experts have worked over for months with only moderate success.

Pneumatic Caisson Foundations of the New York Stock Exchange Building.

The new building for the New York Stock Exchange will occupy a site in the heart of the banking district in New York City, formerly taken up by the old Stock Exchange, the Western Union Telegraph and the Anglo-American buildings. It will be an eight-story steel-cage fireproof building, with an approximately rectangular main part about 150 feet deep, with 138-foot and 153-foot fronts on Broad and New streets, respectively, and an irregular extension about 84 feet long, with a 15-foot front, giving a Wall Street entrance. There are wall columns on all sides, and the interior columns are arranged in three longitudinal and six transverse rows, spaced 20 to 35 feet apart on centers. All columns are supported on concrete piers built on pneumatic caisson foundations; these are sunk to an average depth of 60 feet below the New Street curb to solid rock or to very refractory hard pan, which resembled good concrete, and was considered equally strong.

The substructure contract included the removal of the old building and the excavation of the cellar, and is interesting on account of the special features of design and new methods of execution, the magnitude of the plant installed, rapidity of progress, and the successful fulfillment of the requirements that the foundations should be ready for steel work three months after the demolition of the old building was completed to curb-level; that the finished cellar floor should be carried 54 feet below the New Street curb, and that the floor and walls should be made perfectly water-tight under an hydrostatic pressure head of 42 feet.

The caissons were spaced to clear the walls of the old safe-deposit vault in the cellar of the old building, which were sunk without disturbing it or interrupting its daily use by depositors. A roof was built over the vault and a passageway by which access to it was maintained; and above the roof a platform was constructed for foreman's offices, light storage, etc. The vault is carried temporarily on timbers and shoring, which will support it until the excavation is completed and the columns and girders of the new building are in place and can receive it, when the weight will be transferred to them and the timbers removed. The new vault will be constructed alongside the old one and the contents will be eventually transferred to it without having interrupted the safe-deposit business or hindered the excavation or the erection of the steel superstructure.

A wooden inclined plane was built from the curb to the cellar bottom in the northeast corner of the lot, and materials were drawn in and out there on wagons. Four stiff-leg derricks with 14 x 14-inch booms 50 feet long, were set in the pit so as to command almost all parts of it. Nearly the whole length of the Broad Street sidewalk was covered by a horizontal platform about 15 feet high and 35 feet wide, which projected 15 feet beyond the curb and occupied a part of the street, which was used for storage, concrete mixing, and other purposes. The platform had a deck of 4-inch longitudinal planks supported on heavy transverse beams about 3 feet apart, laid across the tops of three equidistant longitudinal bents, with top and bottom sills and vertical posts about 6 feet apart on centers. The bents had longitudinal X-bracing, and there were knee braces from the vertical posts to the middles of the transverse caps. The main timbers were 12 x 12-inch and the bracing was of 3 x 10-inch planks securely bolted. The sidewalk was covered by a single pitched waterproof roof, made of matched 1-inch boards and tar paper, which protected it from drip and dust from the deck above. On the west side of the deck there was a 25-foot gauge T-rail track about 80 feet long, on which there moved a timber tower about 30 feet wide, 35 feet long and 35 feet high, with a 50-foot boom at each corner. The tower was made with 12 x 12-inch principal timbers and bolted steel connection plates, and was X-braced with screw-end steel rods in each face. The tower carried four hoisting engines, boilers, coal and water, and was stable under heavy boom loads; but when in use it was anchored to the track rails for additional security.

On the opposite side of the lot a similar elevated platform occupied the full width of New Street, and was movable on longitudinal sills laid on the sidewalks, outside the curbs. The deck was supported on two seven-post longitudinal bents braced longitudinally and transversely, and on the side next the excavation there were braced together two stiff-leg derricks with 14 x 14-inch booms 50 feet long. The booms were rigged for 40-ton loads and had very massive connections, the goose-necks at the top of the mast being solid steel forgings about 4½ x 10 inches in cross-section. The derrick booms on Broad and New streets engaged with those in the excavation, and were used for handling caissons, air locks and shafts, machinery, supplies, excavated materials and concrete. Each had a separate Lidgerwood hoisting engine, with two drums for the hoisting and topping lift tackles, and two spools for swinging. There were in all fifteen hoisting engines, and each of them had an independent vertical boiler.

In the Broad Street sidewalk-vaults were set the steam pumps, ejectors, and two 24 x 24-inch Rand air compressors. The 9-inch pipe from the compressors discharged beneath the surface of running water which half filled a large tank, and the outlet from the tank was carried below the surface of the water in a second cooling tank. From this tank the air was taken to a receiving tank, from which it was distributed to the caissons. By this arrangement the air was cooled from 140 degrees Fahr., to 90 degrees or less before expansion. All the compressors and tanks were by-passed and valved, so that any one could be used or disconnected independently of the rest, and a high-pressure compressor used to operate pneumatic tools was valved so that it could be connected to the caisson system if necessary. The compressors and pumps were operated with steam purchased from the New York Steam Company.

The substructure of the building was designed and the methods of building it were devised in conformity with the requirements indicated by the preliminary exploration of the soil. Before the old building was removed more than a dozen holes were sunk from 30 to 50 feet deep in its cellar, where there was but 6 feet headroom. They were made with a water jet at 130 pounds pressure and a churn-hand drill, as described in The Engineering Record of October 20, 1900. Afterward eight more holes were made with a 3½-inch Calyx drill, using chilled shot instead of diamond cutters, and removing a core 2½ inches in diameter. With it holes were sunk 10 or 15 feet into the solid rock, which substantially confirmed the indications from the first holes. The interpretation of the data thus secured conformed to the observations recorded when the caisson excavations were made, viz.: That the quicksand, with occasional boulders and pockets of gravel and clay, extended to hard pan about 50 feet below the New Street curb. The hard pan was about 10 feet thick and was underlaid with soft rock, which was sometimes soft on top and hard below, and sometimes had pockets of quicksand between it and the hard pan.

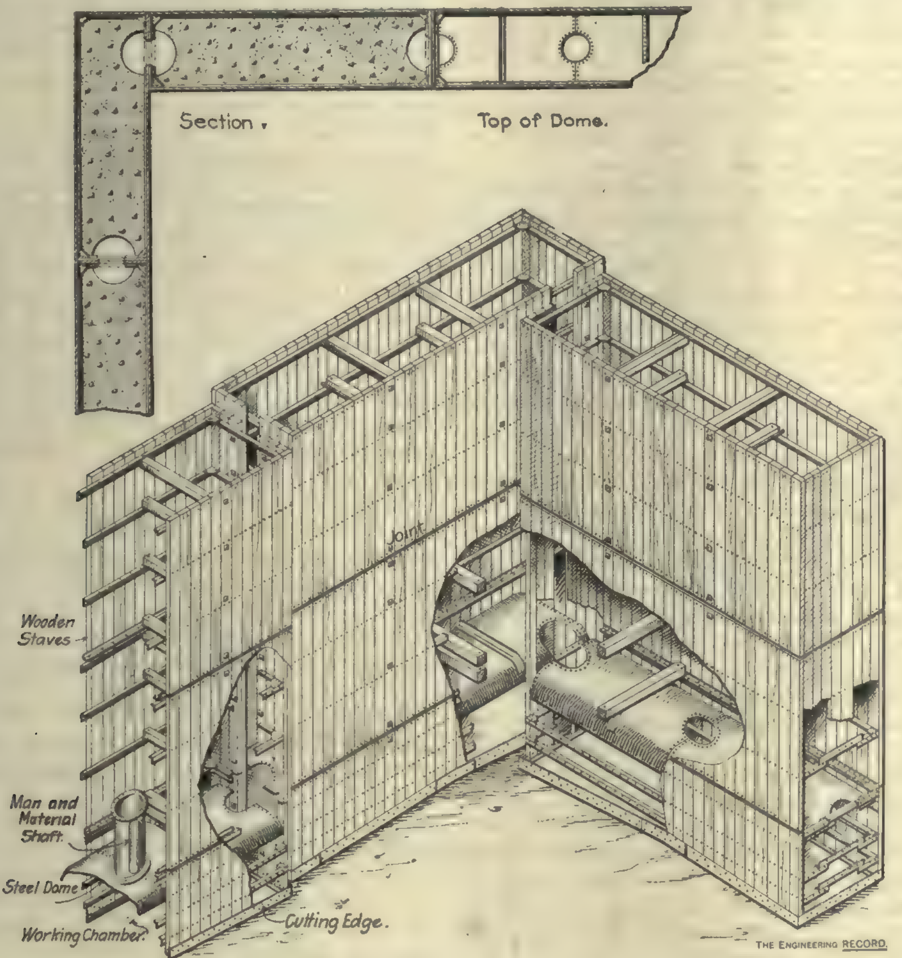
The caissons were arranged as shown in an accompanying general plan, all the interior ones and those in the Wall Street extension being O'Rourke's patent wooden-stave cylinders from 6 feet to 8½ feet in diameter. Their total heights above the cutting edges averaged about 45 feet, and they were made with uniform bottom sections about 8 feet high and 15-foot cofferdam sections above. The details of these caissons and the methods of sinking them corresponded to similar work which has been executed by the same contractor, and which has been described in these columns from time to time.

Sinking the First Two Corner Caissons.

On the south side of the building the walls of the adjacent Commercial Cable Building had been previously carried down to bed rock with pneumatic caissons, as described in The Engineering Record of April 17 and May 8, 1897. These form a massive water-tight wall, which permitted the construction of the new foundations there without danger of undermining or settling, and obviated the necessity which existed on the other sides of the lot for a retaining wall to resist heavy lateral pressures. Detached small piers are therefore used for the wall columns on the south side of the building, but the wall columns on the north, east and west sides are supported on rectangular piers set close together so as to form a continuous thick wall of solid masonry extending to bed rock, and forming a massive subterranean dam to withstand a heavy hydrostatic pressure. This dam was constructed in separate sections or column piers about 8 feet wide, from 24 to 30 feet long, and averaging 50 feet high, which were afterward united by an entirely new and ingenious system of water-tight solid masonry joints, which locked them together into a continuous structure. The sections of the dam, or the piers for the wall columns, were built in separate caissons and cofferdams, which were sunk with an average clearance of 1 inch between adjacent sides and then had communication made between their interiors so that there were large open spaces, through which the concrete masonry extended continuously from caisson to caisson, uniting them strongly, and obviating the necessity of stockramming, puddling, or difficult or uncertain connections between them.

Each rectangular caisson and cofferdam is sheathed with 6 x 12-inch vertical wooden staves with square calked edges, without splines, which are smooth outside, and are secured inside by lag screws to successive courses of horizontal angles. The angles of the same course have their vertical flanges turned in opposite directions on the sides and ends of the caissons so that their horizontal flanges overlap at the corners, where they are bolted to gusset plates with slotted holes. The longitudinal walls are braced by horizontal transverse timbers supported on, and bolted to, the horizontal flanges of every course of frame angles, and by screw-end tie rods parallel and adjacent to them. During transportation the upper end of the caisson was temporarily braced by clevis-ended diagonal rods in the panels between transverse braces. The cutting-edge is a wide vertical plate with the lower edge reinforced with an angle which supports the bottoms of the staves on its horizontal upper flange.

The cofferdam is exactly like the caisson except for the absence of cutting-edge and roof, and is permanently attached to it. The caisson section is made 8 feet high, and the cofferdam regular sections are made 15 feet high, all having the ends of the staves cut square in horizontal planes and butting together on rope gaskets. The horizontal frame angle at the top of each section is set 3 inches below the upper ends of the staves, with its horizontal flange up. The corresponding angle at the bottom of the next section above is set with the horizontal flange down and its vertical web projected 1 inch below the ends of the staves so as to form a kind of tenon, engaging the lower section of the cofferdam and preventing lateral displacement. There is also a row of vertical I-bolts, 1 foot apart, connecting the horizontal flanges of these angles above and below the joint.

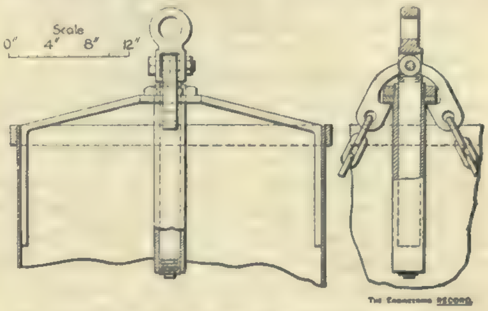


THREE CAISSONS IN THE SUBTERRANEAN DAM.

The working chamber has a domed roof of steel plates, reinforced with transverse angles on the upper side. Each caisson has a 3-foot shaft-hole in the middle of the roof and a 3-foot semi-circular hole, closed with a bolted cover-plate, at each end. The center hole is used for men and materials, and the pipes are carried through the end holes. Each course of the horizontal angles across the end staves of the caisson and cofferdam is made in three sections, with an open space of 30 inches between the inner ends of the end sections. This space is closed by the third section of the angle, which is about 4 feet long, and has the ends of its horizontal flanges bolted on top of the horizontal flanges of the other angles. By removing these splice bolts the middle planks in the end may be taken out from within.

All the caissons and cofferdam sections were delivered complete at the site, and weighed as much as 30,000 pounds each. They were handled by the derrick booms, which lifted them with a spreader consisting of an angle-iron frame 7 feet square, made with corner gusset plates and a single diagonal. In each corner there was a screw-end eye bolt with a chain to the lifting ring, which was shackled to the hoisting tackle. The spreader was attached to the caisson at four points, on opposite sides of the center of gravity, by short vertical chains which terminated in 2-inch eyebolts with short screw ends. Bolted to the insides of the caissons were 4-foot lengths of 6 x 6-inch angles, with holes in their horizontal flanges through which the eyebolts were screwed. After the caisson was set in place the 6 x 6-inch angles were removed and their bolt holes plugged.

The caissons were set to within the fraction of an inch of their required positions, and special care was taken to insure vertical sinking. They were enclosed by horizontal rectangular frames of heavy timber about 10 feet above the surface of the ground, which were solidly supported to resist heavy vertical strains, and were rigidly braced against lateral displacement by inclined shores. Clearance was left between the frame and the caisson, and the latter was centered and lined up with 12 x 12-inch vertical oak blocks 2 feet long, driven between the frame and the caisson, on opposite sides. The blocks were slightly tapered, and had shoulders on the side next the frame; the other side had the ends rounded to prevent biting and was well greased. Packing was usually put between the shoulders and the top of the guide frame to prevent the block from binding too tightly. There were no rivet heads or other projections on the outside of the caissons, and as the vertical staves were planed smooth and well greased, they were sunk with great accuracy, with a clearance of from ¼ inch to 2 inches between adjacent sides.

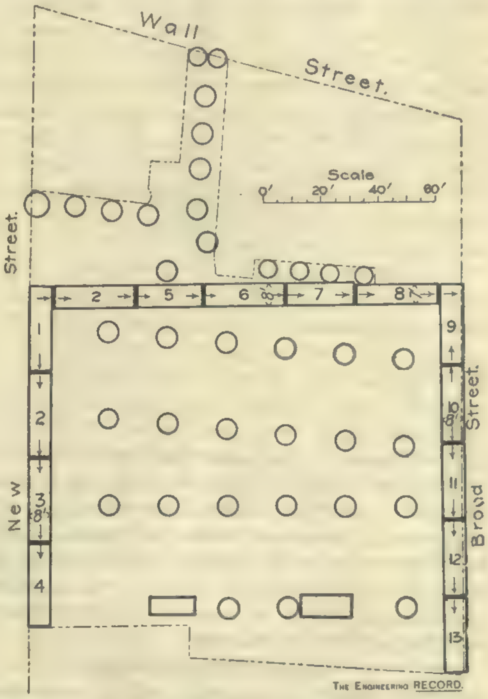


AUTOMATIC LOCK FOR CONCRETE BUCKET.

The material shafts were fitted with improved air locks similar to those used for the pneumatic caissons for the foundations of the Fabbri residence, which were illustrated in The Engineering Record of December 10, 1898.

In soft materials the excavation in the caissons was so rapid that almost as good progress was made with it as in an open cut, and it required eight outside men to load trucks with the spoil excavated by eight men in a caisson. One-half yard cylindrical buckets were used for the spoil, and were dumped by a snub line attached to the bottom. They were passed through the air lock with a delay of sometimes not more than two seconds in hoisting. In some cases the buckets dumped directly into wagons, and in others into storage bins, which were built on both sides of the lot, or on platforms, whence the spoil was wheeled in barrows to the bins and loaded from them at convenience.

There are 37 cylindrical and 16 rectangular caissons, and the last one was sealed 75 days after air pressure was put on the first one. The greatest speed of sinking was 4½ feet in four hours through soft material. Very little underpinning or shoring was done for an adjacent building which had comparatively shallow foundations, and no evidences of undermining, cracking or settlement were observed. The maximum air pressure in the caissons was about 23 pounds, but the sinking was so rapid that the



LOCATION OF CAISSONS.

full pressure, equal to the hydrostatic head of ground water, was seldom maintained. The caissons were loaded with large quantities of concrete rammed in on top of the roof of the working chamber, and by pig iron temporarily piled on platforms across the transverse struts or on beams laid across the angles of the cofferdam. Work was continued night and day in successive eight-hour shifts of about 250 men each, including about fifty sand-hogs, as many as 27 of whom were in a single rectangular caisson at once.

The interior caissons, and all those for the dam, were carried down to solid rock, about 60 feet below the New Street curb; clay was puddled around the cutting-edge, and a 6-inch layer of concrete was rammed on the bottom and allowed to set under pneumatic pressure to seal the caisson against a hydrostatic pressure of 40-foot head of ground water outside. All unsound rock was excavated, all sloping surfaces were leveled, and wherever it was necessary to excavate for the column foundation grillages, the rock surface was cut down so as to leave a bed of concrete to seal above the cutting-edge. The steel work was set on a bed of cement mortar. The rock surface in the dam caissons was scraped and washed and carefully grouted so as to make a water-tight connection with the masonry. The transverse struts were removed from the cofferdams as the concrete was deposited in them by automatic 1¼-yard buckets.

These buckets discharged their contents through double-bottom flaps similar to those used for the piers of the City Island Bridge, described in The Engineering Record of December 2, 1899. The flaps were operated by an improved device, illustrated by the accompanying sketch. The flaps are supported in a closed position by chains attached to a pair of hooks pivoted to an eye which is shackled to the hoisting tackle. The eye has a guide, free to move vertically in a pipe-case passing through the bail of the bucket, and protecting it from obstruction by concrete, which fills the bucket and surrounds it. When the bucket is lowered to rest on the bottom, and the hoist rope is slacked a little farther, the hooks descend and are disengaged, and allow the flaps to open and discharge the concrete when the bucket is raised. When the bucket is again lowered to rest on its bottom, the flaps close and the hooks automatically engage the stop and hold the flaps in place, and so on.

The interior caissons were sunk in any order which was convenient, but the exterior rectangular ones, forming the submerged dam, were sunk in the order indicated by the numerals in the general plan, where it will be seen they made lap joints rather than butt joints with each other at the corners of the lot. The 3-foot steel air shafts were permanently left in the caissons, and the concrete was rammed around them and around semi-cylindrical temporary molds set above and below the semi-circular holes in the roof of the working chamber at both ends of the caissons. Below the roof the molds were 3 feet in diameter, and above it they were 4 feet in diameter.

After the working chamber was filled with concrete, several barrels of a thin grout of pure Portland cement were poured in the bottom of the air shaft. The top of the shaft was closed with a plate in which was a flap door closing upward against an air-tight gasket, and air pressure was applied in the shaft, forcing the grout into all the interstices of the concrete and filling all cavities left under the steel roof plate. More grout was put in, if necessary, and the pressure was maintained until it would hold for ten minutes at 20 pounds, when the connection with the compressor was cut off. Afterward the air shaft was concreted in the usual manner, and confidence was felt that no empty spaces were left in the working chamber.

After the adjacent caisson was sunk almost in contact, a man entered the semi-circular well in the end of the working chamber and, removing the bolts through the horizontal angles there, opened the door formed by the lower part of the two center end staves of the caisson wall. The corresponding door in the other caisson being also opened, communication was established between the two working chambers under pressure, and the space was concreted. The caissons were designed so that each pair of caisson doors opened in the same direction, as indicated by the arrows in the general plan. Communication was similarly established between the semi-cylindrical wells in the adjacent ends of the cofferdams above, and the roof plates were removed and they were filled with concrete, continuous with that in the caisson and cofferdams, making a solid, strong key, locking the sections of the dam together. The cross-section of this concrete key was about 4 feet wide and 5 feet long, with a narrow neck in the middle, where the staves of the caissons passed beyond the edges of the semi-circles, looking like a section through the axis of a rivet with two hemispherical heads.

Before the middle end planks in the caissons and cofferdams were removed to open up communication between the half-wells, a vertical row of holes was bored from one caisson into the other through the permanent staves on both sides of the proposed opening, and bolts were put through them and screwed up tight, binding the caissons as closely together as possible; then when the opening was made, if any spaces were found between the staves, they were filled and the joint was calked.

As the concrete was deposited and allowed to set in the caissons and cofferdams before the connecting wells were filled, the inevitable shrinkage in the large masses of concrete was allowed to occur before the connection between the caissons was made; and then when the wells were concreted, the whole space was entirely filled, and the shrinkage from the comparatively small mass of well concrete was negligible. A solid wall was thus secured, reaching from bed rock to above water-level, enclosing the cellar and forming a massive structure of continuous solid masonry, accurately placed and having tight shrinkage joints, dovetailed together. Below ground-water-level the sheathing of the caissons forms a double water-tight facing on the dam and prevents all leaking or seepage, while it is practically indestructible, because it is permanently saturated.

The accompanying progress picture is from a photograph looking toward New Street, which was taken June 16, the first day after the caisson sinking was commenced, and before the lower part of the old building was demolished. Caissons 1 and 2, forming the northeast corner of the subterranean dam, are seen in the foreground. Caisson 1 has already been sunk several feet, and a section of the cofferdam has been added on top of the working chamber, building it up higher than caisson 2, in which excavation had not yet been commenced. The steel roof of its working chamber is partly visible, and above it a spreader frame and chains for lifting the caissons, is seen resting on the upper edge of the caisson. Behind caisson 1 is the New Street movable platform, with one of its derricks lifting a bucket of sand from the air lock. The braced guide frame around the caisson is clearly shown, and above it vertical black marks are seen where the staves have been greased to slip past the wedge blocks. At the right is a spoil bin, at the left is the shelter protecting the safe-deposit vault, and in the bottom of the pit there are air-lock shafts both sides of caisson 2.

Mr. George B. Post is the architect of the building, and Mr. J. F. O'Rourke, consulting and contracting engineer, designed the caissons and built the substructure here described.

The Convention of the New England Water-Works Association.

The twentieth annual convention of the New England Water-Works Association was held at the New Falmouth Hotel, Portland, Me., on September 18, 19 and 20. Owing to the death of President McKinley the attendance was not so large as usual, about 100 members and guests being present. The opening session was held in the Council Chamber of the City Hall, where the members were welcomed by Hon. Frederick E. Boothby, Mayor of Portland, whose address was responded to by the President of the Association, Mr. F. H. Crandall, of Burlington, Vt.

The following candidates were then elected to membership: Charles N. Fenn, engineer Caribou Water & Electric Light Co., Portland, Me.; Frank A. M. James, Boston water-works, Boston; Edwin F. Dwelley, engineer, Lynn Public Water Board, Lynn, Mass.; Henry A. Fiske, manager Underwriters Bureau of New England, Boston; L. R. Woods, superintendent water-works, Everett, Mass.; Charles A. Mixer, designing engineer, Rumford Falls, Me.; Michael F. Collins, superintendent water-works, Lawrence, Mass.; Jerome W. Goodell, water commissioner, Burlington, Vt.; Joseph C. Beardsley, second assistant engineer water-works, Cleveland, Ohio; M. N. Baker, associate editor Engineering News, New York; John Goodell, managing editor, The Engineering Record; James B. Campbell, president, J. B. Campbell Brass Works, Erie, Pa.

On motion of Mr. C. W. Sherman, the following were appointed a committee to report on nominations for officers of the Association for the year 1902: Dexter Brackett, George A. Stacy, Charles H. Baldwin, F. F. Forbes and J. C. Whitney. It was then voted on motion of Hon. George P. Westcott that no sessions be held on Thursday out of respect for the late President, and that when the convention adjourned Wednesday evening it should adjourn to meet Friday morning. This action made necessary the postponement until the next meeting of some papers which were to be presented at the Thursday sessions.

The first paper read at the Wednesday afternoon session was on "Bacteriological Analysis of Water and its Interpretation. Demonstration of Cultures," by Prof. Charles Edward Amory Winslow, of the Massachusetts Institute of Technology. Mr. George E. Winslow, former superintendent of water-works, Waltham, Mass., stated in the discussion that during the last year a supply of water from the Charles River, varying in amount from 30,000 to 50,000 gallons daily, had been added to the regular supply of spring water in the Waltham reservoir. This river water had been more or less imperfectly filtered through natural gravel, but a change was at once noted in the appearance of the ground water which became turbid to a marked degree. Mr. Winslow desired to know whether this mixing of ground and river water was not likely to be productive of harmful effects and if the city could feel justified in securing an additional supply of water by this means. Prof. Winslow thought that from a sanitary point of view such a course was not to be recommended.

The report of the committee on "Uniform Statistics" was next in order, but owing to the absence of Chairman Joseph E. Beals, the report was deferred. Mr. Sherman, who was present at the last meeting of the committee, informed the members that the matter was progressing satisfactorily. Mr. George E. Winslow then told of his "Experiences in Reducing Water Ram Produced by Direct-Acting Pumping Engines," describing the difficulties he had encountered in this connection, while superintendent of water-works at Waltham, and of the means employed to overcome them.

At the evening session Wednesday a paper entitled "The Work of Sanitary Inspection on the Metropolitan Water-Works" was read by Mr. William W. Locke, sanitary inspector, South Framingham, Mass. He sketched the work carried on by the metropolitan water-works along this line, describing the methods employed in dealing with offenders against the various statutes regarding water-supply pollution. The paper is printed in another column.

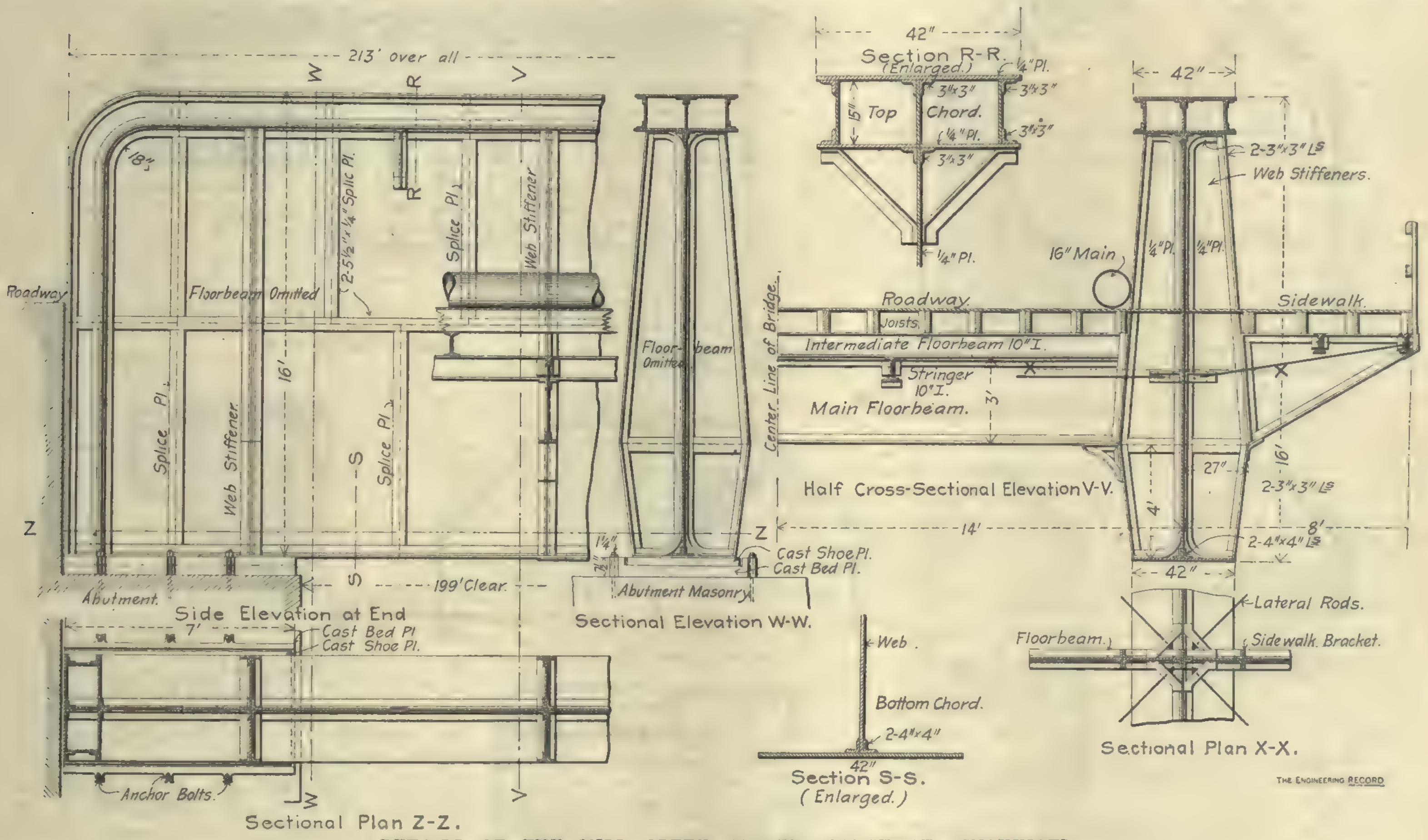
A preliminary report of the committee on "Standard Specifications for Cast-Iron Pipe," Freeman C. Coffin, Dexter Brackett and F. F. Forbes, was then read by Mr. Sherman. The report stated that the committee had conferred with several manufacturers of cast-iron pipe and with committees appointed for a similar purpose by other associations. A set of specifications, together with tables of the proposed dimensions, was submitted with the report.

A partial report of the committee on "Apportionment of Charges for Private Fire Protection, and the Means of Controlling the Supply Thereto," consisting of Byron I. Cook, Edward V. French, J. C. Hammond, Jr., Charles K. Walker and John C. Chase, was then presented. Mr. Cook asked to be relieved of the chairmanship of the committee as he had resigned as superintendent of the water-works of Woonsocket, R. I. This was granted and F. H. Crandall and Henry A. Fiske were added to the committee's membership.

On Thursday night the members attended a banquet tendered by Hon. George P. Westcott, President of the Portland Water Company. On Friday an enjoyable excursion was had to Sebago Lake and the Bay of Naples.

Mill Creek Bridge, Cincinnati.

A large city traffic on Sixth Street, Cincinnati, is carried over Mill Creek by a plate girder through bridge about 80 feet high, which is remarkable for its details of construction and for the dimensions of the two main girders, which are 213 feet long over all. This gives a clear span of 199 feet between abutments, a distance which is probably greater than in any other plate girder span in this country, if not in the world. The girders are 16 feet deep, about 28 feet apart, and carry a roadway, two 8-foot cantilever sidewalks and a 6-inch and a 16-inch pipe line. The girders are built of very thin plates and thin small angles; the bottom flanges are made by very wide and thin plates connected to the web with a single row of ¾-inch rivets, the top flanges are efficient compression members and the deep thin web is stiffened by wide transverse diaphragms, which, with their double flange angles, provide thorough connections between the top and bottom flanges.



DETAILS OF THE MILL CREEK GIRDER BRIDGE AT CINCINNATI.

The web plates of each girder are in two courses, of equal height, those in one course breaking joints with those in the other, and all spliced with butt joints and a cover plate on each side, with a single row of rivets in each edge of each web plate. The web is divided by its vertical stiffeners into two 6-foot end panels and 20 intermediate panels a little more than 10 feet long, each of the latter being composed of five plates, as indicated in the elevation. The web stiffeners are ¼-inch plates, with a pair of 3 x 3-inch flange angles around all sides. The inside flange angles are continuous across both the top and bottom of the diaphragm, are bent to a short curve at the corners to clear the main girder flange angles and are riveted to both web and flanges of the girder.

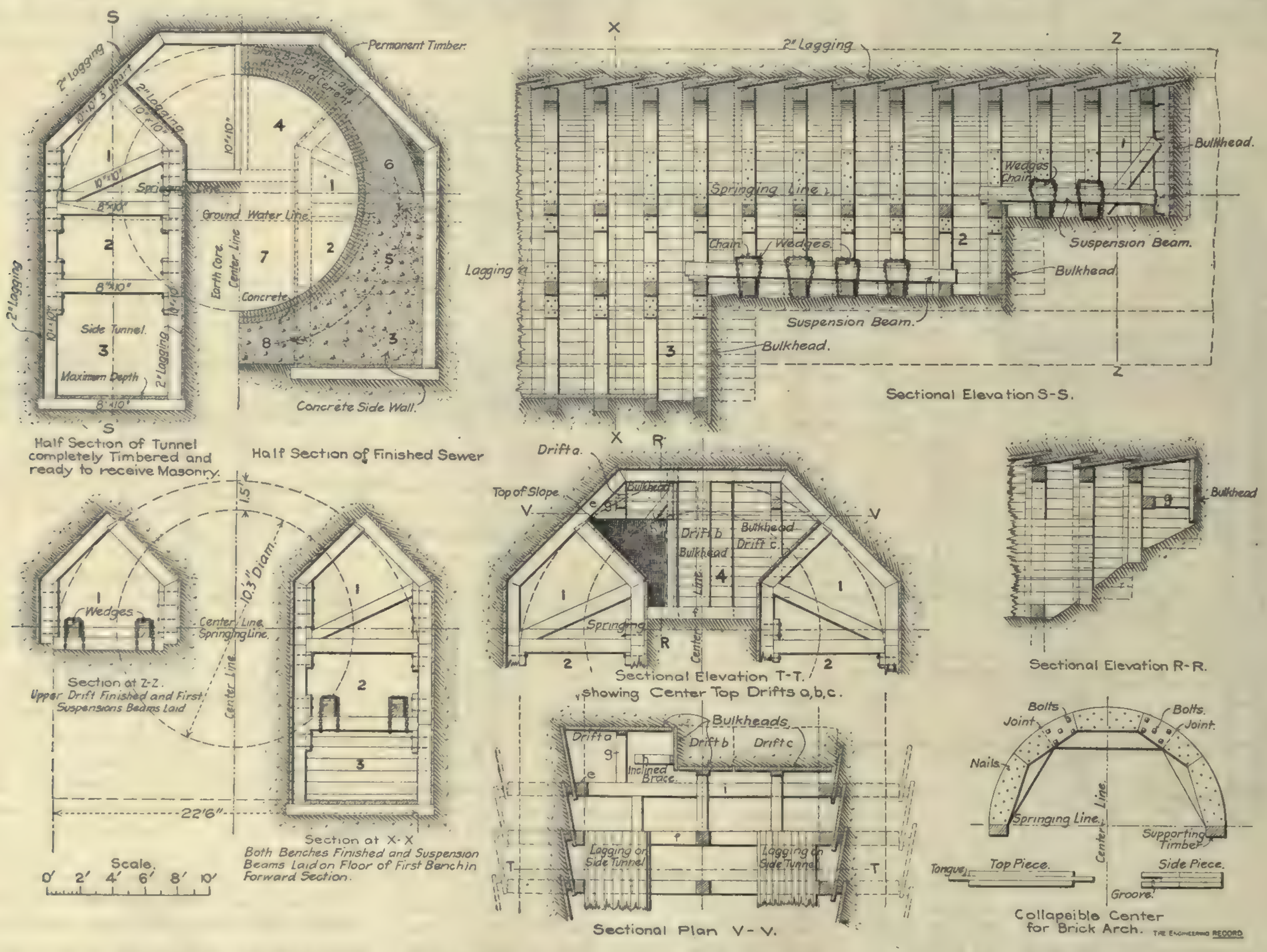
The bottom chord of the main girder consists of a pair of 4 x 4-inch flange angles and one or more cover plates 42 inches wide. As it was inaccessible except at the abutments, the lengths and thicknesses of the plates were not determined, but commencing with a single plate at the end of the girder there was apparently one plate added at each panel point toward the center for at least four or five panels. The top flange or chord of the girder is a closed rectangular section with three webs, and is not unlike the top chord of a modern truss bridge, except that the thickness of the angles and plates is small. The angles are spliced by flat bars on their vertical flanges only, and the cover plates are spliced by short top plates with two transverse rows of rivets in each end. In the middle of the top chord the total thickness of the cover plates is 1½ inches, and the thickest plates are ⅝-inch. At panel points the top chord is riveted to the vertical web stiffeners, and midway between them it is braced from the outside of its bottom flange to the web by 5 x 3-inch T-bar knee braces with bent ends. The upper corners of the girders are rounded, and the top chords bend 90 degrees there, so that their continuous extensions make vertical end posts reaching to the lower edge of the girder.

Each end of the girder has a flanged cast-iron shoe plate about 4 inches thick and 7 feet long, which slides on a corresponding flanged bed plate anchor-bolted to the masonry, on which it has a bearing about 7 feet long. The edges and surfaces of the plates and angles throughout the bridge were so badly rusted that it was difficult to measure their thickness accurately, but most of them appeared to have been from ¼ to ⅜ inch thick originally. Plate-girder floorbeams, 3 feet deep, are riveted to the flanges of the web stiffeners at panel points, and carry two lines of 10-inch I-beam stringers which are web connected to them. A 10-inch I-beam is set across the tops of these stringers between each pair of floorbeams, and on them are wooden joists, 2 feet apart on centers, which carry the 2-inch transverse floor plank. The sidewalk cantilever floorbeams have two lines of web-connected I-beam stringers which may originally have carried the floor, but now serve only as braces, the floor being carried on wooden joists on the top flanges of the cantilevers.

The lateral diagonals are single round rods reaching across three panels of floorbeams, and having screw ends with nuts bearing on the vertical flanges of short horizontal angles with bent ends, riveted across the corners to the webs of the main girders and their stiffeners. The intersecting diagonals terminate at the center of the panel and are connected by a small horizontal welded ring of angle iron, with their nuts bearing on the inside of its vertical flange. In several places the bottom flanges of the girders have been tied together with 1-inch transverse rods, with loop ends bolted to them, and having sleeve nut adustments.

Except that it was badly rusted, the bridge appeared, so far as could be determined by a hasty informal inspection, to be in serviceable condition, fairly well aligned and rigid under traffic when sketched last fall by a member of The Engineering Record's staff. It was built about 1870, and is said to have cost $50,000 besides an additional sum of $30,000, due to a wash-out during erection. A few years ago a transverse trestle bent was put under the bridge about 50 feet each side of the center of the span, to check the lateral vibrations. Each bent was attached to the lower flanges of the girders and has three steel columns with top, bottom and intermediate horizontal struts, and diagonal sway brace rods in every panel.

On one of the girders there is a cast-iron name plate inscribed, "No. 2, Patented Dec. 4, 1866. O. G. Leopold, Bridge Builder, Cincinnati, O." When this bridge was built it replaced a truss or arch span on the same site, and remains of foundations were discovered which indicated that a still earlier and shorter span had existed there, of which there is now no record.



SYSTEM OF EXCAVATION AND METHOD OF TIMBERING, WALWORTH STREET TUNNEL, CLEVELAND.

The Walworth Street Sewer Tunnel, Cleveland.

The Walworth Street sewer in Cleveland passes under the tracks of the Big Four Railroad in a brick and concrete circular tunnel 14¾ feet in diameter and about 200 feet long. At this point the double tracks of the railroad and one side track are carried on a high earth embankment which it was intended at first to replace with a pile trestle. This plan was not carried out and it became necessary to build a tunnel about 18 feet in the clear below the rail base and at an angle of 36 degrees with the line of the tracks, through very soft wet ground excavated about 12 feet below the original surface. The railroad traffic was heavy and great care was necessary to avoid serious disturbance of the tracks and to prevent the earth from caving in at the tunnel roof under the heavy load and severe vibrations.

The excavation was made in eight operations and the masonry was built in four operations. The total excavation was 21 feet high and 25 feet wide, and was made piecemeal from both sides and from the top down. First a heading 7 feet high and 9 feet wide, with the roof sloping both ways, was driven in the haunches of the tunnel arch on each side simultaneously. Its position and dimensions are sown in the diagrams marked 1-1, etc. After a convenient length of these headings had been driven benches about 5 feet deep, marked 2-2, were excavated and finally a second bench, 3-3, on each side of the center line, was excavated to below grade. After the headings 1-1 were driven two 12 x 12-inch longitudinal suspension timbers were laid on top of the bottom sills in each heading and supported on wedges at both ends. The sills were chained to the longitudinal timbers, and made snug with pairs of wedges. Then, bearing cleats having been nailed to the vertical posts above the sills, the bench was excavated and the timbering was supported from the longitudinal timbers until the second sections of the vertical posts could be driven in under the bottoms of the first ones and the side lagging and lower cross struts placed. The second bench was then taken out in a similar manner.

The concrete side walls 5-5 were built in them, the vertical timbers and lagging being left permanently in the ground and the cross struts being removed as the concreting progressed. The upper center heading 4 was through very fine dry sand with about 18 feet cover, and as the face had to be continually protected by vertical transverse bulkheads, it was excavated in three parallel successive drifts, as shown in the plan and sections. These drifts were started at the highest part of the tunnel and only made 3 feet high and 3 feet long, the bottom sloping downward and backward and the sides being retained by poling boards and bulkheads. The front bulkheads were braced back against temporary horizontal cross struts, and when the whole width of the heading was excavated the drifts were deepened to a point below the tops of the walls of sections 1-1 and the permanent roof timbers were put in, supported by inclined posts at the ends which rest on the apexes of the side tunnels and on vertical center posts.

Collapsible timber centers for the brick arches were made in three sections each, bolted together at the splices as shown in the elevations, with long tongue and groove joints. These centers were set between timbers on horizontal longitudinal sills supported on the concrete, and jack screws were set on top of them under the roof timbers and screwed up to relieve the pressure on the braces and allow them to be removed. The lagging was laid as required and the arch 6-6 completed, leaving the roof timbers permanently in place. The centering was not braced or secured, but was found rigid and satisfactory.

Finally the dumpling, 7, was removed and the concrete invert 8 being laid, the tunnel section was completed. The sequence of the different operations is indicated by the numerals written on the different parts of the sections, which correspond in the several views. The material encountered was fine sandy clay and loam, about half of it being below the ground water line. The sides and roof were sheeted everywhere with 2-inch lagging in 3-foot lengths and the benches were taken out between bulkheads. The material, especially when wet, would run very easily, and large quantities of marsh hay were used to pack in behind the lagging. It was often difficult to set the lagging and sometimes it was blocked and wedged as much as a foot back from the timbers. Wedging and cleats were used very freely and the headings were advanced about 3 feet in 10 hours by six miners in each heading. The rest of the work was carried on at a corresponding rate and about 50 men in all were employed in each of two shifts in 24 hours.

The tunnel was driven through from one end only and materials were handled in and out of the single shaft by a boom derrick. The spoil was shovelled from bench to bench and then taken to the shaft in wheelbarrows; the concrete was mixed on the surface of the ground at the foot of the railroad embankment and wheeled to the required place in the tunnel. The bottom of the tunnel was graded about 1:1,000 downward from the shaft, but all the water was removed by a steam pump with its suction in a sump 3 feet deep in the bottom of the shaft. The sewer was lined with very hard tough vitrified shale brick locked into the Flemish bond of the arch rings. Notwithstanding the utmost care in tunneling the railroad tracks above the tunnel settled several inches some days, and were frequently raised and tamped with cinders. The 16-foot circular section of the outfall sewer is flattened and widened to a 60-foot channel at the outlet; it is being built in open cut through wet clay and loam, which is excavated by hand, and hoisted and backfilled by a Carson-Lidgerwood cableway of about 300 feet span.

Work on this sewer was commenced in 1896 and has been continued under the direction of Mr. M. E. Rawson, Mr. James Ritchie and Mr. W. J. Carter, who have been the successive chief engineers. Mr. Walter C. Parmley has been assistant engineer in charge of sewers since the commencement of this work and has been responsible for most of the design and construction.

The Work of Sanitary Inspection on the Metropolitan Water-Works.

A paper presented to the New England Water-Works Association by Wm. W. Locke, Assoc. M. Am. Soc. C. E.

The public water supplies of cities and towns are derived either from surface supplies or wells. By surface supplies we mean those whose waters are collected from streams and ponds and stored either in natural or artificial reservoirs for use as needed. If the amount of water needed is large, either the water-shed and storage reservoirs must be large or the rainfall abundant. It is manifestly impossible for most cities and towns to own the water-sheds from which their supplies are taken, so as to exclude all inhabitants from the same, consequently the aim should be to use a water-shed with as sparse a population as possible upon it, that the amount of pollution getting into the supply may be a minimum. As the land along most of our large streams is fertile, it is generally kept in a high state of cultivation and is quite densely populated. At every heavy rain, large quantities of organic matter may be washed into the streams.

The object in presenting this paper to this Association is to call attention to the dangers constantly menacing the health and well-being of our cities and towns where surface water-works are in operation, through the pollution of the sources of supply by house and barn drainage, and to suggest some of the agencies through which such pollution may be prevented. I need only to call attention to the sad experiences of Lowell and Lawrence, where epidemics of typhoid fever have been repeatedly shown to be caused by a polluted water supply, and to the recent epidemic in New Haven, where it was established that the disease was spread by means of the water supply, to convince you that eternal vigilance and the authority to prevent pollution, by the use of stringent measures if necessary, are essential to the well-being of a community.

Perhaps you are not all familiar with the facts relating to the New Haven epidemic, and it may be proper for me to allude to them here. I am indebted to Dr. Frank W. Wright, Health Officer of New Haven, for the following statement: In the remote limits of an adjoining town, eight miles from New Haven, there had been during the first three months of the year, at different times, three cases of typhoid. The discharges from the patients were not disinfected, but the father of the family was directed to bury them. During the illness of these patients the ground was frozen solid, and there is every reason to believe that there was no true burial of the fœces. The alleged place of burial was on a side hill with a steep inclination to a watercourse leading directly to Dawson Lake, an important reservoir of the New Haven Water Company.

During all the season there had been an unusual absence of rain. On the 11th of March, 1901, there was a precipitation of 2.46 inches in 24 hours. This heavy fall had a scouring effect upon the surface, carrying all loose debris into the water courses. The temperature had risen during the previous three days, so that the surface of the ground was partly thawed, but the deeper ground was still frozen. Doubtless the greater part or the whole of the infected material was washed into Dawson Lake by this rain of March 11. The first notice of a marked increase of typhoid was on April 3, twenty-three days after the heavy rainfall of March 11, or on the expiration of the period of incubation. The number of cases reported increased daily, until the maximum was reached on April 9, when there was a gradual decrease until April 15, when the total number of cases reported was 350. The persons afflicted were limited very closely to those who were supplied with water from Dawson Lake. No other source of infection was discovered, although the most diligent inquiry was pursued. Many of the students at Yale College were afflicted and others remained away after the Easter vacation because of the prevailing conditions. Besides the loss of life and impaired physical vigor of the victims, which cannot be reckoned in dollars and cents, the direct financial loss to the city must have been very great.

The city of Boston, through its Water Board, early recognized the necessity of adopting a vigorous policy to protect the purity of the water. In 1874 a medical commission, consisting of Drs. Chas. W. Swan, Edward S. Wood and H. P. Bowditch, made a very valuable report upon the sanitary qualities of the Sudbury and some other river waters. In 1879, Mr. Desmond FitzGerald, then superintendent of the Western Division, made a detailed report to the Board, showing the number of cases of contamination, and proceedings were begun in the courts against the offenders. But, owing to the uncertain bearing of the law, not much was accomplished until 1885, when the now classic case of Martin vs. Gleason was decided by the supreme court in favor of the city. This decision may be found in the Ninth Report of the Boston Water Board, p. 76. Mr. Gleason was the proprietor of a hotel in Natick, the discharges from sinks and waterclosets being conducted by a pipe directly into Pegan Brook, one of the feeders of Lake Cochituate. This decision showed clearly that the city had the right to protect its water supply against pollution, as far as the Cochituate watershed was concerned. Mr. FitzGerald's report of that year described ninety-one cases of pollution in Natick, the most of which had been at least partially remedied at the end of the year. Between 1885 and 1889 there were one hundred and thirty-three cases reported in Natick, from which there was direct pollution into Pegan Brook, one hundred and thirteen of which were dwellings or hotels, thirteen were factories and seven were stables. Although a sewerage system was put into operation in 1896, and every effort short of carrying the cases into court was made, still, out of these original one hundred and thirty-three cases, six were yet unsatisfactory at the beginning of this year and twenty-one had been only partially remedied by means of cesspools. I have cited the case of Natick to illustrate what is true everywhere throughout the water-sheds of the Metropolitan Water supply, viz.: the practical difficulty in the way of persuading people to take care of their wastes. The proper officers should have authority to order and supervise all changes in drainage and the power to enforce reasonable rules and regulations for the protection of water supplies.

The drainage area of the Sudbury River and Lake Cochituate supplies embraces about ninety-three square miles, upon which there was a total population, according to the census of 1890, of 39,390, or an average of 424 per square mile. The drainage area of the south branch of the Nashua River above Clinton is about one hundred and eighteen square miles, with a total population in 1895 of about 8,160, or 69 per square mile. Although the population of some of the villages upon the Sudbury and Cochituate water-sheds has increased since 1890, that of others has decreased, so that the average per square mile is probably about the same now as then. On the Nashua there has been a material reduction in the population, owing to the removal of houses and factories from the site of the Wachusett Reservoir.

There are several large towns upon these water-sheds where the population is quite dense over small areas, but outside of these centers of population the country is probably no more thickly settled than in the average New England farming community. In towns where there is a public sewerage system there ought to be no difficulty in getting all houses along the line of the sewer connected with it. This is especially true in Massachusetts, where Chapter 132 of the Acts of 1890, Section 1, reads as follows: "Every building situated on a public or private street, court or passageway, in which there is a public sewer, shall, when required by the board of health of the city or town in which it stands, be connected by a good and sufficient particular drain with such public sewer." This act puts the burden of compelling connections upon the local boards of health, but their labors may be made much less arduous if the town adopting a sewerage system also puts into its by-laws a clause charging sewer rentals. The officers of the town then become interested to keep the tax rate down by compelling all owners of houses along the lines of the sewer to become users of the same, and to bear their proportion of the cost of construction and maintenance.

I am aware that there are not many towns in New England having the water-sheds of their surface water supplies within the town limits, or, if such is the case, having a sewer which can be reached. But, as you know, the supply of the Metropolitan Water and Sewerage Board is procured from water-sheds located in several towns, and through the local boards of health, acting under the before-mentioned law, we have been able to remedy many cases of pollution. If, in any case, the local authorities should fail to act under Chapter 488 of the Acts of 1895, the Metropolitan Water and Sewerage Board may enforce the rules and regulations made by the State Board of Health for the sanitary protection of waters used by the Water Board for the supply of the metropolitan district. In brief, these rules are as follows:

No cesspool, privy or other place for the reception, deposit or storage of human excrement, and no urinal or watercloset not discharging into a sewer, shall be located within fifty feet of high-water mark of any lake, pond, reservoir, stream, ditch, water-course or other open waters used by the Metropolitan Water Board as a source or for the conveyance, storage or distribution of its water supply.

No human excrement shall be deposited or discharged in or into such water supply, or shall be kept in or deposited or discharged in or into any cesspool, privy or other receptacle situated within two hundred and fifty feet of high-water mark of any such waters, unless such cesspool, privy or other receptacle is so constructed that no portion of its contents can escape or be washed into any such waters.

No human excrement, or compost containing human excrement, or contents of any privy or cesspool or sewer, or other receptacle for the reception or storage of human excrement, shall be deposited or discharged upon or into the ground at any place from which any such excrement, compost or contents, or particles thereof, may flow or be washed or carried into any such waters.

No house slops, sink waste, water which has been used for washing or cooking, or other polluted water, shall be discharged into any such waters, or into the ground within fifty feet, or upon the ground within two hundred and fifty feet of high-water mark of any such waters.

No garbage, manure or putrescible matter whatsoever shall be put into any such waters, or shall, except in the cultivation and use of the soil in the ordinary methods of agriculture, be put upon the ground within two hundred and fifty feet of high-water mark of any such waters.

No stable, pig sty, hen house, barnyard, hog yard, hitching or standing place for horses, cattle or other animals, or other place where animal manure is deposited or accumulates, shall be located, constructed or maintained, any part of which is within fifty feet of high-water mark of any such waters; and no stable or other place as above enumerated shall be located, constructed or maintained within two hundred and fifty feet of high-water mark of any such waters, unless suitable and adequate provision is made to prevent any manure or other polluting matter from flowing or being washed into such open waters.

No interment shall, except by permission in writing by the Metropolitan Water Board, be made in any cemetery or other place of burial within fifty feet of high-water mark of any such waters.

No manufacturing refuse or waste products or polluting liquid or other substance of a nature poisonous or injurious either to human beings or animals, or other putrescible organic matter whatsoever, shall be discharged directly into, or at any place from which it may flow or be washed or carried into, any such waters.

No person shall bathe in any such waters.

The penalty for the violation of these rules may be a fine of five hundred dollars or imprisonment not exceeding one year in the house of correction, or both such fine and imprisonment.

I have not quoted the rules in full, but enough to show that they specify very clearly the various kinds of pollution and how each case is to be treated. These rules and regulations do not apply to the water supplies of the other cities and towns of the State; but if the local authorities have difficulty in preventing the pollution of their supplies, they may appeal to the State Board of Health, which, under Chapter 510 of the Acts of 1897, has the general supervision of and authority to examine all the streams and ponds used by any city, town or water or ice company as sources of water supply, together with all springs, streams and water-courses tributary thereto, with reference to their purity, and to make rules, regulations and orders for the purpose of preventing pollution and securing the sanitary protection of the same.

We have usually succeeded in persuading the owner to remedy any defects in the sanitary arrangements of his premises by simply calling his attention to them and explaining what was required; but sometimes we are met by the assertion that he rents his house and is not responsible for the actions of his tenant. But the supreme court has decided that a landlord is liable for the acts of his tenant in polluting the waters of a brook which is a natural water-course running through the premises, by discharging sink water therein, if the building leased is adapted and intended to be used in the manner complained of, whether he retains control over the house or not. Where an owner will not yield to moral suasion, the local board of health is appealed to if the case can be classed under the head of a nuisance or is dangerous or detrimental to health. In any case, there are laws enough in Massachusetts to cover all cases of pollution of a public water supply. Sometimes it requires courage and possible loss of political position to enforce them.

The work done by the sanitary inspector of the Metropolitan Water-Works during the past year is briefly summed up by the Board in its annual report to the Legislature as follows: "The water-sheds of the various sources of supply have been constantly inspected by the sanitary inspector and his assistant, in order to insure suitable sanitary conditions, and to prevent contamination of the water from infectious diseases. The larger part of the work has been directed to the Sudbury and Cochituate water-sheds, but considerable attention has been devoted by the inspector to the Wachusett water-shed, partly in assisting the medical inspector, whose attention has been devoted to the works of construction.

"The number of different premises inspected on the Sudbury and Cochituate water-sheds has been 1,041. Many cases of objectionable drainage have been prevented, offensive cesspools have been abandoned, the building of sewer connections or cesspools has been required, manufacturing wastes have been diverted from the supply, and in other ways sources of contamination have been removed, so that a marked improvement has been effected in the sanitary condition of the water-sheds.

"Endeavor has been made to enforce the statutes of the Commonwealth and the regulations of the State Board of Health prohibiting bathing in all waters which are used for the purposes of domestic water supply."

Standard Methods of Water Analysis.

Second Report of Progress of the Committee o Standard Methods of Water Analysis, of the Ameri can Public Health Association, presented at th Buffalo meeting by George W. Fuller, New Yor George C. Whipple, Brooklyn, N. Y., Harry Clark, Boston, Dr. Adolph Gehrmann, Chicago, Wyatt Johnston, Montreal, Dr. E. O. Jordan, Cl cago, and Dr. H. L. Russell, of Madison, Wis.

In the first report of progress, read at t Indianapolis meeting a year ago, your comm tee gave, as the result of its first step in t consideration of this problem, a summary the methods of water analysis now in use America, based upon replies received to a c cular letter sent to 125 leading analysts. From the evidence thus developed, and from personal correspondence with leading workers, it was apparent that the data were too meager to put the committee in a position to present a set of standard procedures which would receive general support; and consequently no recommendations were made.

During the past year efforts have been made to secure a fuller expression of opinion upon certain portions of this line of work, and in a number of instances the committee has taken steps to facilitate matters through experimental work undertaken by analysts working in their individual capacity. These efforts have been so far successful that the committee is now able to make definite recommendations for the methods to be pursued in physical, microscopical and quantitative bacterial examinations. These methods are given below.

Substantial progress has also been made in the investigation of certain methods of chemical analysis, and in qualitative bacteriological examinations, but sufficient data are not yet at hand to justify final action. In respect to the two latter portions of the problem, therefore, this report will be simply a record of current progress.

Physical Examination.

Temperature.—The temperature shall be taken at the time of collection, and expressed, preferably, in centigrade degrees, to the nearest 0.5 degree or closer. For obtaining temperature of water at various depths the thermophone gives the most accurate results.

Turbidity.—Three methods of measuring turbidity are in common use at the present time, namely, the Wire Method, the Diaphanometer Method and the use of Silica Standards of Comparison, each of which has its special field of application. For field-work, and especially for use on turbid streams where a single daily observation suffices, the wire method is most convenient; for turbid waters in connection with purification works, the diaphanometer is most serviceable, while for general use with waters of comparatively low turbidity, the use of the silica standards seems desirable. While it may not be said that these methods have been perfected, yet in view of the importance of the turbidity problem, it seems desirable that, as far as possible, the observations by the various methods shall be made comparable with each other and given a uniform mode of expression. To this end it is recommended that the standard unit of turbidity shall be considered as that produced by one part per million of finely divided silica (prepared as described below) in distilled water; that the results of turbidity shall be expressed in parts per million of silica; and that the results obtained by the wire method and the diaphanometer method shall be reduced to their equivalents in parts per million of silica for purposes of report. Furthermore, in order that the turbidity may be conveniently compared with the weight of the suspended matter which produces it, it is suggested that the number obtained by dividing the weight of suspended matter in parts per million by the turbidity expressed in parts per million of silica shall be known as the "turbidity coefficient."

On this basis the turbidity coefficient would indicate the general character of the suspended matters. Water containing relatively large particles, which obviously increase the opacity of the water less than an equal weight of fine particles, would thus have a larger coefficient than water containing very fine particles. While considerable information along this line is available, it is insufficient to allow a further elaboration at this time. By way of illustration, however, it may be added that in the case of the Mississippi River water at New Orleans, which contains suspended particles varying widely in size, it has been found by Mr. Robert Spurr Weston that the turbidity coefficient ranges from .83 to 1.46 and averages 1.09. After this water has been subsided for 24, 48 and 72 hours, and the coarser particles removed thereby, the turbidity coefficient has been found to become on an average 0.80, 0.77 and 0.73 respectively. With less turbid waters it appears, in some cases at least, that the coefficient may be much smaller than at New Orleans.

A stock suspension of silica shall be prepared as follows: Diatomaceous earth, as free from amorphous silica and sponge spicules as may be obtained, is washed with water to free it from any soluble salts, and ignited to remove any organic matter. It is then treated with warm dilute hydrochloric acid, and washed with successive portions of distilled water until free from acid. The material, now composed of practically pure diatomaceous frustules, is then ground to an impalpable powder in an agate mortar, sifted through a sieve that has 200 meshes to the inch, and dried in a dessicator. One gram of this prepared diatomaceous earth in 1 liter of distilled gives the stock suspension, which has a turbidity of 1,000, that is, contains 1,000 parts per million of silica.

Standards for comparison shall be prepared from this stock suspension by dilution with distilled water. For turbidity readings below 20 standards of 0, 5, 10, 15 and 20 shall be kept in gallon bottles made of clear white glass; for reading above 20 standards of 20, 30, 40, 50, 60, 70, 80, 90 and 100 shall be kept in 100 cubic centimeter Nessler jars, approximately 20 millimeters in diameter.

Comparison of the water under examination with the standards shall be made by viewing them sidewise toward the light, looking at some object and noting the distinctness with which the margins of the object can be seen. The standards shall be kept stoppered, and both sample and standards shall be thoroughly shaken before making the comparison. In order to prevent any bacterial or algae growths from appearing in the standards, a small amount of bichloride of mercury may be added to them.

At the present time it does not seem possible to prescribe rules for the use of wire method and the diaphanometer method, save in the manner of expressing results, as recommended above. To this end, it is suggested that all forms of apparatus used shall be calibrated in terms of the silica standard under the conditions in which they are to be used, and that these graduations shall be used in place of the old method of expressing results in reciprocals of the depths in inches at which the wire or the cross of light in the diaphanometer disappears.

Color.—The platinum-cobalt method of color measuring, as devised by Allen Hazen and described in the "Am. Chem. Jour.," Vol. XIV, No. 4, shall be considered as the standard, except that the unit of color shall be equal to the amount of plainum in parts per million, rather than in parts per 10,000, as originally proposed. The figures will be, accordingly, whole numbers

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXV, DRESDEN, VIEW NEAR AUGUSTUS BRIDGE.

A view of another part of the Bruehl Terrace shown in a previous issue. This terrace was built by Count Bruehl in 1738 on the city ramparts, and was widened in 1814.

instead of decimals, reading to hundredths, as in Hazen's original method.

A standard solution which has a color of 500 shall be made by dissolving 1.246 grams potassium-platuric chloride[*] ($PtCl_4, 2KCl$), containing 0.5 gram platinum, and 1 gram of crystallized cobalt chloride ($CoCl_2, 6H_2O$), containing 0.25 gram of cobalt in water, with 100 cubic centimeters concentrated hydrochloric, and making up to one liter with distilled water. By diluting this solution, standards shall be prepared having 0, 5, 10, 15, 20, 25, 30, 35, 40, 50, 60 and 70. These shall be kept in 100 cubic centimeter Nessler jars of such diameter that the liquid shall have a depth between 20 and 25 centimeters and shall be protected from dust. The color of a sample shall be observed by filling a similar tube with the water and comparing it with the standards. The observation shall be made by looking vertically downward through the tubes upon a white surface placed at such an angle that light is reflected upward through the column of liquid. The reading shall be recorded to the nearest unit. Waters that have a color darker than 70 shall be diluted before making the comparison, in order that no difficulties may be encountered in matching the hues. Water containing matter in suspension shall be filtered until no visible turbidity remains. If the suspended matter is coarse, filter paper may be used for this purpose; if the suspended matter is fine, the use of the Berkefeld filter is recommended. The use of a Pasteur filter is to be avoided, as it exerts a decolorizing action.

Odor.—The odor of the sample shall be observed both hot and cold, and the most characteristic of these odors shall be recorded according to the following method, expressive of the quality and intensity of the odor.

Quality of the odor.—This shall be expressed by some such descriptive epithet as the following, which for purposes of record may be abbreviated: v—vegetable; m—moldy; a—aromatic; M—musty; g—grassy; d—disagreeable; f—fishy; p—peaty; e—earthy; s—sweetish., etc.

Intensity of the odor.—This shall be expressed by a numeral prefixed to the term expressing quality, which may be defined as follows:

Numerical Value.	Term.	Approximate Definition.
0	None.	No odor perceptible.
1	Very Faint.	An odor that would not be ordinarily detected by the average consumer, but that could be detected in the laboratory by an experienced observer.
2	Faint.	An odor that the consumer might detect if his attention were called to it, but that would not otherwise attract attention.
3	Distinct.	An odor that would be readily detected and that might cause the water to be regarded with disfavor.
4	Decided.	An odor that would force itself upon the attention and that might make the water unpalatable.
5	Very Strong.	An odor of such intensity that the water would be absolutely unfit to drink. (A term to be used only in extreme cases.)

Microscopical Examination.

The modified Sedgwick-Rafter method of microscopical examination, as described in Whipple's Microscopy of Drinking Water, is recommended for general use. The results shall be expressed in "Number of Standard Units per Cubic Centimeter."

Qualitative Bacteriological Examinations.

Following the inquiry as to the general status of this subject, it was thought best to ascertain to what extent the present methods for species determination, as used in various laboratories, are comparable with each other. Through the kind co-operation of many of the members of this Section, this was tested in a practical manner. Two species of bacteria were selected from a sample of water, and pure cultures on agar were mailed on the same date to about thirty bacteriologists, with the request that each one study them according to his customary methods and report the results without giving his name. The species were selected at random, save that one was chosen as being a non-liquefying, gas-producing form, and the other as possessing the opposite characteristics in these respects. Strangely enough, the sequel showed that both were apparently undescribed species. Seventeen sets of results were returned to the committee. These were collated, and blue print copies sent to each one who had participated in the work, in order to secure a better understanding of the data and the individual conditions associated therewith. In the final report of the committee it is intended to publish them for the benefit of the Section. The results of these comparative studies are of considerable interest, and indicate quite clearly that much assistance can be expected from a continuance of such studies. In a general way the present data are fairly comparable, but in certain tests, as in the coagulation of milk, the production of indol, the production of nitrates and gas production, there were found differences which indicate variations in laboratory procedures. With regard to the morphological characteristics, it may be said in passing that the agreement among the several workers was very striking. For the most part it was found that the methods recommended by the Bacteriological Committee of 1897 were in use.

It is proposed to repeat this work during the coming year by sending out two more unknown cultures, with the request that the methods recommended by the Bacteriological Committee of 1897 be followed rigidly, in order to determine the differences due to manipulation, as distinguished from those due to variations in method.

Quantitative Bacteriological Examinations.

In order to secure more detailed and more definite information than was available from the replies received to the circular letter issued last year, a second letter, containing a list of twenty-four questions bearing upon the details of the process, was sent out. About forty replies were received, representing the views of very nearly all of the laboratories in which most attention is given to this class of analytical work.

With regard to the unanimity of opinions expressed in this correspondence, it is to be said that the evidence on the whole is gratifying in this respect. If we make exception of a few special points, such as the elimination and addition of sugar to the culture medium, about which data are very meager, it is found that the proportion of analysts dissenting from the views of the majority is quite small. It seems, at least in some instances, that the differences of opinion are explained by differences in conditions associated with the studies of the workers. Without doubt, conditions are to be found wherein the numbers of bacteria might be better determined by special procedures, rather than by those which most commend themselves to the majority of workers both in this country and abroad. Your committee is not unmindful of this condition of affairs, and in no sense desires to take a position which would seem to discourage thorough studies as to improvements for special conditions.

As all quantitative examinations of bacteria can yield only relative, and not absolute, results, it seems clear enough that the great gain to be obtained by putting on a strictly comparable basis the data secured at a large number of laboratories, not only in this country, but abroad, far more than outweighs the sacrifices made in the scattering instances of special conditions. Wherever special procedures seem advisable, after careful study, the differences between the methods actually used and the standard procedures should be recorded without fail.

Taking the best available evidence as the basis, including the replies to the circular letter, as well as opinions and data personally expressed, your committee has formulated the following standard procedures for the quantitative bacteriological examination of water:

Outline of Standard Method for the Quantitative Bacteriological Examination of Water.

Samples.—Collection bottles shall have a capacity of at least four ounces, and shall have wide mouths and glass stoppers. Before use they shall be cleaned with sulphuric acid and potassium bichromate (or with alkaline permanganate of potash, followed by sulphuric acid), rinsed until free of acid, drained and sterilized with dry heat for one hour at 160 degrees C., or in an autoclav at 115 degrees C., for fifteen minutes. For transportation they shall be wrapped in sterilized cloth, or the neck and stopper protected with tin-foil or some substitute, and the bottle enclosed in a tin box. If the sample is not plated at the time of collection, the temperature of the sample shall be maintained between 0 degrees and 10 degrees C. during the interval. If this temperature is maintained, the following approximate intervals between the time of collection and the time of plating may ordinarily be considered safe: Relatively pure water, 12 hours; relatively impure water, 6 hours; sewage, 1 hour. It is recommended, however, that the interval between the time of collection and the time of plating be stated in the report.

Culture media.—Sterilized nutrient gelatine prepared as described below shall be considered as the standard culture medium for the quantitative bacteriological examination of water, except for field work and in the case of sewage and highly polluted streams, when standard agar may be substituted. All variations from these two media shall be considered as special media. For general work, a reaction of + 1.0 should be used, but for long-continued work upon water from the same source the optimum reaction should be ascertained by experiment and thereafter adhered to.

Standard Method for Making Nutrient Gelatine and Nutrient Agar, for Quantitative Bacteriological Examinations of Water.

<table>
<tr><th></th><th>Gelatin.</th><th>Agar.</th></tr>
<tr><td>1.</td><td></td><td>Boil 15 g. thread agar in 500 c. c. water for half an hour and make up weight to 500 g. or digest for 10 minutes in the autoclav at 110° C. Let this cool to about 60° C.</td></tr>
<tr><td>2.</td><td>Infuse 500 g. lean meat 24 hours with 1,000 c. c. of distilled water in refrigerator.</td><td>Infuse 500 g. lean meat 24 hours with 500 c. c. of distilled water in refrigerator.</td></tr>
<tr><td>3.</td><td colspan="2">Make up any loss by evaporation.</td></tr>
<tr><td>4.</td><td colspan="2">Strain infusion through cotton flannel.</td></tr>
<tr><td>5.</td><td colspan="2">Weigh filtered infusion.</td></tr>
<tr><td>6.</td><td>Add 1% Witte's peptone and 10% gold label sheet gelatin.</td><td>Add 2% of Witte's peptone.</td></tr>
<tr><td>7.</td><td colspan="2">Warm on water bath, stirring till peptone and gelatin are dissolved and not allowing the temperature to rise above 60° C.</td></tr>
<tr><td>8.</td><td colspan="2">Neutralize.</td></tr>
<tr><td>9.</td><td></td><td>To 500 g. of the meat infusion add 500 c. c. of the 3% agar, keeping the temperature below 60° C.</td></tr>
<tr><td>10.</td><td colspan="2">Heat over boiling water (or steam) bath 30 minutes.</td></tr>
<tr><td>11.</td><td colspan="2">Restore loss by evaporation.</td></tr>
<tr><td>12.</td><td colspan="2">Titrate, after boiling one minute to expel carbonic acid.</td></tr>
<tr><td>13.</td><td colspan="2">Adjust reaction to + 1.0% by adding normal hydrochloric acid or sodium hydrate as required.</td></tr>
<tr><td>14.</td><td colspan="2">Boil two minutes over free flame, constantly stirring.</td></tr>
<tr><td>15.</td><td colspan="2">Make up loss by evaporation.</td></tr>
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[*] Potassium platinous chloride is a salt that is often substituted by dealers in place of the potassium platuric chloride. It is sometimes incorrectly labelled. The platinous salt has a reddish color, while the platuric salt has a yellow color.

16. Filter through absorbent cotton and cotton flannel, passing the filtrate through the filter until clear.
17. Titrate and record the final reaction.
18. Tube, using 5 c. c. in each tube in the case of gelatin, and 7 c. c. in the case of agar.
19. Sterilize 15 minutes in the autoclav at 110°, or for 30 minutes in streaming steam on three successive days.
20. Store in the ice chest in a moist atmosphere, to prevent evaporation.

Method of plating.—The bottle which contains the sample shall be shaken at least twenty-five times, after which one cubic centimeter shall be withdrawn with a sterilized one c.c. pipette, and delivered into a sterilized Petri dish (10 centimeters in diameter). If there is reason to suspect that the numbers of bacteria will be more than 200 per cubic centimeter, one centimeter of the sample shall be first mixed with nine cubic centimeters of sterilized tap water, or distilled water, and after shaking at least twenty-five times, one cubic centimeter of the diluted sample shall be measured into a Petri dish. If higher dilutions are required they shall be successively made in the same manner. To the liquid in the dish, 5 cubic centimeters of standard 10 per cent. gelatine at a temperature of about 30 degrees C. shall then be added, and the dish tipped back and forth until a thorough mixture has taken place and the contents equally spread over the bottom of the plate. Or, the sample may be mixed with the gelatine in the tube and afterward poured into the plate. The gelatine after mixture with the sample should be allowed to cool rapidly on a horizontal surface, and transferred to the incubator as soon as it is hard; or, if the shelves of the incubator are perfectly level, the plates may be placed at once in the incubator. If agar is employed instead of gelatine the quantity used shall be 7 cubic centimeters, and its temperature shall be approximately 40 degrees C.

Incubation.—Incubation should take place in a dark, well-ventilated chamber where the temperature is kept substantially constant at 20 degrees C., and where the atmosphere is practically saturated with moisture. Proper atmospheric conditions with respect to oxygen and moisture may be obtained by the use of a ventilated dish and an incubator in which a shallow pan of water is placed in the chamber. The standard period of incubation shall be forty-eight hours. If for any reason a longer period is used, that fact shall be so stated in the records.

Counting.—So far as practicable the number of bacteria upon the plate shall not be allowed to exceed 200. Counting shall be done with the aid of a lens which magnifies about five diameters, and of a glass plate suitably ruled. The whole number of bacteria on the plate shall be counted, and the practice of counting a fractional part resorted to only in case of necessity.

Expression of results.—In order to limit fictitious accuracy and yet to express the numerical results by a method consistent with the precision of the work, the following mode of expression shall be followed:

Numbers of Bacteria from	to	shall be recorded to nearest
1	50	unit.
51	100	5
101	250	10
251	500	25
501	1,000	50
1,001	10,000	100
10,001	50,000	500
50,001	100,000	1,000
100,001	500,000	10,000
500,001	1,000,000	50,000
1,000,001	5,000,000	100,000

Clinker Concrete made of one part Portland cement and two parts of crushed clinker from refuse incinerators has been subjected to a large number of cross-breaking tests, reviewed at length in the "Surveyor" of August 30. As a result, the practice recommended is to break the whole of the clinker to a 2-inch size, throwing out the very fine portion which passes through a 1/16-inch sieve.

The Power Station at Hagneck, Switzerland.

An important part of the public work undertaken by the Swiss government for the betterment of the Aare Basin was the construction of the Aare canal, joining the river at Aarberg with the Lake of Bienne. This work was finished in 1880, its object being to drain the marsh land adjoining the Lake of Bienne, and to diminish the severity of the floods occurring in the Aare by affording them an outlet, at the same time creating a considerable water power. Although the development of this power was a part of the original plan, the actual construction of the power plant was not begun till 1896, when it was undertaken by the firm of Brown, Boveri & Company, of Baden. The work was recently described by Professor H. Rupp in the "Zeitschrift" of the Society of German Engineers, from which the following is taken.

In order to concentrate the total fall of about 30 feet at one point and thus render the water power available, it was necessary to build an extensive dam. This was attended with considerable difficulty, as the foundation consisted of soft mud, the trouble being increased by the official requirement that the sill of the sluiceway be 10 feet above the existing bottom, in order to avoid erosion. In addition to this, considerable work was necessary to properly strengthen the canal banks for some distance above. The design and execution of this part of the work was placed in the hands of Professor Zschokke, of Aarau. The dam is located about 160 yards from where the canal empties into the lake, and is about 200 feet in length. It is shown, together with the head race and power house, in the accompanying general view. It consists of three parts, a spill-way, a double sluice-way and a movable weir. The shore ends are secured by heavy concrete abutments whose foundations are carried down well below the canal bottom. The spill-way is on the right-hand side, and extends some distance down-stream, the walls being stepped off to give a gradual fall. It is closed by a gate, which carries an ice shield at the water level and is raised and lowered by an electric motor. Next to the spill-way are the two sluices, each 33 feet wide and with sills about 10 feet below the level of the spill-way, the three stone piers supporting the gates being set on steel caissons. The gates are of steel, with roller bearings against the piers, and are counterbalanced, so that they may be operated by two electric motors exerting a relatively small amount of power. The floor of these sluice-ways is extended on the down-stream side in order to prevent undercutting when the gates are open. The rest of the dam consists of a movable weir, of iron posts supporting a curtain, which can be raised by a crane traveling on the bridge above. The iron posts are hinged at the bottom, and can be lowered at times of high water.

Just above the dam is the head race leading to the power house. It is about 650 feet long and 89 feet wide on the bottom, with sloping sides, which are paved with limestone. The bottom is above the natural level of the canal water, so that the opening of the weir will entirely empty it, this being facilitated by a drain extending along its middle, and discharging to the canal. It is admissible thus to drain the head race entirely, as the water passing down it serves only for the power plant, the surplus in the canal being taken care of by the sluiceways in the dam. It is necessary, however, that care be taken to keep the ice out of the head race, for which purpose there are four iron piers placed at the entrance, to which an ice boom is attached. There is also a substantial grating built into the face of the power house, extending the whole width of the head race.

The vertical section and plan of the power house are shown in the illustration. It is designed for five turbines, of which there are four now in place, there being two swinging head-gates for each turbine. The latter were made by Bell & Company, of Kreins, and are rated at 1,300 normal and 1,500 maximum horse-power. They are each composed of four wheels, placed one above the other on a single shaft, and are of the inward flow type, the water entering at the circumference and escaping in a direction parallel to the axis, to one of the two draft openings. These are placed one above the other, and unite just beyond the turbines. As the discharges of each pair of wheels are in the opposite direction, they balance each other to a great extent. The main bearing, which is placed in the basement of the power house above, is of special design, and is surrounded by an oil reservoir holding some 6 gallons, which is kept cool by a small pipe coil in which water circulates. The shaft is threaded just above the main bearing, thus allowing vertical adjustment, and making the bearing more accessible. There are guide bearings both above and below the main bearing, and between it and the wheels there is a coupling.

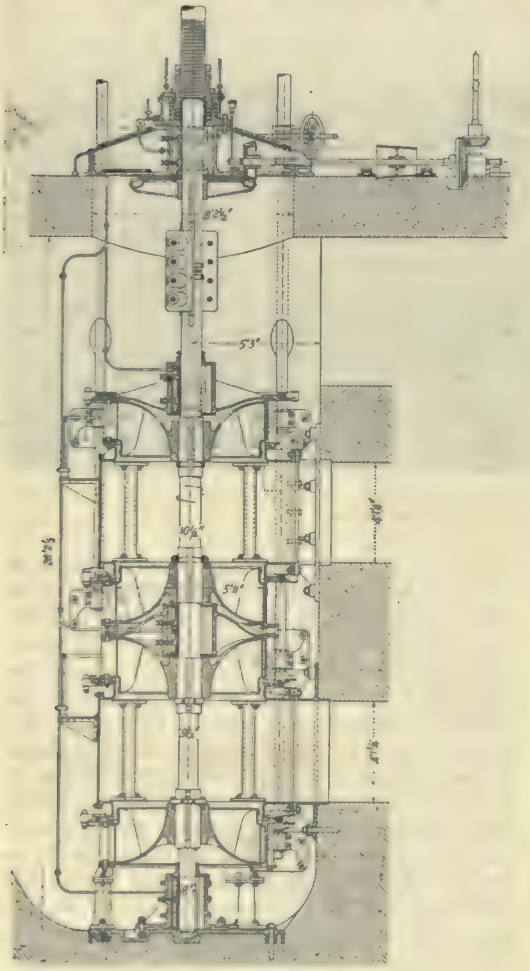
The turbines have movable guides, hydraulically balanced, by means of which the system is effectually and economically governed. These guides are controlled by three separate devices. A water-pressure governor regulates the two lower wheels; the upper wheel is provided with a worm and wheel worked by hand, or it can be coupled up while in motion with the governor before mentioned, and there is an independent worm and wheel for the next to the uppermost wheel, operated by hand exclusively. This arrangement makes it possible to govern the tur-

General View of Dam and Power House.

bines by the water-pressure regulator for the most part, using the hand devices only when needed. The governor consists essentially of a differential piston acting on a vertical shaft, the rotation of which moves the guides.

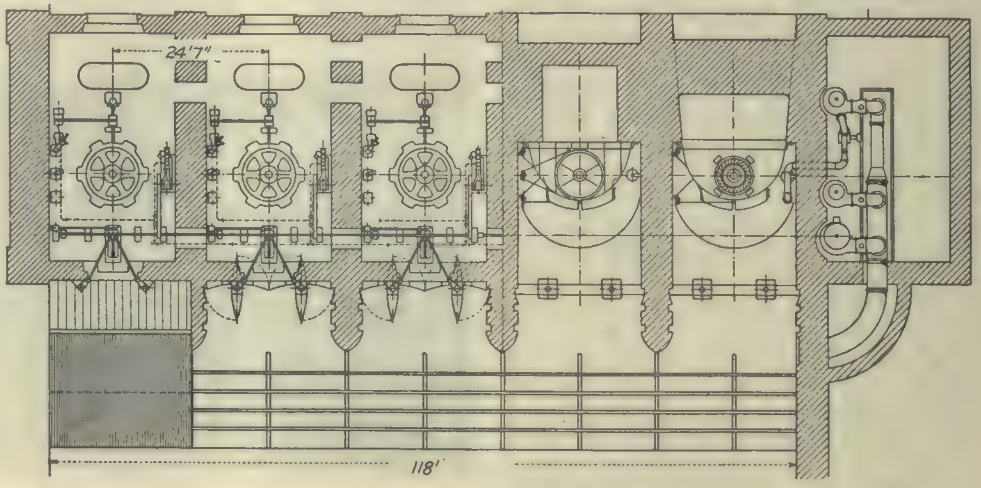
In summer, when there is a large body of water passing down the canal, but a diminished height of fall, due to the rise in the lake, all four of the wheels on each shaft are used. In the winter season, when there is less water and more fall, one or more wheels can be cut out. The available fall in times of summer high water is 19 feet, while at times of low water it is 24 feet, or, at some seasons, 29½ feet. The volume of water available under the latter conditions is 2,120 cubic feet per second, which is sufficient for the four units.

In addition to the four main turbines, there are three smaller auxiliary wheels placed in a chamber beneath the right-hand end of the main building. These turbines have vertical shafts and receive water by a penstock leading from the head race, as shown in the plan of the power house. Two of them are of 20 horse-power and drive two auxiliary exciters; the other is of 45 horse-power and its power is transmitted by a bevel gear to a shaft running the whole length of the power house basement. From this shaft the head-gates are controlled by means of a belt and screw gear, it being possible to open or close them inside of 1½ minutes. This shaft also drives the pressure pumps for the governor, there being a separate pump for each main turbine, though the delivery pipes are so connected as to admit of shutting down one or more pumps in case of need. The system is also provided with an air reservoir, a small compressor serving to renew the air cushion when it is absorbed. The turbine chambers can be emptied by means of a rotary pump driven from the governor shaft before mentioned, there being a pipe connection for this service with a valve to each chamber. The discharge from the three auxiliary turbines is led by three vertical tubes to a common draft tube, emptying into the main tail-race. The latter leads to the lake, 500 yards distant, by a dredged channel 35 feet wide on the bottom.



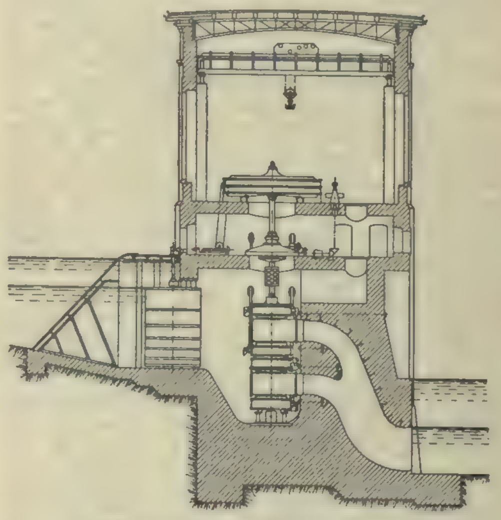
Section through Turbine.

Access is provided to the turbine chamber so that the separate parts of the wheels can be hoisted by a 25-ton traveling crane, shown in the section, and transferred to the workshop for repairs. There is also a swing crane mounted on the right-hand side of the head race, so that it can handle loads coming by either land or water directly into the power house. The generators are of the horizontal type and are coupled directly to the turbine shaft. They give three-phase alternating current at 8,000 volts tension, and 2,400 alternations per minute, running at a speed of 100 revolutions. The armatures have 48 poles and are set as near as may be to the uppermost bearing, in order to avoid all side stresses. They are so designed that they can also deliver their full load of 1,300 horse-power in single-phase current, allowing any one of them to supply the existing extensive single-phase lighting circuit. The voltage losses in the generators on three-phase current with non-inductive load are 5 per cent., against 15 per cent. with inductive load under a power factor of 0.77, the efficiency being 93 to 94 per cent. For single-phase current, non-inductive load, the figures are 8 and 93 per cent. The generator is supported on a circular base having an opening 8½ feet in diameter, and it is therefore only necessary to lift off the armature in order to gain access to the turbines below in the manner already described.



Plan of Power House.

The exciting current is supplied by 120-volt, 230-ampere generators making 550 turns per minute, one for each alternator, driven from the turbine shaft by means of bevel-gears. These are in turn excited by two 100-ampere generators driven by the auxiliary turbines before mentioned, one of the latter serving as reserve. The current from the main generators is conducted by a cable laid in a conduit leading to the right-hand end of the power house, where the main switchboard is placed, as shown on the plan, surrounded by a raised platform. It is in two sections, one for the generators having 8 panels, and one for the distributing circuits having 7 panels, the latter being behind the former. There are two complete sets of bus-bars, each bar extending along both boards, and being connected by switches at each end; so that the two sets may be connected up in a sort of ring bus bar, the generators feeding in either direction from the leads. Each set of busses is provided also with a switch in the middle, so that one half in each case can be handled independently of the other. The generators on the one board and the feeder circuits on the other are so arranged that they may be connected to either system at will. It is therefore possible to run the station on one set of bus-bars, supplying all the circuits, or at will to operate two entirely independent systems of any desired grouping of generators and circuits for the lighting and power service respectively. By this arrangement the supply of current is rendered as nearly as possible independent of disturbances in the operation of the power house.



Section through Power House.

On the generator board, six panels, of which four are now completed, are for the generator connections, and carry the main switches, a voltmeter and ammeter, a pilot lamp and a voltmeter connected so that it will show the difference of pressure between the phases of either circuit. There is also a circuit-breaker and a rheostat controlling the exciter current on each panel. The two middle panels are for the two main systems, there being a voltmeter and three ammeters and a rheostat for each. The rheostat hand wheels are provided with a coupling device, so that the generator rheostats can be worked from them, or they can all be worked separately. On the two middle panels are also the switches, rheostats, ammeters and voltmeters for the auxiliary exciters, so that by regulating them the main systems are regulated, and by adjusting the rheostats for the separate generators they are regulated.

On the second switchboard five of the panels are provided with a main switch and three ammeters for each feeder circuit, and on one of the remaining panels is a ground detector. The conductors pass from this board to a lightning arrester, and out of the building through a cement-lined opening of ample size, the conductors being covered with heavy glass tubing near the wall.

There is a small supplementary switchboard at one side of the main one, by which single-phase current from a 15-kilowatt transformer is distributed to light the power house, dam and the adjoining village of Hagneck by means of a three-wire circuit carrying 125 volts between the feeders. A second transformer of 20 kilowatts capacity delivers three-phase current at 250 volts to run the crane and weir motors.

The long-distance transmission lines are of copper, except one stretch of about two-thirds of a mile near the power house, on which aluminum is being tried. The conductors are carried on poles or on steel-framed supports for the longer spans, and the lines extend to the neighboring towns and villages. Transformer stations are placed at the centers of distribution, and from them the circuits for light and power are carried to the immediate vicinity. These transformer stations are of concrete and steel construction, and have a circular tower of steel plate to which the conductors are attached. The transformers are of the static type and deliver single-phase current to a three-wire lighting circuit, at a pressure of 125 volts between the conductors. The three-phase current for the power circuit is delivered under 250 volts pressure.

Refuse Disposal in the District of Columbia.

Extracts from a paper read before the American Public Health Association by Dr. William C. Woodward, Health Officer, District of Columbia.

The generally unsettled state of the refuse disposal problem has been well illustrated in the history of the city of Washington during the past ten years. From a loosely-drawn contract providing only for the collection and disposal of swill and dead animals, fixing but vaguely the duties of the contractor, giving what was probably inadequate compensation for the work, and binding the city to the performance of certain acts which it had no authority to perform, the District of Columbia has, through a process of evolution, reached a stage where its refuse disposal contract provides for the collection and disposal of all forms of waste except stable manure, where the obligations of the contractor are clearly defined and easily enforced, where he is adequately compensated, and where the city is ready and able to perform every obligation which it has undertaken.

Ten years ago swill was collected in wooden barrels placed on goose-neck wagons, from receptacles whose character and location were determined only by the intelligence or caprice of individual householders and without reference to the convenience of the city's agent for the collection of such material. The contract was annulled by the city for alleged breach of its requirements by the contractor and the work undertaken by the municipality through its own employees. That the service under this system was more efficient is not open to doubt. That its cost, however, was much greater than the amount that had been paid the contractor is clearly beyond question, and that the service thus obtained could have been given by him for such increased compensation is possible.

In the summer of 1891, following the abrogation of this early contract and the performance of the work by the community, came a period which, in the beginning at least, gave promise of better things. Householders were to keep their garbage in water-tight receptacles at places on their premises convenient to the collectors. The service to be performed by the contractor was clearly specified, collections were to be made daily, tri-weekly, and semi-weekly, as the circumstances seemed to require. Dead animals were to be collected daily. The material collected was to be transported beyond the limits of the District of Columbia, but once beyond such limits the contractor was free to dispose of it as he saw fit. In theory, at least, it was dumped on farms along the lower Potomac and there used as a fertilizer. For the service thus rendered the contractor was to receive $29,400 per annum.

On July 14, 1892, a special appropriation of $2,500 per annum was made to enable the Commissioners to secure the removal of all garbage in "enclosed tanks," and its "immediate destruction." A contract was made for disposal by the reduction process, and a plant for this purpose was erected in one of the more sparsely settled and remote sections of the city and put into operation. Complaints from those living in the neighborhood were many and bitter. As the writer was not then connected with the Health Department, he is unable to speak definitely as to the character of this establishment, but judging from its remains, as seen some time after its destruction by fire, such complaints were probably well founded. But in the midst of the controversy which centered about the complaints of citizens and to which the municipality itself and the contractor may be said to have been parties, the entire problem was settled, temporarily at least, by the destruction of the reduction plant by fire. No attempt was ever made to rebuild it and the contracting company soon went into the hands of receivers. The receivers conducted the business for a short time, but one of them soon purchased the interests of the defunct company. The service rendered had been, and continued to be, extremely unsatisfactory, due largely to the facts that the contract was not a profitable one for the contractor; that the District had undertaken to have the garbage placed in a specified kind of receptacle in accessible parts of the premises, but had no legal authority to bring this about; that the contractor would be put to additional expense to attempt to collect without the enforcement by the District of this part of its obligation; and that there was no prompt and certain way of enforcing the contract by means of fines or through any provision of the contract whereby the Commissioners might remedy neglect and charge the cost of so doing against the contractor.

Relief finally came, March 2, 1895, in the way of legislative authority for the making of a new contract upon the termination of the existing one by mutual consent or otherwise.

The bill authorizing a new contract was so framed as to confer upon the District specifically the right to make necessary regulations for the collection and disposal of garbage and to annex to such regulations such penalties as would secure the enforcement thereof. Specifications were drawn and proposals invited and received. The essential differences between the resulting contract and those preceding were practically these: First, that for each well-founded complaint of neglect by the contractor of any of the requirements of the contract, a fine might be imposed; second, that if on account of any disregard of the specifications on the part of the contractor extra inspectors should be required, they might be employed by the Commissioners in such number as they saw fit and the cost of their services be charged against the contractor; and, third, that if the contractor failed to remove any dead animals or garbage within a specified time after notice they might be removed and the cost charged against the contractor. The resulting contract provided that they should be incinerated. The cost of the entire service was $57,000 per annum. The contract provided for the collection of garbage within the city of Washington daily during the summer months, and twice per week during winter, and in the suburbs three times per week during the summer months and twice a week during winter. The particular method of disposal submitted by the contractor was the Dixon furnace, but he offered to install any other furnace satisfactory to the Commissioners. After a careful study of the various systems of garbage disposal then in use, arrangements were entered into whereby the contractor installed a Brown furnace, being the system selected by him, and a Smith furnace, being the system selected by the Commissioners of the District. It was designed that each plant should be of sufficient capacity to destroy the city's entire output of garbage and dead animals under any circumstances, so that if either furnace required repairs or was for any other reason out of use there would be no trouble in disposing of the putrescible refuse of the city. Much difficulty was experienced in finding sites for these establishments. Citizens of every locality felt that their swill should be disposed of in their neighbor's domain, but not in their own. This difficulty having been adjusted, however, the furnaces were duly erected. Upon trial it was found that the Brown furnace was capable of destroying a reasonable amount of garbage without nuisance if properly operated, but that its actual capacity was far below that which had been estimated, and attempts to crowd it resulted in widely distributed odors. The Smith furnace ran for a time on trial, but gave rise to so much complaint, based on odors emitted from it, that, although it had been selected by the Commissioners in the first instance, it was never accepted by them and never went regularly into service. Moreover, during its experimental runs it never even approximated its estimated capacity.

The Smith furnace having been rejected as unsatisfactory and the Brown furnace failing to destroy more than 40 or 50 per cent. of the daily output of the city during the summer months, the garbage problem again confronted the community. Experience in locating garbage crematories within the city had demonstrated the difficulty of doing so; the fact that the Smith furnace which had failed had been specifically designated by the Commissioners as the one to be erected involved a nice question as to the right of the Commissioners to require the contractor to build another furnace to replace it; and it seemed to be scarcely worth while to have 40 per cent. of the garbage burned and the remainder towed down the river to be disposed of on farms along the shores. The contract was, therefore, modified so as to authorize the contractor to carry all of the garbage and dead animals of the city down the river on scows and to dispose of them in the same primitive manner which had been followed under the preceding cheaper contract. For such service the contractor was paid the same amount that he would have been paid for burning it. In support of his claim for compensation at that rate he produced figures, satisfactory to himself and to some of the municipal officers charged with the adjustment of such matters, which proved that he could burn garbage in the Brown furnace as cheaply as he could haul it down the river on scows and dispose of it there.

The Commissioners finally invited bids for the collection and disposal of garbage, dead animals, night soil, miscellaneous refuse, and ashes, under certain fixed regulations, for a period of five years. Proposals were received from various responsible parties, the lowest and best being from a gentleman who had had experience in the business and who offered to do the entire work for $115,000 per annum. An effort was made to secure authority to enter into the contract with this individual for such work at the price named. Congress, however, refused to authorize such a contract, and on June 6, 1900, required the preparation of new specifications and a new bidding. When the new proposals were received, the Commissioners of the District awarded separate contracts for the collection and disposal of various items of waste, as follows:

A contract for the collection and disposal of garbage and dead animals for five years for $51,600 per annum, with a minimum additional compensation of $1,000 per annum for any extension of the service whatsoever, and with a deduction of 50 cents per ton for each ton in excess of 20,000 collected during the year. A contract for the collection and disposal of ashes for five years for $29,979 per annum. A contract for the collection and disposal of miscellaneous refuse for five years for $8,000 per annum. A contract for the collection and disposal of night soil for five years for $17,000 per annum.

The figures represent an expenditure per capita per annum of approximately 17.3 cents for garbage and dead animals, 10 cents for ashes, 2.7 cents for miscellaneous refuse, and 5.7 cents for night soil.

The contract for the collection and disposal of garbage and dead animals, which was awarded to the Washington Fertilizer Company, went into effect on August 1, 1901, and is the contract under which the work is now being done. Under it garbage is collected in steel-bodied wagons, so arranged that the bodies when filled can be lifted from the running gear by means of hoisting apparatus and placed on flat cars specially constructed for their accommodation. Dead animals are collected in wagons similar to those generally used for that purpose. The car in which they are shipped is an ordinary freight car, the floor and a part of the sides of which are covered with metal so as to prevent absorption and to promote easy cleansing. All cars are removed from the siding and taken to the disposal plant as soon as practicable after being loaded. The entire transfer from the wagons to the cars is, under normal conditions, effected without nuisance.

All garbage and dead animals collected are disposed of by the reduction process at a point about 30 miles, by railroad, from the city. As the establishment is located on the Potomac River, transportation by boat is possible, though hardly practicable under existing conditions. The reduction plant is modern, but it contains nothing particularly new. The material collected is placed in digesting tanks, subjected to steam under pressure, the liquid portions drawn off, and the tankage compressed within the digester by steam by means of special apparatus. The cooked mass is compressed further by hydraulic pressure after removal from the digesting tanks. All liquids drawn off are allowed to settle, the grease saved, and the residue discharged into the river. The tankage is dried, ground, screened, and placed in sacks for shipment. The characteristic feature of this establishment is the method of preventing nuisance, which is accomplished simply by locating the plant at a point so remote from habitations of persons not interested in it as to diminish or absolutely to avoid complaint. As the prevention of complaint from residents in the vicinity is always a matter of considerable expense in the cost of operating a reduction plant, it might seem at a first glance as though this were the ideal solution. It remains to be seen, however, whether the increased cost of transportation does not more than offset the cost of operating such an establishment in a more or less sanitary manner nearer the point of collection. When it is remembered, too, that a very large percentage of the material collected is water, it would seem as though some means should be found whereby the garbage could be relieved of this worthless element at the point of collection, even if it be necessary to transport the dried residue away from the city for the purpose of extracting the grease and preparing the tankage for the market.

The collection of dead animals extends to every part of the District of Columbia, an area of about 64 square miles, and is made daily, including Sunday, during the entire year. They are carried out of the city along with the garbage, and disposed of at the reduction plant just referred to.

Until recently a certain amount of garbage and a considerable number of the larger dead animals were collected by what were known as private collectors. The garbage collectors were granted permits on the application of the householders desiring their services and upon providing facilities for collecting and transporting the material without nuisance. Nearly all of the material collected was taken beyond the limits of the District of Columbia and there fed to swine. The men engaged in the service were usually poor colored farmers and the swine thus fed were raised for domestic consumption. Their services were desired by householders in many cases because of the impracticability of keeping the material on their premises accessible as required by the city's contractor, the private collectors being willing to move it from any place, however inconvenient. In other cases the garbage was given to private collectors because they were willing to remove other refuse along with it, to clean the yard or wood shed, or to render any other slight service. Collectors removing garbage from hotels sometimes paid the hotel for the material collected. There was but a single party, other than the contractor, engaged in the collection of dead animals. He, the proprietor of a reduction establishment on the Potomac River, purchased carcasses of horses from the owners and carried them to his establishment, where they were utilized in the usual manner. Since the present contract has been in effect permits are no longer issued to private collectors of garbage and a special permit is needed by the collectors of dead animals for each animal removed. Most of the men engaged in such work, being without means, have acquiesced to the new order of things. The collector of dead animals, however, continued to collect such material without reference to authority or permit, and, as a consequence, was duly arrested and tried in the police court. The facts being admitted, he was of course, in that court, convicted. An appeal has been taken, however, to determine the validity of the law. On his behalf it is maintained that no regulation is valid which undertakes to prevent the collection and transportation of refuse food of any sort or of dead animals, when such food or carcasses do not in fact constitute nuisances and so long as the collection and transportation of such material can be easily regulated without being forbidden.

Ashes and miscellaneous refuse are collected in wagons with large wooden bodies, the bodies being covered with canvas when filled. Such collections are made weekly and extend to the city of Washington and its more densely populated suburbs. Under the term "ashes" the contract includes practically all noncombustible refuse. The material collected is taken to low places, designated as public dumps, and under the immediate supervision of a dump master. Theoretically all combustible material is incinerated in the Brown crematory, which was used for the destruction of garbage, but abandoned because of insufficient capacity. Practically, a considerable quantity of it finds its way to the dumps and there creates nuisances. While this contract as at present executed is a convenience to the individual citizen who wishes to avail himself of it, it is of only secondary advantage to the community as a whole. The defect arises from the fact that householders have not been required to provide themselves with suitable receptacles for the care of these materials. Instead of compelling them to do so under penalty of fines and imprisonment, as was designed, the only penalty is the refusal of the contractor to move the wastes which accumulate on their premises. The refusal of the contractor with respect to this is not a matter which concerns certain classes of our citizens, who continue as heretofore to allow refuse of various sorts to accumulate on their premises until incommoded thereby, or until required by the health officer to remove it, and who then deposit it themselves or have others deposit it on the nearest vacant lot or unfrequented street or alley. The failure of the citizens to have proper receptacles is, of course, not a matter to which the contractor objects; so long as he is not required to remove refuse from their houses, it is a matter of financial profit to him.

Night soil is collected by the pneumatic process. The public collection of this material extends to every part of the District. The material collected is carried in air-tight barrels on scows to land lying on the Potomac River some miles below the city, and there emptied into pits.

From the foregoing statement it will be seen that the District of Columbia provides for the collection and disposal, without direct expense to the individual householders, of all forms of refuse with a single exception, and that is, stable manure. Material of this sort is a common source of nuisance, and with the growth of the city its disposal through individual effort becomes more difficult. It is particularly objectionable as it forms a breeding place for the domestic fly, a creature now believed to be, under certain conditions at least, an important agent in the dissemination of infective diseases. While no action has been taken toward preventing or limiting this nuisance, by means of a public service for the collection of such material, the time will soon come when the storing of it in and about the stable, and its removal, will be as carefully regulated and provided for as are the storing and removal of garbage and of human excreta.

The Purification of Blast-Furnace Gas, as regards the removal of dust, was referred to by Mr. A. Greiner, in the discussion of a paper on blast-furnace gas by Mr. B. H. Thwaite at the International Engineering Congress at Glasgow. He mentioned a case in which the Theissen gas-washing apparatus was used; with a fan about 6½ feet in diameter, driven by a 120-horsepower motor at 700 revolutions per minute, 2,470,000 cubic feet of gas were passed per hour and nearly 5,000 cubic feet of water were used. The gas was cooled to one-tenth its initial temperature and the amount of dust was reduced from 2.5 grams per cubic meter (0.071 gram = 0.0025 ounce per cubic foot) to 0.2 or 0.25 gram per cubic meter.

The Steam Consumption of Steam Turbines follows a straight-line law, according to the Hon. Charles A. Parsons and Mr. G. Gerald Stoney in a paper on some tests of steam turbines for driving dynamos, presented at the International Engineering Congress at Glasgow, Scotland. The steam consumption, they state, is proportional to the load, plus a constant quantity which represents the consumption of steam at no load. From a series of tests on various 500-kilowatt turbine-driven alternators, they find that the benefit of superheat in the steam is as follows: For 50 degrees Fahrenheit superheat, 8 per cent. improvement in steam consumption; for 100 degrees, 12 per cent. Every inch of vacuum above 25 or 26 inches, they say, results in a fall in the steam consumption of about 4 per cent.

A Code for the Conduct of Competitions.

Extracts from the "Proceedings" of the Thirty-fourth Annual Convention of the American Institute of Architects.

Form of competition.—A competition as a means for the selection of an architect may properly assume one of the following forms: A, Limited to a certain number of architects, each of whom is invited to take part. B, Open to all who desire to enter or to all of a certain class. C, Mixed, certain architects being invited, others being at liberty to take part.

Payment of competitors.—In all competitions the first prize should be the award of the commission to design the building and superintend its construction, and the program should definitely state that the successful competitor will be so retained, and that he will be paid for his services at the rates established by the American Institute of Architects.

In certain cases, however, this procedure may not be legal; then the course to be pursued as to the successful competitor should be clearly stated.

To provide for the contingency of delay or of the discontinuance of the work, the program should provide for a substantial payment to the successful competitor on the award of the competition, such payment to be regarded as on account of the final commissions.

Payments to unsuccessful competitors should be as follows:

In Limited Competitions each should be paid a fixed amount.

In Open Competitions prizes fixed in number and amount should be provided.

In Mixed Competitions the two classes of competitors should be paid in the manner above described.

The professional adviser and the jury.—It is highly desirable, in the interests of both owner and competitors, that a professional adviser should assist in the preparation of the program and that the professional adviser or a competent jury, consisting at least in part of experts, should assist in making the awards.

The professional adviser or jury may have full power to make the award, or they may select a number of designs and, placing them in the order of merit, leave the final choice to the owner or his representatives.

Where possible, the adviser or the jury should make a positive report, in favor of one design, and recommend the employment of its author as architect for the building.

The program.—The program should be so drawn as to form a contract. It should—

a. Name the owner of the structure forming the subject of the competition, and state whether the owner institutes the competition personally or through representatives. If the latter, name the representatives, state how their authority is derived, and define its scope.

b. State the kind of competition to be instituted, and, in limited competitions, name the competitors; or, in open competitions, if the competition is limited geographically or otherwise, state the limits.

c. Fix a definite time and place for the receipt of the designs. The time should not be altered except with the unanimous consent of the competitors.

d. State the limit of cost, if fixed; the desired accommodation, and the conditions of the site.

e. Fix uniform requirements for the drawings, giving the number, the scale or scales, and the method of rendering. As the presentation of a general scheme (rather than of a design perfectly studied in all its parts) is the object of the drawings, they should be of the simplest kind capable of explaining such a scheme.

f. State whether the submission of more than one design by a competitor is forbidden or permitted.,

g. State whether the competition is to be anonymously conducted or not, and if anonymously, provide the method.

h. Name the judge or jury or provide a method for their selection. Define his or their power.

i. Provide for the placing out of competition any drawing which violates the terms, or of any set of drawings whose authors have so disregarded the terms as to deserve the extreme penalty.

j. Provide that during the competition there shall be no communication upon anything relating to the competition, except in writing, between any competitor on the one hand and the owner, or any representative of the owner, the professional adviser or any juror, on the other, and that any information, whether in answer to such communication or not, shall be given in writing simultaneously to all competitors. Set a date after which no question will be answered.

k. Fix the nature or amount of the awards or prizes.

l. State, in case the professional adviser or jury is not empowered to make the award, in whom such power is vested.

m. Fix the period of time within which the final decision will be rendered.

n. Provide for sending the decision and a copy of the report of the professional adviser or of the jury to each competitor.

o. Provide that no drawing shall be exhibited or made public until after the award, and not then without the consent of the author.

p. Provide for the return of unsuccessful drawings to their respective authors within a reasonable time.

q. Provide that nothing original as to this competition in unsuccessful designs shall be used without compensation to the author of the design in which it appears.

Mr. H. L. Warren: The President made a suggestion, which Mr. Day and myself, as the committee, thought might well be incorporated in it. The President recommended there should be a heading of this character: "It is recommended that, when possible, an architect be employed without competition. When competition is necessary, the American Institute of Architects recommends the following code for the conduct of competitions."

Mr. F. M. Day: The committee reports the code, with that prefix, and we move that the code be adopted, with the prefix, as the code of the Institute on competitions.

Mr. Walter Cook: I speak in the name of a number of persons with whom I have spoken on the subject and who recognize the care with which this document has been drawn, and who are disposed, with trifling exceptions, if any, to believe it is an excellent statement of the position which is taken by a large number of members of the Institute, and, perhaps, all of us. There is, however, in the minds of these gentlemen and myself a reasonable doubt as to whether it is advisable that the Institute should adopt any printed code for competitions. The preamble which it is proposed to affix to this expresses, to a certain extent, the fact that the Institute does not desire to encourage competitions, and that competitions shall take place only when they are necessary. It is, however, true that this paper is to be printed and that it is to be circulated, and that it indicates an acquiescence in competitions which we are, all of us, obliged to submit to, but which it is of doubtful propriety we should proclaim. It also establishes a minimum, if you will, which many of us desire to exceed in a certain way. In other words, if all the conditions of this programme were fulfilled, there are a considerable number of us who would decline to go into the competition, even if we thought it was an advantageous competition. It is, therefore, not my desire to criticise any of the articles of this document, but to question the propriety of the American Institute of Architects, at present, at all events, putting itself on record in any way in regard to the subject of competitions, especially the propriety of its laying down laws under which the members might almost feel themselves compelled to participate in certain competitions. I should therefore myself, not because this document does not seem to me an excellent one, but as a matter of general policy, vote against its adoption.

Mr. Day: In answer to Mr. Cook's remarks, I would say that the committee is acting under the mandate of the Board of Directors and of the Institute. The Institute, at its last convention, gave positive direction to the Board to prepare a code for the conduct of competitions. The Institute has had for a number of years a code which was felt to be unsatisfactory, and it was the mandate of the Institute that a new code should be prepared. But the desirability of such a code may, perhaps, fairly be considered a matter for discussion.

I want to say a few words which will throw a little light on how the profession in general feels upon the subject, or at least such members of the profession as I have been able to reach. When the question of whether the code should be mandatory or not was being considered, I took the opportunity of calling together a number of architects in Philadelphia, and I invited to that meeting all of the younger men. There were about forty architects present, and perhaps not more than ten had any connection with the Institute or its Chapters. I wanted to get the feeling of the architects practicing in Philadelphia, without regard to their connection with the Institute. After an interchange of ideas, they unanimously expressed themselves as opposed to a mandatory code. But they did wish, most heartily, that the Institute would issue some simple directions on the subject of competitions.

Mr. H. L. Warren: I should like to add a word or two to the statement made by Mr. Day, on behalf of the committee, in reply to Mr. Cook's suggestions. I quite appreciate Mr. Cook's attitude, and I know it is the attitude of a considerable minority of the very best men in the profession. I think it is a minority. Your committee, in considering this question of the code, found itself face to face with the question of what was really the opinion of the profession with regard to this matter. They took pains to consult in various ways different members of the profession of different ways of thinking. It was after that consultation, and after the experiences we have been having in various ways throughout the country with regard to competitions in the last few years, that it became clear, in the first place, that a mandatory code was simply impossible. We have to recognize the fact that there are in the profession men of equally high standing and equally high ideals who differ in their opinions on the question of competitions. There are some who, like Mr. Cook and his associates, take the extreme view that competitions are altogether undesirable, and that it is best to try to discourage them utterly. There are others who view the matter from the opposite extreme, men who, I think, have equally at heart the benefit of the profession and the benefit of the community at large, which the profession serves, and who think that competitions, far from being a necessary evil, are desirable. These men think that by means of competitions for large work the best results for the community are obtained, and that architects in competition are led to put forth their best efforts. There is quite a large number of men who take that entirely opposite view with regard to competitions, and there is every variety of opinion in between these two extremes. That being the case, it is obviously impossible for the Institute to take a very definite position with regard to the question of competitions. At the same time, I think, when we look at the facts of the case, we find that competitions are established and that they are gradually being regulated, so that the evils connected with them are, at any rate, being more and more ameliorated. We must also recognize that we have officially urged competitions upon the Government, and most of us, I think, feel certain that the adoption of competitions by the Government, properly regulated, has been a great benefit to the architecture of the country, and also a benefit to the profession.

Under these circumstances it would be inconsistent to discourage competitions altogether. We must recognize the fact that competitions are here with us, and probably to stay for a long time. The committee found it absolutely impossible to frame a code, acceptable to any considerable majority in the profession, which would be more stringent than that here offered. It seemed to the committee desirable to present a code for adoption which was so broad that it could be supported with fair unanimity by the profession at large. We conferred with the League in order to obtain opinions outside of the ranks of the Institute, and we have found ourselves able to present a code which they will probably follow us in adopting if we pass it here.

It seems to me the question for us to consider is whether on the whole the adoption of this code is not the best thing that can be done at the present time. It is not mandatory, but suggestive. It is not presented as the best ultimate possibility in this line, but as the best we can do now, and as one on which we can in the future build. There is no reason to suppose it is definitive, and that if we adopt it now we shall not be able to go on and improve it in the future as we have in the past gradually improved the condition of competitions. The question on the whole is whether the adoption of this code is not going to be a step forward, whether it will not clear the atmosphere and tend to ameliorate the conditions of competitions still further. It seems to your committee it will do this, and for these reasons we urge its adoption.

Mr. F. M. Howe: In talking with many of the members, I find they have the same opinion as expressed by Mr. Cook. I abominate the practice as much as anyone can, but the fact remains; whenever a project comes up and a set of promoters or authorities of an institution talk building, they immediately want a competition, and the fact remains that the best men in the profession will go into such competitions. They have done so under conditions very much worse than those projected in our code. It only demonstrates the fact that competitions are practically universal, and it seems to me absolutely necessary that the Institute should, as a body, take certain steps to regulate the practice. While the code may not be perfect (it seems to me imperfect in many ways), it certainly is a basis upon which a code for the conduct of competitions may ultimately be framed, which shall be more generally acceptable to all.

Whenever this matter comes up, the first thing that a set of promoters wants to find out is, what sort of a competition to have. We have had absolutely nothing to indicate what is satisfactory to architects as a body. They consult individual architects, and each one is of a different opinion, sometimes modified by his estimate of his chances with the committee on building. Now, this code is a basis for the framing of competitions which is an expression of the opinion of the Institute. I think it is due us as a professional body, as well as to our clients, present or prospective, to have some such code in operation.

Mr. C. W. Hopkinson: I think the influence of the American Institute of Architects on the country is much more than its influence on its own members, and that is a point I would like to have seriously thought of in connection with the passing of the motion. Coming from a Western city, where the Chapters are necessarily small and the number of men outside the Chapter exceeds the number of men in the Chapter, I feel it is of special importance that the influence of the Institute should be spread and strengthened, and I would seriously ask that this code be endorsed by the Institute and printed, and be given to the Chapter men in the West, that the men outside of the Chapters, as well as ourselves, might feel the influence of the national body.

In the Eastern cities, such as Washington, where the Chapters are large, and the esprit de corps of the profession is great, the business men are much more easily influenced in architectural matters. In the West it is not so easy to command the influence of the best men. I would, therefore, urge the code seriously for this reason: We need it in the Western cities, whether you need it in the East or not.

There is one thing more I would speak of. When Professor Warren spoke of the heading to this code, I was hoping that it might take the form of a brief and concise statement on the other side of the case, stating as to why it would be better to employ an architect directly. It may not have been the proper place to put such remarks, but I do wish that the Convention could, in some way, direct some gentleman of the Institute, who is a brilliant writer, to prepare a brief pamphlet for general distribution, stating concisely the cogent arguments why the public is not best served by the great competitions which have taken place. I want to leave this suggestion with you, and if anything like that can be done it will be welcome in Cleveland. I have been approached by men saying, "What are your arguments why we shall not have the best efforts of two or three men for this problem?" and I am free to say that it has not been easy to combat a sharp business man in his idea that he is the gainer if he can see three designs instead of one. The arguments could be stated, and it would be of value in the Western cities if the Institute could follow this code by some such statement; and I believe it would be much appreciated. (Applause.)

Mr. Walter Cook: I rise largely in order to correct an impression Professor Warren has, in regard to my own opinions and those of the gentlemen for whom I speak, which is not entirely correct. Professor Warren has represented me as being opposed to all competition. This is not, however, the fact. I recognize that in some cases competitions are inevitable, and that in other cases they may even be advisable. The question which presents itself to me, therefore, is not as to whether those who disbelieve in any competition, under any circumstances (and I do not think there are any of us here who do so), should oppose the adoption of this document, but whether the adoption of this document, or any document, by the Institute, in which competition is spoken of at such great length, will not have, as a matter of fact, the effect of rather encouraging those of the outside world, who are acquainted with its contents, in the belief that competition is a thing to be encouraged, rather than a thing to be submitted to, or even, perhaps, encouraged, in certain specified cases. I naturally recognize that competitions in certain cases are inevitable, and even in certain cases are to be recommended.

Mr. W. P. Laird: I would like to add a few words to what has been said in support of the resolution, and from the point of view of one who has had experience with competitions. In writing programmes, I have been met, I can say, I think, invariably with a state of mind on the part of owners or projectors which, if left alone, would result in the sort of thing which is called competition, and which we know is always productive of disappointment and wrong when it is reduced to its lowest terms, that is to say, the advertising for proposals and the submission of plans by architects. If the average state of mind of the average committee or owner is left to itself, it degenerates into that sort of thing. But I find that the average committee or owner is always willing to consider the suggestions of the adviser, and, upon good reasons being shown for their adoption, to adopt them.

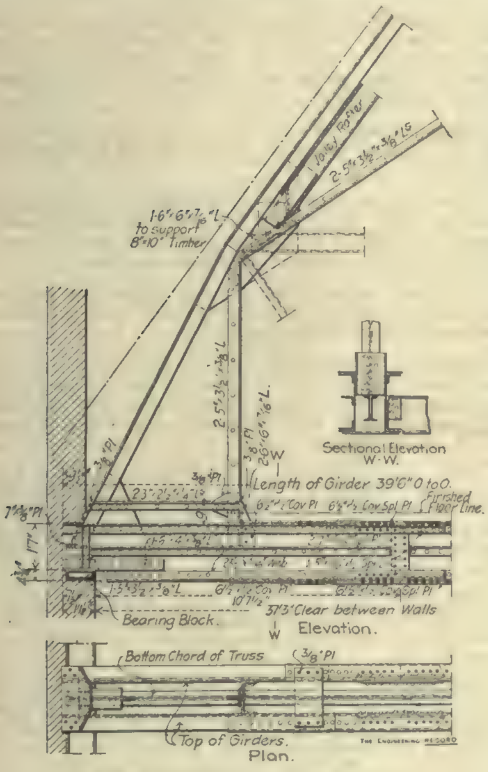
I have had no part in the preparation of this code, but I want to say that the code seems to me to embody in a general way those general principles for which I have always stood, and for which I have often been obliged to argue very strongly, in many cases, before I could secure their adoption. Now, if the adviser could be backed up in his efforts to secure the adoption of fair, general conditions, by a resolution of the Institute of Architects, which is simply advisory, which is simply the result of long experience in competitions, a great deal of good can be accomplished. But the good that can be accomplished thus is very slight in comparison, it seems to me, with that good which could be done with this kind of document placed in the hands of every member of the Institute for circulation upon any occasion when competitions were proposed. It is not proposed that this shall be mandatory; that it shall be binding upon the members of the profession. The members of the profession need no code to bind them to these simple, broad, fair, general principles. It is simply advisory, as being a thing, in the judgment of the Institute, a body best qualified to know, which will produce the best results for the clients under the conditions that are generally fair for the competitors. It does not touch the highest ideal of competitions. No code could do that, perhaps, but it does seem to embody the essential principles of fairness as between client and competitors. I believe from what I have seen on the part of clients that this statement would appeal to any fair-minded business man to whom it should be presented, and I believe the influence of it for good and toward the lessening of the great evils of competition would be very, very great.

Mr. G. F. Shepley: The gentleman who has just spoken has stated that a document embodying the ideas of this committee would be a valuable instrument in the hands of a committee where a competition was intended. It seems to me this might work in a reverse manner. A committee having a large matter in charge, which had no intention of having a competition, might, through receiving a circular which was vouched for by the American Institute of Architects, change their method of procedure entirely upon a matter which might be settled much more satisfactorily, and open it to competition, which, I think, we all doubt as being the best means of arriving at a successful result.

The question was put, on the adoption of the code, after a little further debate, and it was carried.

Remodelling Steel Roof Trusses.

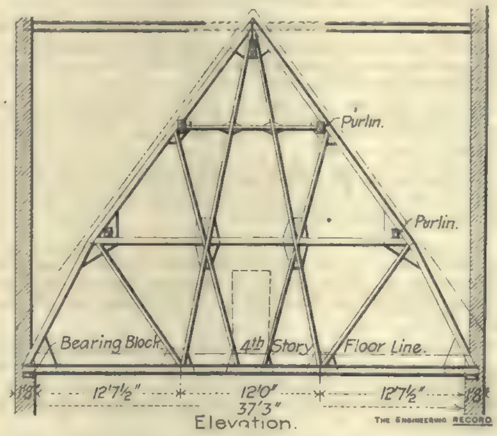
The main roof of the Hollywood Inn, Yonkers, N. Y., was supported on riveted steel trusses of 37¼-foot clear span. They were 31 feet deep, spaced 24 feet 2 inches apart on centers and carried longitudinal floorbeams on their stiff bottom chords and heavy wooden purlins at intermediate points of the top chords, which served as steep rafters. The bottom chord had an I-shape cross section composed of two 10-inch channels back to back, with vertical connection plates riveted between. There was a horizontal channel strut across the truss at the lowest purlin and about 10 feet in the clear above the lower chord in the plane of the fifth floor, which was carried by the trusses; and there was another horizontal strut across the truss about 10 feet above it in the ceiling of the fifth story. The T-shape top chords or rafters were made of two angles back to back, and all the diagonal members were single or double angles with gusset plate connections. The trusses were connected together by a 20-inch I-beam longitudinal strut at the peak, and were seated on filler plates in a 12-inch longitudinal channel with horizontal web, laid back down, on the top of each 20-inch longitudinal brick wall.



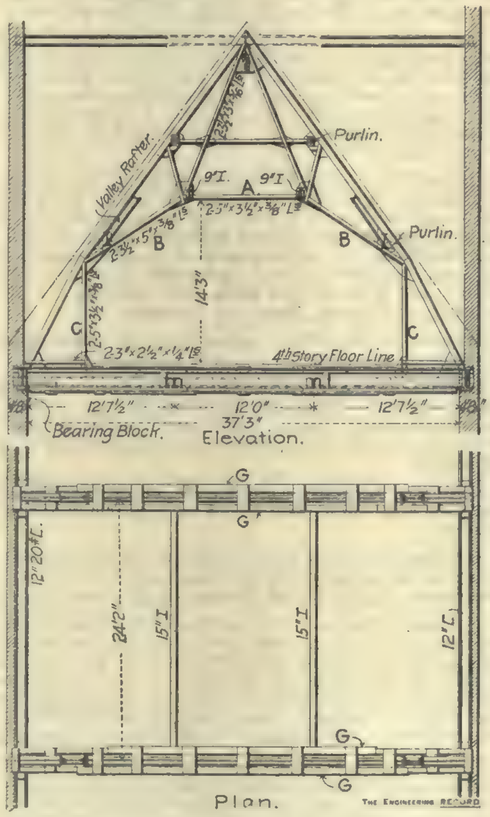
End Section of Twin Girders.

It was decided to convert the small rooms in the fourth story into one large public hall, and in order to have it free from obstructions two of the roof trusses were remodelled so that all the diagonal members in the lower part were cut out, the partitions in which they had been concealed were removed, and the new hall had a clear width and center height of about 28 feet and 14 feet respectively. The trusses were changed in nearly every respect except the position of the top chords, and in the new arrangement practically became shorter span and shallower trusses in the peak of the roof, supported at a height of about 10 feet above the old bottom chords by braced verticals rising from the floor level, as shown in the accompanying plan and elevation.

The first step in the reconstruction was to shore up the rafters, purlins and the transverse wooden floor joists, which latter rested on 15-inch longitudinal floorbeams carried by the stiff bottom chords of the trusses. The 15-inch I-beams were taken out, lowered to the floor below and their ends drilled off and finished to the required new lengths. A new 2-foot plate girder, G, was set on each side of and close to each old bottom chord, the pairs were connected by top and bottom flange tie-plates, and the 15-inch I-beams were put back in place and connected to the new girders; the joists were placed on them and the shores removed. This supported the floor from the brick walls, entirely independent of the roof trusses and left the old lower chords in place undisturbed. The new center bottom chord panel, A, and its connection plates, were then put in place and riveted. The end panels, B-B, of the new bottom chord were riveted in place and the new vertical supports, C-C, were riveted at the top of the truss and at the bottom to transverse girders.



Original Roof Truss.



Reconstructed Truss and Girders.

As the verticals and bottom chord members were riveted to the old connection plates, it was necessary first to cut off the ends of the old truss members meeting there before they could be assembled. Care was taken to remove only as many rivets as was necessary to secure the required clearance, thus leaving enough rivets to develop part of the strength of the old members and preserve the integrity of the original truss until the new members were competent to receive strains, after which the old members were entirely removed. The main diagonals in the upper part of the truss were taken out and replaced at new angles, so as to engage the bottom chord center panel connection plates and conform to the required positions for members of the new truss; the bracing was completed by the addition of short new struts to the middle parts of the rafters. New 12-inch I-beam valley rafters were web-connected to the ends of the lower chords on both sides of the roof, and new 9-inch longitudinal ceiling beams were added at the intermediate lower chord panel points. The reconstruction was effected without disturbing the slate roof or even cracking the ceilings of the rooms in the third story immediately below. Great care was taken to make all parts of the structure secure before removing the old members, but the work was so much obstructed that the progress was slow. All of the important connections were riveted, and the cutting, drilling and fitting were slow and tedious in the confined positions. The new floor girders had to be assembled in three short sections each and riveted together in place, each joint being thoroughly spliced with web and flange cover plates and cover angles, as shown in the detail, involving a large number of field rivets.

Mr. George Stirratt, of New York, was the architect of the building and Mr. Bernt Berger was the consulting engineer for the contractor, Mr. W. C. W. Child.

Personal and Obituary Notes.

Mr. Walter J. Connor has been appointed chief sanitary inspector of the water sheds of the New Haven Water Company.

Mr. John G. Van Horne, M. Am. Soc. C. E., has removed his offices to the Columbia Building, 29 Broadway, New York City.

Mr. G. H. Benzenberg, M. Am. Soc. C. E., has been appointed consulting engineer on the tunnel construction of the Cleveland water-works.

L. C. Brady, since March, 1897, assistant city civil engineer of Ottumwa, Ia., died in that city on September 23, after an illness of five months.

Mr. W. S. Graffam, a graduate of the Worcester Polytechnic Institute, has been appointed superintendent of shops in the Clarkson School of Technology at Potsdam.

Prof. Edwin Haviland, Jr., has been appointed to the chair of civil engineering in the Thomas S. Clarkson Memorial School of Technology at Potsdam, N. Y. He is a graduate of Swarthmore and Cornell.

Mr. C. E. Rogers, of the city engineering department of North Adams, Mass., has been elected instructor in civil engineering at Lehigh University. He is a graduate of the Rensselaer Polytechnic Institute.

Capt. Charles H. McKinstry, Corps of Engineers, U. S. A., has been assigned to temporary command of that portion of the engineer depot left at Fort Totten, N. Y., and Lieut. Henry C. Jewett, Corps of Engineers, has been ordered for duty at that point.

Mr. Arthur P. Davis, hydrographer of the United States Geological Survey, serving as consulting engineer for reservoir surveys in Arizona and adjacent States, has returned to Washington and is preparing a report upon various reservoir surveys made during the field season of 1901.

Mr. H. C. Lange has been appointed by the Governor of Texas as commissioner of water-works and sewers, and Mr. Vallery Austin, commissioner of streets and public improvements of Galveston, becoming members of a board of commissioners into which the city government has been merged.

Mr. F. H. Newell, chief hydrographer of the United States Geological Survey, has returned from an inspection trip to Colorado, Utah, Idaho and Oregon. In the latter State he made a rapid reconnoissance, starting from the Dalles and driving up Deschutes River, then easterly along Crooked River, and down Malheur River, a distance of about 525 miles. On this trip he was accompanied by Mr. Gifford Pinchot, chief of the Forestry Bureau, and by Hon. Malcolm A. Moody, member of Congress from eastern Oregon. The conditions of the water resources and the possibilities of storage were considered, and the character and importance of the forestry growth on the mountains adjacent to the desert areas.

A Series of Fire Tests on tile and plaster blocks and thin metal-plaster partitions will be conducted by the Department of Buildings of New York City on Monday, September 30, at the north side of East 105th Street, at one o'clock in the afternoon.

The Article on the Stability of Small Dams in last week's issue lacks an exponent in equation 23, in some copies. The first term under the radical should be squared and the equation read:

$$B = \sqrt{\left[\left(\frac{c}{s} - \frac{c}{2}\right)^2 + \frac{c^2}{s} + \frac{h^2}{s}\right]} - \left(\frac{c}{s} - \frac{c}{2}\right) \qquad (23)$$

The Louisiana Purchase Exposition, to celebrate the centennial in 1903 of the Louisiana purchase, will occupy a site embracing the unfinished half of Forest Park, St. Louis. The part of the park to be used contains about 668 acres and about 300 acres of surrounding property will be added, bringing the entire area of the site up to about 1,000 acres. The main buildings will, it is stated, be larger than those of any previous exposition in Europe or America; as stated in another column, under Contracting News, $7,000,000 is to be spent in buildings and $4,000,000 on grounds.

Cooling Ponds with Sprinklers are provided for the condensing water for the recently completed power station near Wallsend, of the Newcastle-on-Tyne Electric Supply Co., Ltd., of Newcastle, Eng. The plant lies about 1,050 feet from the River Tyne and 60 feet higher, and rather than force water from the river for condensing purposes, it was decided to cool the water by means of a pond and sprinklers and to pump from the river only the amount required to compensate for evaporation. The plant includes five alternating-current generators aggregating 4,300 kilowatts in capacity.

The American Institute of Architects will hold its thirty-fifth annual convention at Buffalo, October 3-5. Papers are to be presented by Mr. Cass Gilbert, Mr. W. A. Boring and Mr. John H. Rankin, on the effectiveness of the Tarsney Act and suggestions for modification. The other papers to be read have reference to the Pan-American and other expositions and include the following: "Some Phases of Exposition Making," by Mr. Carleton Sprague; "The Management and Design of Expositions," by Mr. Thomas R. Kimball; "The Exterior Color Effects of the Pan-American Exposition," by Mr. C. Y. Turner; "The Electrical Installation and Decorative Effects of the Pan-American Exposition," by Mr. Luther Stieringer; "Government Architecture at Expositions," by Mr. E. A. Crane.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Winnipeg, Man.—Bids are wanted Oct. 4 for the supply of a quantity of cast-iron water pipe and special castings, hydrants and valves, as advertised in The Engineering Record.

Weatherford, Okla. Ter.—Bids are wanted Oct. 9 for a water and light plant, as advertised in The Engineering Record.

Salisbury, N. C.—Bids will be received by Burton Craige, Special Master, until Oct. 7, for the purchase of the property, franchises, etc., of the Salisbury Water-Works Co.

White Plains, N. Y.—Bids are wanted Sept. 30 for $86,000 water bonds. Wm. B. Sutherland, Village Clk.

Moose Lake, Minn.—Bids are wanted Oct. 5 for $200,000 water-works improvement bonds. Peter W. Ehr, Village Recorder.

Dover, Del.—A charter has been granted at Dover to the Washington Water, Light, Heat & Power Co. of New York, with incorporators from Ohio, California and New York, capital stock $500,000.

Geneseo, Ill.—D. H. Maury of Peoria, Ill., is stated to have been engaged to prepare plans and specifications for water-works. Bonds to the amount of $20,000 have been authorized for said improvement.

Wickliffe, Ky.—The contract for building water-works has been awarded to Thomas W. Gannon and E. A. Burke, of Cairo, Ill., for $11,987.

Glenwood, Minn.—Bids for the extension and improvements of the water system from plans by Loweth & Wolff, of St. Paul, are stated to have been received as follows: Allan Black Co., St. Paul (accepted), $11,379; W. I. Gray & Co., Minneapolis, $11,993; F. E. Kreatz, St. Cloud,. Minn., $12,497.

Colusa, Cal.—E. T. Crane, District Attorney, writes that bids will probably be asked soon for the construction of a pumping plant at Knight's Landing. Estimated cost $150,000. T. H. Sullenger, Grimes, Cal., is secretary of the Reclamation District No. 108, which proposes to erect the plant; capacity 500,000 gals. per minute. J. W. Kaerth, of Colusa, Engr. in Charge.

Stoneboro, Pa.—The proposition to issue water-works bonds is stated to have carried.

Russell, Mass.—Town Clk. E. D. Parks writes that a private company, of which Henry L. Norton, Springfield, Mass., is the head, will construct water-works in this place, at an estimated cost of $8,000.

Chester, Ia.—City Clk. C. H. Meredith writes that on Sept. 16 it was voted to construct water-works.

Eureka, Cal.—The Council has under consideration the proposition to bond the city for the purchase of the Ricks Water Co.'s plant.

Colorado Springs, Colo.—The City Council has decided to take up the option for the purchase of the Seven Lakes reservoir site for $69,000. To make it available as a part of the Colorado Springs water system it will be necessary for the city to expend about $400,000 or $500,000 in the construction of dams, open cuts and tunnels.

Scranton, Pa.—Recorder Connell has signed the ordinance providing for the execution of a 5-year contract with the Scranton Gas & Water Co. for the furnishing of water to the city for municipal purposes, at $12,000 per year.

Madison, Wis.—It is stated that the Water-Works Committee has under consideration plans for improving the water system.

Ft. Grant, Ariz.—The following bids were opened Sept. 16 for constructing a reservoir and laying pipe at Ft. Grant: E. R. Hooker, Willcox, Ariz., $47,000; Dennis J. Tirsway, Denver, Colo., $34,600; L. V. McCourt, Willcox, Ariz., $48,750.

Springfield, O.—Plans and specifications have been prepared by J. D. Cook, of Toledo for an auxiliary water supply. Estimated cost, $10,000.

Baltimore, Md.—The Water Board has approved the plans of Water Engineer Quick for the extension of the Edmondson Ave. mains to Irvington, and also the extension of the upper service in the neighborhood of Roland Park.

Cambridge, Wis.—Bids are wanted Oct. 3 for furnishing material and constructing a complete system of water-works. There will be required about 46 tons of 4, 6 and 8-in. cast iron pipe, 2 tons of special castings, 7 fire hydrants, a 60-ft. stone tower, a 20 x 20-ft. wood tank. a 20-H. P. gasoline engine and a 200-gal. triplex pump. W. G. Kirchoffer, Engr., Baraboo, Wis.

Troy, N. Y.—Bids will be received by the Board of Contract & Supply until Oct. 4 for furnishing one Venturi water meter for the Quackenkill pipe line of the Troy water-works extension. John Phelan, Commr. of Pub. Wks.

Grand Meadow, Minn.—It is stated that bids are wanted by the Council until Oct. 5 for $5,500 water-works bonds.

Brookville, Ind.—Bonds to the amount of $24,000 are stated to have been voted for water-works.

Washington, D. C.—In his annual report, W. A. McFarland, Supt. of the Water Dept., submits estimates for the fiscal year ending June 30,1903, which include $90,000 for pumping expenses and pipe distribution.

Weiser, Idaho.—A survey and estimate have just been completed for a large reservoir in Black's gulch on Crane Creek.

Salt Lake City, Utah.—See "Power."

Lewistown, Mont.—The City Council has decided to have the taxpayers vote on the issue of $50,000 bonds for complete systems of water-works and sewerage.

Elgin, Tex.—A vote has been taken by this town in favor of incorporation, with a view to securing a system of water-works.

Santa Fe, N. M.—The Territorial Irrigation Commission has approved an application of J. R. Hinkle and others for 30,000 acres of land along the Rio Hondo in Lincoln and Chaves Counties, which they intend to reclaim by building storage reservoirs. An application of U. S. Bateman and others for 1,000 acres in Eddy County for the same purpose was also approved.

Meridian, Miss.—Local press reports state that the Meridian Water-Works Co. proposes to install a filtration system at an estimated cost of $30,000. J. H. Stoltzfus, Gen. Mgr.

Detroit, Mich.—The Engineer of the Water Board has been instructed to furnish plans and estimates of the cost of supplying water to the villages of Woodmere and Hamtramck.

Duluth, Minn.—Water and gas mains are to be extended (26,167 ft.) on Woodland Ave. to Minneapolis Ave., at a total estimated cost of $26,394. This work will probably not be done until next spring.

Blackstone, Va.—A vote has been taken in favor of the issue of $15,000 bonds for water-works.

New Windsor, Colo.—The Water-Works Committee has, according to local press reports, been authorized to award contracts for the construction of a system of water-works.

Willmar, Minn.—The electric light and water-works station of the city is reported to have been wrecked by an explosion.

Allegan, Mich.—The Village Council is stated to have engaged A. T. Maltby, of Chicago, to prepare plans and specifications for contemplated water-works improvements, for which $15,000 was recently voted.

San Fernando, Cal.—H. J. Stocker, of Los Angeles, Ch. Engr. of the McClay Rancho Water Co., writes that improvements, to cost $150,000, are contemplated, including the construction of a water-power plant with electric distribution for pumping.

Winside, Neb.—Village Clk. Walter Gaebler writes that it is proposed to construct water-works, but bids will probably not be asked until the spring.

Des Moines, Ia.—A plan is under consideration providing for the erection of a private water-works plant at the army post. D. B. Lyons is said to be interested.

Sherburne, Minn.—Recorder Henry Rose writes that it was voted on Sept. 16 to issue $4,500 bonds for water main extensions.

Philadelphia, Pa.—The following bids for the improvement. extension and filtration of the water supply were opened Sept. 25 by the Department of Public Works, Bureau of Water: *a*, low-service pumping station for Upper Roxborough filter; *b*, extension of testing station at Spring Garden pumping station: Henderson & Co., Ltd., *a* $15,997, *b* $3,617; Hiram A. Miller, *a* $17,981, *b* $4,256; Harry Kuemmerle, *b* $4,990; Patrick Gormley, *b* $4,275.

Allegheny, Pa.—The Common Council of Allegheny, on Sept. 20, concurred with the action of the Select branch in passing the ordinances authorizing the issues of $430,000 water bonds, $100,000 city home bonds, $50,000 sewer improvement bonds, $100,000 electric light bonds, $83,000 public safety and $335,000 street improvement bonds.

New York, N. Y.—Ordinances providing for the laying of water mains in several parts of Brooklyn and The Bronx have been passed by the Board of Aldermen. Approximate cost, $100,000.

Washington, D. C.—The following bids were opened Sept. 21 by the Commissioners of D. C. for the construction of the Trumbull St. pumping station; bids received were received under eight sets of specifications, according to the materials used, notably the trimmings of the buildings. The specifications were lettered from *a* to *h*, inclusive: Cramp & Co., Philadelphia, *a* $335,000, *b* $342,000, *c* $349,000, *d* $332,000, *e* $379,000, *f* $384,000, *g* $415,000, *h* $433,000; Arthur Cowsill, Washington, D. C., *a* $340,000, *b* $332,000, *c* $344,200, *d* $354,000, *e* $376,000, *f* $378,000, *g* $380,000, *h* $372,000; E. M. Noel, Baltimore, *a* $298,000, *b* $312,000, *c* $290,000, *d* $325,000, *e* $336,000, *f* $360,000, *g* $320,000, *h* $375,000; Penn. Bridge Co., Beaver Falls, Pa., *a* $347,335, *b* $341,336, *c* $336,335, *d* $397,700, *e* $440,000, *f* $447,000, *g* $435,000, *h* $424,700; R. A. Malone & Son, Washington, D. C., *a* $379,800, *b* $374,800, *c* $375,800, *d* $377,800, *e* $441,400, *f* $428,400. *g* $427,000, *h* $426,750; P. J. Carlin, Brooklyn, N. Y., *a* $319,593, *b* $232,590, *c* $325,590, *d* $304,900, *e* $390,000, *f* $396,600, *g* $357,500, *h* $364,000; William E. Spier, Washington, D. C., *a* $363,165, *b* $366,165, *c* $364,165, *d* $368,165, *e* $424,050, *f* $423,050, *g* $423,050, *h* $436,050; George A. Fuller Co., Chicago, Ill., *a* $305,283, *b* $314,282, *c* $326,282, *d* $320,282, *e* $345,282, *f* $395,282; Richardson & Burgess, Washington, D. C., *a* $342,935, *b* $388,379.

Bids as follows were also received at the same time for the steam generating plant for the pumping station, including piping, boilers and furnaces: Crook, Horner & Co., Baltimore, $51,803; Westinghouse, Church, Kerr & Co., New York, $55,184; Babcock & Wilcox Co., New York, $55,193.

SEWERAGE AND SEWAGE DISPOSAL.

Canon City, Colo.—Bids will be asked on or before Oct. 8 for furnishing materials and constructing a system of sewers, as advertised in The Engineering Record.

Thomaston, Me.—Bids will be received by the Warden and Board of Inspectors of the State Prison at Thomaston, until Oct. 2, for furnishing material and building a sewer and blasting a quantity of rock on the property of the Prison Institution. Hillman Smith, Warden.

Kendallville, Ind.—Bids are wanted Oct. 1 for constructing a sewer in a portion of Oak St. Henry C. Bower, City Clk.

Westboro, Mass.—Bids will be received by the Trustees of the Lyman and Industrial Schoo's until Sept. 30 for furnishing material and constructing 2,360 lin. ft. of 8-in., 1,600 lin. ft. of 6-in. and 450 lin. ft. of 5-in. Akron pipe sewer, 17 manholes, etc., to connect the Lyman School for Boys with the trunk sewer of the town. M. H. Walker, Chmn.

White Plains, N. Y.—Bids are wanted Sept. 30 for $10,000 sewer bonds. Wm. B. Sutherland, Village Clk.

Hammond, Ind.—Bids are wanted Oct. 1 for constructing sewers. Peter J. Lyons, City Engr.

Monticello, Ind.—Bids are wanted Oct. 5 for constructing sewers. W. J. Gridley, City Clk.

Knox, Ind.—Bids will be received by the Board of County Commissioners until Oct. 7 for furnishing material and constructing a culvert of stone and iron pipes, between Center and Jackson townships. John W. Kurtz, Co. Aud.

Rankin, Pa.—Bids are wanted Sept. 30 for 2,600 ft. of 5-ft. 6-in. brick, 750 ft. 30-in. and 1,110 ft. of 24-in. pipe sewers. U. G. Duvall, Boro Engr.

Indianapolis, Ind.—Bids are wanted Oct. 2 for constructing a local sewer in the first alley south of Downey St. Albert Sahm, Chmn. Bd. Pub. Wks.

Gallitzin, Pa.—H. G. Ehrenfeld, Clk. of the Council, writes that on Sept. 17 a vote was taken in favor of sewerage and paving.

Wellesley, Mass.—Town Clk. Fred. H. Kingsbury writes that at a recent town meeting a committee was appointed to secure estimates, etc., for a sewerage system. J. W. Peabody, Chmn. of Com. F. L. Fuller, of Boston, Engr. in Charge.

Pueblo, Colo.—Engineer Peach has reported to the Council a set of specifications establishing two storm sewer districts in the business section of the city, and one sanitary sewer district comprising the entire city. Accompanying the specifications was an estimate, showing that the total cost will be $405,836, including all items of expense except interest and collections. The cost of the sewer proper is estimated at $381,777, including appurtenances, materials and construction. The specifications have been adopted by unanimous vote.

Celina, O.—Press reports state that A. W. Fishbaugh and Martin Lutz, appointed to examine the plans and specifications prepared by J. P. Force, of Columbus, for a sewerage system for this city, have reported favorably.

Yonkers, N. Y.—City Clk. John Pagan, Jr., writes that the following bids were opened Sept. 23 for the construction of sewers on Warburton Ave.: B. F. Jones, New York, $18,411; Richard Parrott, Newburgh, N. Y., $15,500; Chas. E. Pearsall & Son, Yonkers, N. Y., $9.900 (awarded); John Monks & Son, New York, $13,308.

Eureka, Cal.—The City Council has under consideration the proposition to bond the city for the construction of a sewerage system and additional school houses.

Elkhart, Ind.—City Engineer Hitchcock has submitted his final estimate of the cost of the Aspenwold Ave. Allendale sewer, showing the total to be $12,180.

La Porte City, Ia.—The La Porte Sewer Co. has filed articles of incorporation for the purpose of constructing and maintaining a sewer system in La Porte City. Capital stock $5,000. F. E. Wettstein, Pres.; A. E. Osborn, Secy. and Treas.

Reading, Pa.—J. J. Deery, of the Pennsylvania Sewage Co., has laid before the Board of Public Works plans for the enlargement of the sewage disposal beds. It is believed that before long it will be necessary to increase the capacity of the plant.

Lancaster, Pa.—City Engr. Carpenter writes that the Street Committee will recommend to Councils on Oct. 2 the building of six sewers at a probable cost of $265,000, which will necessitate a vote of the people to increase the debt.

Charles City, Ia.—W. W. Dennis, City Clk., writes that the contract for sewer construction in certain streets, has been awarded to Ford & Delahunt, of Cedar Rapids, for $8,040. The work includes 4,140 ft. of 10 to 20-in. brick sewer, 13 manholes, 2 catchbasins and 2 flushtanks. Average depth of excavation, 10 ft.

Jackson, Mich.—Contracts will soon be let by the Board of Public Works for the construction of about 1,400 ft. of 5-ft. internal diameter brick sewer.

Kings Park, L. I., N. Y.—The following bids were opened Sept. 18 for the construction of a sewage disposal plant at the L. I. State Hospital: *a*, Deduction to be made if certain work is done by Hospital; *b*, cost of installing plumbing in existing building. The City Waste Disposal Co., $18,741; *a*, $1,752. International Sewerage Disposal Co., $24,570; *a*, $2,200; *b*, $200. Municipal Engineering Co., $22,485.

Derby, Conn.—The total estimated cost of proposed sewer work is $13,287.

Roswell, N. M.—It is stated that $35,000 bonds have been voted for a sewerage system.

Homestead, Pa.—It is stated that West Homestead will issue $50,000 bonds for a municipal building and sewers.

Cincinnati, O.—Bids are wanted Oct. 8 for constructing sewers and drains in a portion of Straight St. Geo. F. Holmes, Clk. Bd. Pub. Service.

Delta, Colo.—Sewer bonds to the amount of $30,000 are stated to have been sold recently.

Flint, Mich.—The contract for constructing St. John St. sewer is stated to have been awarded to Lynch & Lynch for $18,179.

Milwaukee, Wis.—John J. Crilley, of Milwaukee, is stated to have received the contract for Delaware Ave. brick sewer for $16,472. The work includes 1,320 ft. of 84-in., and 52 ft. of 30-in. brick sewer, at $12 a ft., and 104 ft. of 15-in. pipe sewer at $2 a ft.

Ft. Edward, N. Y.—Local press reports state that F. E. Crane, of Amsterdam, has been engaged to prepare plans for a complete system of sewers.

Lewistown, Mont.—See "Water."

Atlantic, Ia.—The City Council has decided to levy a 2-mill tax for the construction of a sewerage system.

Allegheny, Pa.—See "Water."

New York, N. Y.—Bids are wanted Oct. 9 for sewers in several streets in the Boroughs of Manhattan and Brooklyn. Jas. Kane, Commr. of Sewers.

Swissvale, Pa.—Bids will be received by the Finance Committee, until Oct. 1, for $105,000 sewer bonds. R. M. Cummings, Chmn.

Greenville, Miss.—Bonds to the amount of $50,000 are stated to have been voted for a sewerage system.

Braddock, Pa.—The borough Councils of Braddock, North Braddock, Rankin and Swissvale have passed ordinances authorizing the construction of a brick sewer one mile long, to be used jointly by the four boroughs.

Nashville, Tenn.—The bill appropriating $45,000 to continue the construction of Lick Branch sewer, from its present terminus to the corporate limits, has passed the City Council on third reading.

Delaware, O.—Press reports state that the contract for constructing a system of sewers has been awarded to Ulrick & Williams, of Springfield, O., for about $25,000. It is stated that a sewage disposal plant is to be built.

Stratford, Ont.—The ratepayers are reported to have voted to issue $20,000 bonds for the completion of the sewage disposal works.

Davenport, Ia.—Bids are wanted Oct. 2 for sewers in 14th St. Thos. Murray, City Engr.

Denver, Colo.—The construction of sub-district No. 23 sewer, of Capitol Hill Storm Sewer District No. 1, has been authorized at the estimated cost of $10,430.

Greenville, Pa.—A J. Gillespie, Boro. Sec'y, writes that the contract for street sewers (bids opened Sept. 23) has been awarded to J. W. Mitchell, of New Castle, Pa., as follows: Vitrified pipe sewer, 400 ft. 20-in. in trench 7 ft. deep, $1.24 per ft.; 800 ft. 18-in., trench 7 ft. deep, $1.07; 388 ft. 12-in., trench 7 to 10 ft. deep, 69 cts.; 1,468 ft. 10-in., trench 7 to 9 ft. deep, 62 cts.; 677 ft. 8-in., trench under 8 ft. deep, 54 cts.; 4,145 ft. 8-in., trench 8 to 10 ft. deep, 60 cts. Y branches, 5 20-in. x 6-in., $2 each; 5 18-in. x 6-in., $1.50; 6 12-in. x 6-in., $1; 54 10-in. x 6-in., 50 cts.; 116 8-in. x 6-in., 40 cts., manholes complete, 26 8 ft. deep, $30 each; all manholes more than 8 ft. deep, $1.50 per ft. extra; 20 cu. yds. concrete, $4 per cu. yd.; 500 ft. B. M. white oak lumber used permanently, $40 per M.; 500 ft. B. M. sheeting left in place by order of engineer, $30 per M.; 10 cu. yds. rock excavation, $4 per cu. yd.; 40 ft. 20-in. cast iron pipe in trench, $4.50 per ft.; 10 cu. yds. second-class masonry for outlet, $5 per cu. yd.; total, $6,639.

The contract for an outlet sewer (bids opened Sept. 23) has been awarded to Irwin Bros., of Greenville, as follows: 4,070 ft. 20-in. vit. pipe sewer in trench 7 ft. deep and less, $1.10 per running ft.; 100 ft. 20-in. vit. pipe sewer in trench more than 7 ft., $1.75 per running ft.; 35 Y branches, 20-in. x 6-in., $3 each; 8 manholes, complete, 2 ft. deep and less, $35 each; all manholes more than 7 ft. deep, $5 each per ft. extra; total, $5,037.

Oelwein, Ia.—City Clk. H. V. Hoyer writes that the following bids were opened Sept. 16 for sewer construction: A, E. L. DuBois, Des Moines, Ia., $15,631; B, M. V. Kennedy, Des Moines, Ia., $18,994; C, Ford & De La Hunt, Cedar Rapids, Ia., $17,472; D, O. P. Herrick, Des Moines, Ia., $15,896; E, Dunnegan & Sullivan, Shenandoah, Ia., $19,800; F, Fraser & Armstrong, Rochester, Minn., $16,302; G, W. A. Edgar, Cedar Rapids, Ia., $14,564. For detail bids see accompanying table:

Items and Quantities.	A	B	C	D	E	F	G
Sewers:							
626 ft. 20-in........	$2.07	$1.93	$2.30	$2.00	$1.50	$1.60	$1.50
4,985 ft. 15-in......	1.35	1.53	1.20	1.25	1.35	1.00	.90
1,356 ft. 12-in......	.70	1.15	1.15	.82	1.00	.72	.77
1,390 ft. 10-in......	.70	1.00	.85	.74	.90	.65	.68
4,200 ft. 8-in.......	.54	.90	.60	.60	.80	.60	.63
3,700 ft. 6-in.......	.37	.40	.50	.50	.75	.50	.59
Standpipe con., 610 ft. 4-in.	.10	.10	.15	.10	.70	.20	.15
Iron pipe:							
80 ft. 12-in.........	1.39	1.75	2.50	1.50	1.40	2.40	1.50
80 ft. 10-in.........	1.21	1.75	2.00	1.25	1.25	1.95	1.30
60 ft. 8-in..........	1.21	1.75	1.50	1.00	1.15	1.65	1.00
Manholes, 47........	30.00	42.00	40.00	25.00	50.00	60.00	34.00
Flushtanks, 6.......	65.00	65.00	70.00	40.00	75.00	90.00	45.00
Drop manholes, 2..	33.00	45.00	50.00	50.00	40.00	70.00	39.00

Cleveland, O.—The following bids were opened Sept. 17 by the Board of Public Works for the construction of a conduit to divert Giddings Brook, through Baldwin Ave., into Doan Brook: Bidders all of Cleveland.

Items and Quantities.	Clements Bros. Const. Co.	C. H. Fath & Son Const. Co.	A. F. Helm.	N. O. Pav. & Const. Co.
Excavation	$.81	$.85	$.97	$1.00
No. 1 shale brick.........	8.00	9.75	9.50	12.00
Portland concrete.........	5.65	5.40	7.00	10.00
Nat. concrete.............	4.00	4.05	4.10	6.00
Rock-faced ashler......	635.00	900.00	800.00	2,500.00
Brick in manhole.......	7.50	7.50	9.00	9.00
Cast iron:				
in catch basin..........	.03	.05	.05	.04
in manhole.............	.03	.04	.03	.04
Catch basin..............	24.00	50.00	29.50	40.00
Spec. catch basin......	40.00	100.00	60.00	50.00
12-in. C. B. pipe.........	.80	.40	1.00	.75
Lumber	25.00	30.00	30.00	30.00
Total	$54,858	$59,030	$64,793	$82,324

BRIDGES.

Des Plaines, Ill.—Bids are wanted Sept. 30 for constructing a stone arch structure to replace Senne Slough bridge. David J. Gillespie, Village Clk.

Victoria, B. C.—City Engr. C. H. Topp writes that bids will be opened Oct. 21 for the construction of a bridge at Point Ellice. Estimated cost $85,000.

Westminster, Md.—Bids are wanted Sept. 30 for constructing a steel bridge across Big Pipe Creek. J. E. Mannheimer, Co. Commr.

Jersey City, N. J.—Bids are wanted by the County Board of Chosen Freeholders until Oct. 7 for the reconstruction of Newark Ave. bridge. John P. Egan, Clk.

Long Island City, N. Y.—The American Bridge Co. is reported to have secured the contract for building 4 steel viaduct bridges on the Port Jefferson branch of the Long Island R. R.

Vancouver, B. C.—McLean Bros., of Vancouver, are stated to have secured the contract for repairs to North Arm bridges, at Eburne. Contract price is said to be about $14,000, Dundas, Wis.—It is stated that $25,000 bonds have been voted for the purpose of building a bridge across Chippewa River.

Toronto, Ont.—The construction of a bridge across Severn River is said to be contemplated.

Strasburg, Va.—An order, subject to the approval of the Board of Supervisors, has been entered in the County Court at Woodstock, for the construction of an iron bridge across Shenandoah River, near Strasburg.

Spring Valley, Ill.—Bruce & Barron, of Joliet, are stated to have received the contract for construction and repair of the ice-breakers on Illinois River bridge, for $5,000.

Flint, Mich.—The construction of a bridge at Court St., to replace the structure recently collapsed, is being considered.

Batavia, N. Y.—The Owego Bridge Co., Owego, N. Y., is reported to have secured the contract for constructing a high-truss bridge, 110 ft. long, at Indian Falls, for $7,500.

Buenavista, Pa.—Local press reports state that bids will be asked at once for the construction of a steel bridge, 500 ft. long, across Yough River, at Buenavista, connecting Sewickley township with Elizabeth township.

Berkley, Va.—The Board of County Supervisors has petitioned the County Court for authority to construct an overhead bridge across the Norfolk & Western and the Belt Line Rys. in Berkley.

Augusta, Ga.—The construction of a bridge at Sand Bar Ferry, connecting Augusta with the Beach Island section, is being considered.

South Bend, Ind.—The Commissioners of Elkhart and St. Joseph counties are considering the construction of a $20,000 structure, which will replace the present Eby bridge.

Durand, Wis.—The citizens have voted in favor of issuing bonds for the construction of a steel bridge across Chippewa River.

Livingston, Mont.—The construction of a 2-span steel viaduct at Main St. is contemplated.

Elizabeth, N. J.—The Board of Freeholders' Committee appointed to investigate the condition of Crane St. bridge, recommend the construction of a new single span iron-beam bridge, to replace the present structure. Probable cost, $12,000.

Natchez, Miss.—It is stated that the Board of Supervisors will soon award the contract for constructing a steel bridge, on concrete piers, having a draw span 176 ft. long, and one span 100 ft. long.

North Manchester, Ind.—Bids will soon be asked, according to press reports, for the building of a $4,000 bridge in Chester township.

Bloomington, Ill.—Press reports state that the Highway Commissioners are having plans prepared for both an iron and a concrete arch bridge.

Washington, D. C.—Bids will be received by the Commissioners, D. C., until Oct. 12 for the construction of foundations for a masonry bridge across Rock Creek, as advertised in The Engineering Record.

Perrysville, Pa.—It is stated that plans are being prepared for a double track bridge which is to be constructed across Susquehanna River, at Perrysville, by the Philadelphia, Wilmington & Baltimore R. R. Co.

Refugio, Tex.—The citizens have voted in favor of constructing a $5,000 bridge across Blanco River, 5 miles from Refugio.

Jackson, Ky.—See "Railroads."

Gonzales, Tex.—Local press reports state that contracts for constructing 3 county bridges will soon be let.

Ft. Dodge, Ia.—The Chicago, Great Western R. R. Co. is stated to have awarded the contract for substructure of bridge to be constructed across Des Moines River valley, at Ft. Dodge, to the Bates & Rogers Construction Co., of Chicago. The bridge is to be 186 ft. high and a half mile long.

Victoria, B. C.—It is stated that bids are wanted Sept. 30 for building a bridge across Kettle River at Ingram, West Kootenay Dist. W. S. Gore, Deputy Commr. of Lands and Works.

Indianapolis, Ind.—Bids are wanted Oct. 7 for building bridges over Bakers and Dry Branches; also for the substructure and superstructure of a bridge across Indian Creek, all in Lawrence township. Harry B. Smith, Co. Aud.

Reading, Pa.—Local press reports state that bids will be received by the County Comptroller until Oct. 14 for the superstructure and masonry necessary for bridge to be constructed at Ziegler's Mill in Bethel township.

Madison, Ark.—It is stated that bids will be received Oct. 7 for building a bridge across Allen Bayou, about 8 miles north of Madison. Geo. P. Taylor, Co. Judge, Forrest City.

Pueblo, Colo.—The construction of a bridge at Mesa Ave. is under consideration.

Grand Rapids, Minn.—Bids are wanted Sept. 30 for building a bridge at the mouth of Prairie River. Felix Mallette, Clk. Bd. Supervisors.

Ravenna, O.—It is stated that bids are wanted Sept. 30 for constructing a high Pratt truss steel superstructure over Cuyahoga River, to consist of one span 120 ft., with a 14-ft. roadway. E. J. Smith, Co. Aud.

PAVING AND ROADMAKING.

Rome, N. Y.—Paving Inspector John L. Plunkett writes that the contract for paving E. Liberty St. with asphalt has been awarded to the Barber Asphalt Paving Co., for $7,095.

New Haven, Conn.—Local press reports state that bids will be received by the Paving Commission until Oct. 7 for paving with crushed stone on Wilson, Asylum and Clay Sts. Probable cost, $10,000.

Allegheny, Pa.—See "Water."

Columbus, O.—The following are reported to be the lowest bids received Sept. 16 for paving on 2 streets: Town St., Ayers Asphalt Co., $29,149; Goodale St., N. B. Abbott, Wassall block, $9,455. For furnishing 400,000 brick for repair work, Townsend Brick Co., at $12.25 per thousand, is stated to have been the lowest.

Boston, Mass.—The widening of Dorchester St., at a cost of $300,000, is under consideration.

Toronto, Ont.—The paving of a portion of Cottingham St., 21 ft. wide, with Pitch Lake asphalt has been recommended. Estimated cost, $5,725.

Albany, N. Y.—An ordinance has been passed by the Common Council providing for the extension of Manning Boulevard. Probable cost, $40,000.

Muskegon, Mich.—H. P. Streicher, Toledo, O., is stated to have received contracts for brick pavement on 6 streets, at a total bid of $28,971.

Bay City, Mich.—Bids are wanted Sept. 30 for paving with block asphalt on a concrete foundation, in Van Buren St. Geo. Turner, City Engr.

Barberton, O.—Bids are wanted Oct. 14 for paving with brick on 2d St., also for stone curbing. W. A. Witner, Village Clk.

Knox, Ind.—Bids are wanted Oct. 7 for improving John and Cooper Sts., in all 5,395 ft., by grading, macadamizing and paving with stone; also for improving, in a similar manner, 12 miles of road in Center township. John W. Kurtz, Co. Aud.

Norwood, O.—Bids are wanted Oct. 18 for $5,808 Floral Ave. improvement bonds. W. E. Wichgar, Village Clk.

Cleveland, O.—The contract for macadamizing Noble road is stated to have been secured by Thos. H. Garland & Sons. Cost of improvement about $44,000.

Buffalo, N. Y.—Bids are wanted Oct. 2 for paving Marilla St. R. G. Parsons, Secy. Bd. Pub. Wks.

The lowest bids received Sept. 19 for paving Grace St. are stated to have been as follows: Henry P. Burgard, with asphalt, $10,700, and Louis H. Gipp, with brick, $11,297.

New York, N. Y.—Bids are wanted Oct. 3 for 6,470 sq. yds. asphalt pavement relaid on present pavement as foundation, in the Boro. of Manhattan, for repaving with asphalt, about 3,635 sq. yds. in the Boro. of Bronx, and for repaving with granite block on concrete foundation, 5,560 sq. yds. in the Boro. of Richmond. James P. Keating, Commr. of Highways.

Bids are wanted Oct. 3 for furnishing labor and material required for setting bluestone edging, building walk basins, laying drain pipe, constructing asphalt walks, and other work in Hudson Park, Boro. of Manhattan. Geo. C. Clausen, Commr. of Parks.

Steubenville, O.—Bids are wanted Oct. 1 for paving 2 alleys with hard-burned brick. Wm. M. Trainer, City Clk.

Albany, N. Y.—Bids will be received by the Board of Contract and Supply until Sept. 30 for constructing Riverside Park, for grading, curbing and paving the carriageway of Sheridan Ave. with brick or block and the carriageway of Robin St. with Mack or Metropolitan block. Isidore Wachsman, Clk.

Contracts for paving have been awarded by the Board of Contract & Supply, according to local press reports as follows: Broadway, with asphalt, to the Metropolitan Asphalt Co., at $2.19 per yd. Perry St., with brick, to Mulderry Bros., $1.98 per yd., and Livingston St., with brick, to Robt. A. Dumary, at $1.97 per yd.

New York, N. Y.—The Board of Estimate and Apportionment has authorized the expediture of about $300,000 in opening streets in the Bronx Boro.

Troy, N. Y.—An ordinance has been passed by the Common Council providing for the paving, with white brick, of Franklin St., between Liberty and Washington Sts.

White Plains, N. Y.—Bids are wanted Sept. 30 for $75,000 bonds for the purpose of macadamizing and otherwise improving certain streets, avenues and highways. Wm. B. Sutherland, Village Clk.

Winnipeg, Man.—Local press reports state that bids will soon be asked for the following works: Macadam pavement, 24 ft. wide, on Market St., estimated cost, $3,740; 24 ft. wide on Jarvis St., and on a portion of Hallett St., estimated cost $5,295.

The Council's Committee, appointed to receive bids for asphalt pavement, 24 ft. wide, on Balmoral St., estimated to cost $19,111, recommends that said work be done by day labor, no bids having been received. They also recommend that block pavement on Logan Ave., estimated to cost $5,966, be done in a similar manner, bids received having been above the engineer's estimate.

Savannah, Ga.—Geo. M. Gadsden, Dir. of Pub. Wks., writes that the contract for brick paving, for which bids were opened Sept. 21, has been awarded to the McAvoy Vitrified Brick Co. of Philadelphia, at 98.89 cts. per yd., total $9,889.

Kansas City, Mo.—The Board of Public Works has approved ordinances for paving Main St. from 3d to Front.

Freeport, Ill.—G. Maffioli, of Rockport, is stated to have submitted the lowest bid for grading, paving, excavating, concrete foundation and extra work under the street car tracks on Stephenson St., at $28,286, using Clinton, Ind., paving blocks, and Springfield block, $26,486.

Mt. Clemens, Mich.—The Council has adopted a resolution to pave Grand Ave., from Washington to North Aves.

Huntington, L. I.—Isaac Harris, of Brooklyn, is stated to have received the contract for paving Main St., at $9,379.

Monmouth, Ill.—An ordinance has been passed by the City Council providing for the paving of about 6,908 sq. yds. of single course paving on N. Main St., estimated to cost $9,947.

Niles, Mich.—The City Council has decided to macadamize 11 blocks on Main St.

Marinette, Wis.—Nelch, Patteson & Striffler are stated to have submitted the lowest bid for about 6,200 yds. of brick paving on Main St., at $1.85 for the paving, 35 cts. a cu. yd. for the excavation and 56 cts. a lin. ft. for the curbing.

Newport News, Va.—City Clk. W. L. Cooke writes that on Oct. 14 paving bonds, which were authorized by vote on Aug. 13, will be offered for sale.

Des Moines, Ia.—The Following bids were opened Sept. 19 for 8,398 sq. yds. of asphalt pavement on W. 8th St.: Bermudez Asphalt Paving Co., Chicago, $2.02 per sq. yd. for Bermudez asphalt; Capital City Brick & Pipe Co., Des Moines (awarded), their bid being $2.10 per sq. yd. on Bermudez asphalt, and $1.99 on Alcatraz.

Gallitzin, Pa.—See "Sewerage and Sewage Disposal."

Indianapolis, Ind.—Bids are wanted Oct. 4 for grading and paving with brick on a portion of Washington St.; also for cement sidewalks on portions of 3 streets. Albert Sahm, Chmn. Bd. Pub. Wks.

Weehawken, N. J.—It is stated that bids will be received until Oct. 2 for paving with asphalt on Hudson Ave. Geo. W. Bond, Jr., Township Engr.

Lima, O.—Bids are wanted Oct. 21 for $12,444 street improvement bonds. Address, City Clerk.

New Brunswick, N. J.—R. A. Montgomery, of Lambertville, N. J., has received the contracts for brick paving on Seaman St., at $1.97 per sq. yd., using Mack brick; total, $5,048; and on Spring St., using Catskill block, at $1.76 per sq. yd.; total, $1,068.

Swissvale, Pa.—Bids are wanted Oct. 8 for 2,800 cu. yds. grading on Riverview Ave. and 6,000 cu. yds. grading on Lloyd Ave. Also until Oct. 7 for grading, paving and curbing Denniston Ave., work to include 2,537 cu. yds. grading, 3,189 sq. yds. paving and 1,918 lin. ft. curbing. C. B. Judd, Boro. Engr., 1219 Park Bldg., Pittsburg.

North Canaan, Conn.—Bids will be received by the Board of Selectmen until Oct. 2 for constructing a macadam and gravel road in the town. James E. Rhoades, Selectman.

Cincinnati, O.—Bids are wanted Oct. 21 for improving Webb Alley by grading, setting curbs and paving the roadway with brick. Geo. F. Holmes, Clk. Bd. Pub. Service.

North Yakima, Wash.—Local press reports state that bids will be asked at once by the City Council for macadamizing portions of First and Second Sts.

Oberlin, O.—The lowest bid received Sept. 17 for furnishing material and paving W. College St. was, according to press reports, from Baldwin Bros. & Graham, of Columbus, at $18,382 for Malvern brick, and $18,808 for Canton brick.

Windsor, Conn.—Bids are wanted Sept. 30 for constructing a macadam road in the town. T. S. Loomis, 1st Selectman.

St. Marys, O.—Bids are wanted Oct. 12 for improving Spring St., work to include 7,400 sq. yds. brick paving, 4,727 cu. yds. excavation, 2,900 ft. new curbing (4-in. x 24-in. x 3-ft.), etc. J. H. Rowe, Jr., Village Clk.

Barnesville, O.—Local press reports state that bids will be received Sept. 30 for 5,319 sq. yds. of brick paving on Church St., including 1,828 cu. yds. of excavating.

Newark, N. J.—Local press reports state that contracts for paving (bids opened Sept. 19) have been awarded as follows: To James Seme, 7 contracts, using telford pavement in all, Lincoln Ave. from Arlington Ave to Carteret St., 9,100 sq. yds., $18,318; Montclair Ave. from Ridge to First Sts., 5,600 sq. yds., $9,482; Highland Ave., 9,500 sq. yds.. $15,307; Ridge St. 2,700 sq: yds., $4,242; De Graw Ave., 9,400 sq. yds., $15,763; Lake St., 9,400 sq. yds., $15,708; Parker St., 2,700 sq. yds., $4,240. To David Harper, Lincoln Ave., with Guise brick, 1,300 sq. yds., $3,458; John F. Shanley, Montclair Ave. from Mt. Prospect Ave. to Ridge St., 3,000 sq. yds. oblong granite block pavement, $6,113. To the Essex Asphalt & Contract Co., Franklin St., 2,550 sq. yds., and Pennington St., 6,200 sq. yds., using Trinidad asphalt, at $1.75 per sq. yd. respectively.

St. Louis, Mo.—R. P. Garrett, Engr. of the Bd. of Pub. Improvements writes that the following bids were opened Sept. 20 for brick paving, the work to include granitoid curbing and guttering 3 ft. wide, and the laying a brick pavement on a concrete base of Union boulders: Stifel & Ruckert, $12,566; McIntyre & Teese, $11,937; Francis McCabe, $11,206; Fruin-Bambrick Construction Co., $11,849; Hill-O'Meara Construction Co., $12,886; T. E. Cavanaugh, $10,971 (awarded); Buehler-Conway Construction Co., $11,734; Sinclair Quarry & Construction Co., $11,982; Herman Construction Co., $11,760; Jno. F. McMann, $11,651.

Birmingham, Ala.—The following bids were opened Sept. 18 for paving sidewalks on portions of Aves. 2d to 6th, and 14th to 18th Sts.: *a*, 21,000 sq. yds. cement sidewalk; *b*, 1,200 sq. yds. vitrified brick; *c*, total: H. E. Manville & Co., *a*, 89½ cts.; *b*, $1.18; *c*, $20,211 (awarded). Stamsen & Blome, *a*, 93 4/5 cts.; *b*, $1.16; *c*, $21,090. Byron Sanders, *a*, 95⅞ cts.; *b*, $1.10; *c*, $21,454. Birmingham Paving Co., *a*, $1.30; *b*, $1.50; *c*, $29,100.

Other contracts for paving sidewalks have been awarded as follows: To Stamsen & Blome, for 16,000 sq. yds. of cement sidewalk, at 94⅜ cts. and 800 sq. yds. of brick sidewalk at $1.16, total $16,028; to H. E. Manville & Co., 12,500 sq. yds. of cement sidewalk at 94 cts. and 200 sq. yds. of brick sidewalk at $1.18; total, $11,986.

Birmingham, Ala.—The following bids were opened Sept. 18 for brick paving on a portion of 21st St.: *Contract awarded.

Items and Quantities.	Southern Paving & Const. Co.	Coaldale Pav. Brick Co.	C. M. Buckhalter & Co.
18,000 sq. yds. paving	$1.62	$1.65½	$1.75
50 sq. yds. cement sidewalk	1.50	1.52	1.50
5 manhole covers	7.00	6.00	25.00
200 lin. ft. 6-in. granite curb (curved)	.49	.47	.50
2,000 lin. ft. relining gran. curb.	.04	.05½	.07½
2,000 lin. ft. resetting gran. curb	.02	.03	.07½
6 inlets rebuilt	7.50	8.00	10.00
Totals	*$29,533	$30,208	$32,160

Other paving contracts, for which bids were opened at the same time, have been awarded as follows: To C. M. Burkhalter & Co., Birmingham, grading, macadamizing, curbing and paving brick gutters on Charles Ave., for $8,970: To Dunn Lallande Bros., Birmingham, grading, macadamizing, curbing and paving brick gutters on portions of 20th and 22d Sts., for $7,142.

Erie, Pa.—The following bids were opened Sept. 16 for repaving State St., the work to include 3,350 cu. yds. of grading: Bidders, A, Jno. McCormick & Son, Erie, Pa.; B, Mayer Bros., Erie, Pa.; C, V. D. Eichenlaub, Erie, Pa.; D, Inter-State Paving Co., Utica, N. Y.; E, Barber Asphalt Paving Co., New York, N. Y.; F, Henry Mayer, Sr., Erie, Pa.; G, Cleveland Trinidad Paving Co., Cleveland, O. (awarded):

Bidders.	Paving. 12,500 yds. Brick.	Asphalt.	Medina curb, 700 ft.	Sandstone curb, 600 ft.	Catch-basins, 6.	Land-marks, 4.	Pipe sewer. 12-in., 50 ft.	9-in., 100 ft.	6-in., 300 ft.
A	$1.58	....	$.80	$.62	$45.00	$5.00	$1.25	$.65	$.45
B	1.49	....	1.05	.58	29.50	5.00	.95	.60	.50
C	1.65	....	.50	.50	30.00	3.00	.60	.40	.35
D	....	$1.95	.90	.75	40.00	5.00	.55	.45	.40
E	....	2.03	.60	.50	30.00	6.00	.60	.40	.25
F	....	1.77	1.45	1.10	30.00	5.00	1.10	.55	.50
G	....	1.69	.80	.60	25.00	5.00	.60	.50	.40

Bids received Sept. 20 for 14,500 yds. of paving on Peach St. have been rejected; the lowest bids received were $1.92 on brick and $1.69 on asphalt. New bids will be asked. B. E. Briggs, City Engr.

Southington, Conn.—Bids are wanted Sept. 30 for constructing a macadam road in the town. A. M. Lewis, 1st Selectman.

POWER PLANTS, GAS AND ELECTRICITY.

Washington, D. C.—Bids are wanted Oct. 5 for 2 steam boilers, as advertised in The Engineering Record.

Burlington, Ia.—Bids are wanted Nov. 1 (extension of date) for lighting the city for a period of years, as advertised in The Engineering Record.

Allegheny, Pa.—See "Water."

Atkinson, Ill.—Bids are wanted Oct. 7 for furnishing material and installing an electric light plant. Fred. Johnson, Village Clk.

Mountain Lake Park, Md.—T. A. Rudisill, Secy. of the Garrett Water & Light Co., writes that the proposed electric light plant, for which contracts will soon be let, will cost about $7,000. F. Martin, Fairmont, W. Va., Pres. of the company.

Fremont, O.—The Council is stated to have granted A. H. Jackson, W. E. Proctor and others a franchise for an electric light and a hot water heating plant.

Caldwell, O.—The citizens are stated to have voted to enlarge the electric light plant, at a cost of $5,000.

Winchester, Ill.—The electric light plant here is reported to have been destroyed by fire Sept. 16.

Parkersburg, W. Va.—The Council is stated to have appointed a committee to investigate the cost of a municipal light plant.

Wellington, Kan.—A stock company is reported as being organized with a capital of $15,000 to establish an electric plant. S. P. Kramer is reported interested.

Jeannette, Pa.—A charter has been granted to the People's Light & Power Co., of Jeannette, to construct an electric light plant. Geo. H. Stevens, Pres.; Joseph A. Bing, Secy.

St. Louis, Mo.—Chas. H. Ledlie, Gen. Mgr. of the Citizens' Electric Light & Power Co., is stated to have filed with the Board of Public Improvements application for permission to construct conduits in various parts of the city.

Weatherford, Okla. Ter.—See "Water."

Newport, Me.—C. O. Sturtevant, of the Smith-Sturtevant Light & Power Co., writes that it is proposed to construct an electric light plant at an estimated cost of $5,000.

Pocatello, Idaho.—The American Falls Power, Light & Water Power Co., has been incorporated with a capital of $300,000, to harness the power of the Snake River at American Falls, to generate and transmit electrical energy, primarily for Pocatello, and construct canals for irrigating the lands around American Falls. It is stated that work on the power plant will commence within 30 days. Directors: J. H. Brady and D. W. Standrod, of Pocatello; R. Rounds, of Idaho Falls, and others.

Kensington, Md.—W. B. Clay and J. F. Tilley, Jr., of Washington, D. C., are stated to have secured a franchise for lighting the streets of the town with acetylene gas, and a $12,000 plant is to be erected for the manufacture of the fluid.

Media, Pa.—The Westinghouse Electric & Mfg. Co., Pittsburg, is stated to have received the contract for electrical apparatus for the municipal electric plant, at $4,820.

Ottawa, Ont.—Local press reports state that the construction of supplemenetary water power canals by the Chaudiere Power Companies has been approved by the engineers appointed to investigate this undertaking, and the Board of Works has decided to recommend to Council that permission to construct these canals be granted, subject to a satisfactory agreement being reached between the companies and the city as to the proper control of the water.

Ottumwa, Ia.—See "Electric Railways."

Celina, O.—The Council has granted J. D. Johnson a franchise for heating the village.

Sheldon, Ill.—The plant of the Sheldon Electric Light & Power Co., owned by Geo. Pawley & Son, is reported to have been wrecked by an explosion on Sept. 18.

Alamosa, Colo.—It is reported that the Alamosa Electric Light & Power Co. is to install a new and enlarged plant.

Point Edward, Ont.—The Council is stated to have granted the Sarnia Gas & Electric Light Co., of Sarnia, Ont., a franchise to extend its system to Point Edward.

Chicago, Ill.—The People's Gaslight & Coke Co. has increased its capital stock to $5,000,000, and it is reported that the increase is to be used for new mains and other improvements.

Renfrew, Ont.—The contract for constructing the dam, flume and power house on Bonnechere River, for the Renfrew Power Co., is stated to have been awarded to E. A. Cawsey for $15,000.

Westville, N. J.—It is stated that the South Jersey Gas, Electric & Traction Co. will extend its gas mains from Woodbury to Westville and Newbold.

Willmar, Minn.—See "Water."

Oregon City, Ore.—The Portland General Electric Co. is stated to have secured the contract for lighting the city for 6 years at $7 a month for arc lights and $1.25 per month for incandescent lights.

Bennettsville, S. C.—City Clk. Milton M. Lawrie writes that it is proposed to construct an electric light plant.

Spokane, Wash.—The Washington Water Power Co. is stated to have secured a franchise to string electric wires and erect poles in Spokane County.

Gloversville, N. Y.—The Mohawk Valley Power Co., of Gloversville, has been incorporated to sell power in the counties along the Mohawk Valley; capital, $5,000. Directors: Peter E. Garrison, Wm. H. Dailey and Geo. A. Harris, of Gloversville.

Hazlehurst, Miss.—It is stated that bids are wanted until about Nov. 1 for an electric light plant, to be operated by steam, and to cost about $35,000. E. M. Cook, Mayor; W. C. Porter, Des. Engr., Laurel, Miss.

Holley, N. Y.—J. M. Brown, Village Trustee, writes that bids will be received about Oct. 7 for the construction of an electric light plant, for which $15,000 has been appropriated.

Salt Lake City, Utah.—Clemens Herschel, 2 Wall St., New York, N. Y., is reported to be here, stopping at the Knutsford Hotel. He is reported to have been engaged to come here by the Utah Light & Power Co., to advise with it as to the location of the $250,000 dam which it proposes to build about 6 miles up Ogden Canyon. The water from this lake is to be used to run the machinery of the power company and supply a system of irrigating canals in Weber County.

Gloversville, N. Y.—Wm. M. Harris, Chmn. Lighting Com., writes that the following bids were opened Sept. 3 for furnishing and operating, for a period of 10 years, from March 1, 1902, 120 series-enclosed arc lamps:

Bidders.	Arc.	Incandes't. 24-c.p.	65-c.p.
H. L. Merry, New York	$91.25	$32	$50
Mohawk Valley Power Co., Gloversville	89.00	30	48
John Begley, Gloversville	86.50	26	45
Fulton Co. Gas & Electric Co., Gloversville	86.40	25	45

ELECTRIC RAILWAYS.

Jackson, Mich.—The Council is stated to have granted a franchise to Hawks & Angus.

Louisville, Ky.—The Louisville Ry. Co. is stated to have secured a franchise for a railway on Frankfort Ave. T. J. Minary, Pres. & Mgr.

Peru, Ind.—The Miami County Commissioners are stated to have granted Fred. C. Boyd and associates, of the Wabash River Traction Co., a franchise to extend the electric railroad between Wabash and Peru.

Hamilton, O.—The Board of Control is stated to have granted the Millcreek Valley Electric Ry. Co. a franchise to enter the city.

Newark, O.—The County Commissioners are stated to have granted a franchise to the Columbus & Granville Electric Ry. Co. to construct and operate an electric railway through Licking County.

Clinton, Ia.—The Illinois & Iowa Electric Ry. Co., has been incorporated with a capital of $125,000, to construct a railway between this city and Davenport, a distance of 42 miles.

Long Beach, Cal.—The Council is stated to have granted W. H. Holabird a franchise for a railway extending from the ocean to the northern city limits.

Eaton, O.—The Hamilton, Eaton & Richmond Traction Co., of Eaton, has been incorporated, with a capital of $200,000, by J. S. Steward, Gus M. Hodge and others, to construct and operate an electric street and interurban railway in and connecting Hamilton, Seven Mile, Winchester, Eaton and other cities in Indiana.

Columbus, O.—The County Commissioners are stated to have granted J. M. Wilson, representing the Columbus & Southern Ry., a franchise to construct an electric railway between Columbus and Washington C. H. The power house will be located at Washington C. H., O.

Jamestown, N. Y.—W. J. Conners, of Buffalo, is reported interested in the construction of an electric railway from Buffalo to Jamestown, by way of Dunkirk.

Sharon Springs, N. Y.—The Village Trustees are stated to have granted a franchise to the Mohawk River Traction Co.

Ottumwa, Ia.—The Ottumwa Traction & Light Co. has been incorporated with a capital of $500,000. Incorporators: Joseph H. Merrill, Saml. Mahon, and others.

Albany, N. Y.—Bids will be received by the Board of Contract and Supply until Oct. 14 for a franchise for the construction, maintenance, use and operation of a double-track railway by the overhead trolley electric system. Isidore Wachsman, Clk.

St. Joseph, Mo.—F. E. Reed, an attorney of Kansas City, and representing the Kansas City, Parkville & St. Joseph Electric Ry. Co., is stated to have petitioned the County Commissioners for a franchise.

East Aurora, N. Y.—The Village Trustees are stated to have granted franchises to the Buffalo, Hamburg & Aurora Ry. Co., G. W. Houck, Mgr., Worcester, Mass., and to the Buffalo, Gardenville & Ebenezer Ry. Co. C. Schoepflin, Mgr., Gardenville, N. Y.

Newmarket, N. H.—The Newmarket & Exeter St. Ry. Co. has been incorporated; capital, $75,000. Incorporators: Wallace D. Lovell, Newton, Mass.; John H. Griffin, Newmarket; Saml. W. Emery, Portsmouth, and others.

Ft. Wayne, Ind.—The Ft. Wayne & Lima Traction Co. has been incorporated with a capital of $50,000 to operate a railway in Ft. Wayne, and to construct an interurban line from Lima, O., to Ft. Wayne. Incorporators: D. J. Cable, J. B. Kerr and others, all of Lima, O.

The Allen County Commissioners have granted D. J. Cable a franchise for a trolley line from the eastern limits of the city to a point near Maples.

Syracuse, N. Y.—The Syracuse, Lakeside & Baldwinsville Ry. Co. has petitioned the Council for a franchise for three branch lines in addition to present line. W. Judson Smith, Mgr., Syracuse.

Savannah, N. Y.—The Village Trustees are stated to have granted a franchise to the Rochester & Syracuse Ry. Co.

Dover, N. H.—John A. Jones, Lewiston, Me., has commenced a survey for the proposed electric road from Dover to York Beach, Me., and from South Berwick to connect with the above, a total length of about 20 miles.

Port Clinton, O.—Jas. K. Brown, of Lorain, is reported interested in the construction of an electric railway from Port Clinton to Toledo, about 36 miles in length.

Augusta, Me.—John A. Jones, of Lewiston, Me., has completed the preliminary survey for an electric road from Augusta to Winthrop, Me., a distance of 14 miles.

Pittsfield, Mass.—The Berkshire Electric St. Ry. Co. is stated to have awarded the contract for erecting the new power station here, to Dodge & Devanney, of Pittsfield, for about $40,000, which will include the foundations for the new machinery.

Gloversville, N. Y.—J. N. Shannahan, Ch. Engr. of the F., J. & G. R. R. Co., writes that the contract for building 8 miles of new road has been awarded to D. A. Crage & Co., 70 Terrace, Buffalo, N. Y.

Holland, Mass.—The Selectmen are stated to have granted a franchise to the Hartford & Worcester St. Ry. Co. The proposed road will pass through the towns of Wales, Holland and Brimfield, and the village of Fiskdale. F. C. Perkins, of Hartford, Conn., and F. C. Hinds, of Boston, are promoters of the road.

Elmira, N. Y.—The Council is stated to have granted the Elmira Water, Light & R. R. Co. permission to extend its lines. C. F. Uebelacker, Mgr., Elmira.

Sidney, N. Y.—It is proposed to construct an electric railway from Sidney to Utica, at a probable cost of over $650,000. For further information address the engineer in charge, Mr. Kinsman, Hotel Sidney, Sidney, N. Y.

Newton, Mass.—The Board of Aldermen is stated to have granted a franchise to the Boston & Worcester St. Ry. Co.

Corning, N. Y.—C. M. Grannis, of Syracuse, is reported interested in the construction of an electric railway from Corning to Rochester.

Independence, Mo.—The Suburban St. Ry. Co. is stated to have been formed to construct a railway to Kansas City, a distance of about 10 miles. Incorporators: Joseph Mercer, Chas. Gudgell and others.

RAILROADS

Jackson, Ky.—H. Wade Beaver, Mgr. of the Kentucky Lumber & Veneer Co., writes that the company is building 16 miles of narrow-gauge railroad on which it is expected to use 30-lb. rails. A steel bridge will be built over Kentucky River, channel span to be 160 ft. to 190 ft. long, with probably two deck spans of 45 ft. each.

New Orleans, La.—A correspondent writes that some months ago a Belt R. R. Commission was formed by the City Council to construct a public belt line. The improvement will involve the construction, operation and maintenance of about 12 miles of double track along the river front.

Newark, N. J.—Local press reports state that, with the exception of the share of cost to be borne by the city, all the details of an agreement for the abolishment of grade crossings along the line of the Lackawanna R. R. in Newark were decided upon at a conference between the Board of Works Commrs. and R. R. Officials in Hoboken, Sept. 20; estimated cost of entire work of elevating tracks east of High St. and depressing them through Roseville is $3,320,270, and the R. R. Co. asked that the city pay 30 per cent., or $996,071, as its share.

Seattle, Wash.—The Trans-Alaskan Ry. Co. has been incorporated with a capital of $50,000,000, under the laws of the State of Washington. It is proposed to construct and operate lines in Alaska to connect with the Trans-Siberian Ry. by a line of steel ferry boats across Bering Strait. Headquarters to be at Seattle, where F. S. Granger, will be in charge, as general manager.

Tacoma, Wash.—The Tacoma Southern Ry. & Navigation Co. was incorporated Sept. 18, with a capital of $4,000,000, to construct a railroad from Tacoma to a point on the Columbia River near The Dalles. Incorporators, Wm. Bailey, Ira A. Town and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Lake City, Fla.—Bids will be received by the County Commissioners until Oct. 24 for erecting a court house. R. T. Boozer, Chmn.

Yondota, O.—Bids are wanted Oct. 7 for erecting a town hall near Yondota. Aug. W. Tank, Township Clk., Bono, O.

Farmington, Mo.—Bids will be received by the Board of Commissioners of the State Hospital for the Insane, No. 4, until Oct. 4, for erecting 3 brick buildings; namely, dining hall, kitchen and laundry. H. H. Hohenschild, Archt. & Supt.

Middletown, N. Y.—Bids are wanted Sept. 30 for erecting an addition to the kitchen at the Middletown State Hospital. U. T. Hayes, Vice-Pres. Bd. Mgrs.

Deadwood, S. D.—Bids are wanted by the Board of County Commissioners until Oct. 5 for erecting an addition to the county jail. W. A. Zink, Co. Aud.

Indianapolis, Ind.—Bids are wanted Oct. 2 for furnishing labor and material necessary for a system of fixtures, fittings, piping, sewer, etc., in the engine house at Ashland Ave. and 24th St. Albert Sahm, Chmn. Bd. Pub. Wks.

Paris, Ont.—Bids are wanted Oct. 1 for furnishing and installing a heating apparatus in the public building at Paris. Fred. Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont.

Hazelhurst, Miss.—It is stated that bids are wanted Oct. 7 for erecting a court house. J. B. Mayes, Clk.

St. Louis, Mo.—About $11,000,000 will be expended for construction work on the buildings and grounds of the Louisiana Purchase Exposition. It is planned to apply about $7,000,000 of this amount for the buildings and $4,000,000 for the grounds. The site selected is Forest Park, this city. The general plans have been drawn up by a Commission of Architects. Isaac S. Taylor, 318 N. 8th St., St. Louis, is chairman of this commission and Director of Construction and Maintenance.

Kings Park, L. I., N. Y.—The contract for erecting a nurses' home at the L. I. State Hospital has been awarded to O'Connor & Booth, of Jamaica, L. I. (subject to the approval of the State Commission in Lunacy), for $42,725.

Boston, Mass.—Bids are wanted Sept. 30 for furnishing and installing ventilating, heating and plumbing systems in the hospital and nurses' home on Long Island, Boston Harbor, also for electric work and making lockers in each of said buildings. Address, Pauper Institute Trustees of the city of Boston.

Jackson, Minn.—The Pauly Jail Bldg. & Mfg. Co., of St. Louis, Mo., is stated to have received the contract for erecting the county jail, for $14,200.

Munising, Mich.—The contract for erecting the new court house at Munising is stated to have been awarded to the Northern Construction Co., of Milwaukee, Wis., for $29,448.

Marinette, Wis.—It is stated that a $30,000 library will be erected here, to be the gift of Isaac Stephenson.

Pittsburg, Pa.—The congregation of the East Liberty Presbyterian Church is stated to have decided to erect a chapel to cost about $75,000.

New Britain, Conn.—A $20,000 addition, consisting of a 2-story brick building 52 x 104 ft., is to be built at once to the New Britain Hospital. Architect, W. H. Cadwell, 213 Main St.

Jersey City, N. J.—It is stated that a new church and priest's house is to be erected for St. Mary's R. C. Church, to cost, with the grounds, about $300,000. Rev. H. B. Ter Woert, Rector.

Tacoma, Wash.—M. J. Conley, of Tacoma, is stated to have secured the contract for erecting the proposed public library for $74,193.

Sewickley, Pa.—It is stated that a municipal building will be erected on Chestnut and Washington Sts., to cost about $25,000. W. Dwight Bell, Burgess.

Sharon, Pa.—The city is stated to have accepted the offer recently made by Frank H. Buhl, former President of the Sharon Steel Co., to erect and equip a $200,000 public building in Sharon. The plans call for a 3-story stone building, to contain a public library, gymnasium and auditorium.

Laredo, Tex.—The citizens are stated to have voted to issue $25,000 bonds for a jail.

Baltimore, Md.—Geo. C. Haskell, Central Savings Bank Bldg., is stated to have prepared plans for the Baltimore University Hospital. Dr. Thos. H. Magness and Dr. Edw. C. Moriarity will have charge of this hospital.

Hochelaga, Que.—Bids are wanted Oct. 1 for furnishing and installing a heating apparatus in the public building at Hochelaga. Fred. Gelinas, Sec'y Bd. Pub. Wks., Ottawa Ont.

Hartford, Conn.—Alderman E. O. Weeks is reported to be chairman of a committee appointed to consider the advisability of erecting a new city hall.

Trenton, N. J.—The State Armory Commission is stated to have selected a site on East State St. for the proposed armory, for which the last legislature appropriated $150,000.

St. John, N. B.—Bids will be received by the Department of Public Works, Ottawa, Ont., until Oct. 1, for furnishing and installing a heating apparatus in the quarantine station, Partridge Island, St. John, N. B. Fred. Gelinas, Sec'y.

West Superior, Wis.—Schmidt Bros. are stated to have secured the contract for erecting the Carnegie Library, for $37,288.

Whitby, Ont.—Bids are wanted Oct. 8 for erecting a House of Refuge. John E. Farewell, Co. Clk.

Green Bay, Wis.—The contract for erecting the north wing of the reformatory at Green Bay has been awarded by the State Board of Control, Madison, to the General Construction Co., of Milwaukee, Wis., for $79,540.

Pipestone, Minn.—It is stated that bids are wanted by the County Commissioners, until Oct. 10, for erecting a jail. Geo. A. Berlinghof, Archt., Beatrice, Neb.

Iroquois, N. Y.—Bids are wanted Oct. 8 for erecting a dormitory at the Thomas Asylum for the Orphan and Destitute Indian Children at Iroquois. Henry R. Howland, Pres. Bd. Mgrs.

Norwalk, Conn.—The citizens are stated to have voted to accept the offer of Andrew Carnegie to donate $20,000 for a public library.

Pine Bluff, Ark.—Contracts for building, heating and plumbing the Arkansas Deaf Mute Institute have been awarded to Casey & Powers and to the Arkansas Pump & Pipe Co., both firms being of Little Rock, Ark., not Duluth, as stated through error last week.

Homestead, Pa.—See "Sewerage and Sewage Disposal."

Bloomington, Ill.—It is stated that bids are wanted Oct. 19 for $136,000 court house rebuilding bonds. C. R. Ewing, Chmn. Finance Com.

Braddock, Pa.—Bids will be received by Marius Rousseau, Archt., Smith Blk., for erecting St. Thomas' Church at Braddock.

Syracuse, N. Y.—Bids are wanted Sept. 30 for erecting an addition to engine house No. 7, also for erecting hose house No. 2 in the 10th Ward. Robt. H. Jones, Clk. Bd. Contract & Supply.

McRae, Ga.—It is stated that bids will be received Oct. 5 for enlarging the county jail. Wm. McLean, Clk.

Allegheny, Pa.—See "Water."

Atlantic City, N. J.—Bids are wanted Sept. 30 for erecting a 2-story brick building, to be known as fire house No. 1. Geo. Long, Chmn. Property Com.

Reidsville, Ga.—It is stated that bids are wanted Nov. 11 for erecting a court house. Address, B. F. Alexander.

Carrollton, Mo.—Bids are wanted Oct. 18 for erecting a court house. Bids will also be received at the same time for the plumbing, steam heating, sewerage and gas piping. R. G. Kirsch, Supt.

Marysville, Kan.—Bids are wanted Oct. 10 for erecting a jail. Jas. Montgomery, Co. Clk.; A. Berlinghof, Archt., Beatrice, Neb.

Connellsville, Pa.—Bids are wanted Oct. 7 for the plumbing, heating, wiring, cell and iron work in the new City Hall. A. C. Jones, Chmn. Bldg. Com. of the Town Council.

Little Rock, Ark.—It is stated that bids are wanted Oct. 7 for erecting a boiler house, steam plant and laundry building; remodeling old steam plant and laundry building for an infirmary; removing and rebuilding the smokestack; making pipe tunnels, pipe extensions and removing and resetting boilers; to furnish f. o. b. one 54 x 14 boiler with 63 3-in. flues and a steam dome, at the Arkansas School for the Blind. John H. Page, Sec'y Bd. Trus., State Charitable Institution.

St. Paul, Minn.—A correspondent writes that the following are the lowest bids received Sept. 24 for work on the Minnesota Capitol: Roofing and skylight work, Scribner-Libby Co., Washington and 5th Sts., $109,673; and Butler-Ryan Co., Globe Bldg., $99,000. Mechanical equipment, complete, Allen Black, 144 E. 6th St., $370,000; and W. J. Gray, $352,308. Boiler plant, Allan Black, $64,000; and Geo. R. Morton, $59,492. Electric generators, Butler-Ryan Co., $25,922; and Geo. R. Morton, $41,657. Electric wiring, Arthur Frantzen, 225 Dearborn St., Chicago, Ill., $34,500. Heating and Ventilating, Allan Black, $86,998; and Butler-Ryan Co., $45,840. Elevators, Kiechefer Elevator Co., Milwaukee, Wis., $16,700; and Otis Elevator Co., Manhattan Bldg., $33,450. Plumbing, Allan Black, $34,790. Power House, T. M. Maguire, $62,598. There are a number of modifications which might change results when tabulated in full.

BUSINESS BUILDINGS.

Ft. Washington, Pa.—Press reports state that bids will be received by C. F. Sharp, 1706 De Lancey St., Philadelphia, until Oct. 3 for erecting a station at Ft. Washington for the Philadelphia & Reading Ry. Co. B. L. Gilbert, Archt., 50 B'way, N. Y. City.

El Paso, Tex.—Architect Hughes, of El Paso, is stated to be preparing plans for an exhibition hall, 3 stories high, 345 x 75 ft., to cost about $100,000.

Duluth, Minn.—Palmer, Hall & Hunt, Lonsdale Bldg., are stated to have prepared plans for a 7-story fireproof building, 100 x 140 ft., to be erected on 1st St. and 3d Ave. West, for the U. S. Steel Co.

Chattanooga, Tenn.—A correspondent writes that T. R. Read, proprietor of the Read House, will remodel his hotel in the near future. Cost about $50,000.

Baraboo, Wis.—The C. W. Girdele Co., 3333 La Salle St., Chicago, Ill., is stated to have secured the contract for erecting a $35,000 depot for the Northwestern Ry. Co.

New York, N. Y.—It is stated that the Bank of the State of New York will erect a 22-story building on the n. w. corner of William St. and Exchange Pl., to cost $3,500,000.

Carbondale, Ill.—The Newell House is stated to have been destroyed by fire on Sept. 18.

Des Moines, Ia.—It is stated that the Chicago, Rock Island & Pacific R. R. will erect a freight depot 60 x 400 ft. on 9th and Vine Sts. W. J. Lawrence, Div. Supt., Des Moines.

Duluth, Minn.—The contract for constructing new shops for the Northern Pacific R. R. in Duluth is stated to have been awarded to Geo. Deeks & Co., of St. Paul. The shops and auxiliary buildings will cost about $50,000.

Philadelphia, Pa.—It is stated that the Pennsylvania R. R. Co. will erect a brick and terra cotta depot at 32d and Market Sts. W. H. Brown, Ch. Engr., Philadelphia.

Chicago, Ill.—W. P. Henneberry & Co. are reported to be arranging to erect an 8-story printing establishment at 552 to 556 Wabash Ave., to cost $100,000, from plans of Howard Shaw, 115 Dearborn St.

The Deering Harvester Co. is reported to have plans prepared by T. M. Brooks, care of Deering Harvester Co., for the construction of a 4-story building 118 x 377 ft., in connection with its plant at Fullerton and Clybourn Aves., to cost about $100,000.

L. Mart Mitchell, 145 La Salle St., is reported to have prepared plans for a 6-story manufacturing building for B. F. George, to be built at Nos. 86-90 W. Washington St.; cost, $75,000.

Miami, Fla.—It is stated that S. Graham, proprietor of the Hotel Biscayne, will erect a hotel on 12th St. and Ave. B., to cost about $50,000.

Jacksonville, Fla.—W. A. Bisbee will erect a 2-story white brick business building, with terra cotta trimmings, on N. E. cor. Bay and Laura Sts.

DWELLINGS.

Glenville, O.—Jarvis Hunt, Monadnock Bldg., Chicago, Ill., is stated to have prepared plans for a $125,000 residence for Daniel R. Hanna.

Detroit, Mich.—Greene & Oldfield are stated to be preparing plans for a 3-story brick apartment house for Henry W. Holcomb, to be erected on Warren Ave. and Beaubien St.

Chicago, Ill.—A. G. Lund, 602 W. 63d St., is stated to have prepared plans for a 3-story apartment building which Johnson & Holmgren are arranging to erect between Jefferson and Washington Aves., at a cost of $55,000.

Jas. Gamble Rogers, 1314 Ashland Blk., is stated to have prepared plans for a 3-story gray brick and cut stone apartment building, to be erected at Sunnyside Ave. and Sheridan drive, for R. W. Vonnah; cost, $60,000.

L. M. Mitchell, 145 La Salle St., is stated to have prepared plans for 4 three-story flat buildings for B. F. George, to be built at Nos. 5700-5706 Indiana Ave., 1154-1156, and 1160 57th St., at a total cost of $80,000. He has also prepared plans for an apartment building to be erected at Calumet Ave. and 41st St. for Edw. Mendel, to cost $40,000, and for 2 apartment houses, one 3 stories high, to be erected on Lawrence and Winthrop Aves., for Harry Weymouth, to cost $40,000 and one on Indiana Ave. near 32d St., to cost $18,000.

Henry L. Newhouse, 4630 Prairie Ave., is stated to have prepared plans for a brick residence for Frank Harris, to be erected on Ellis Ave. and 50th St.; cost, $35,000.

SCHOOLS.

Washington, D. C.—Bids opened Sept. 21 by the Commissioners, D. C., for the 4-room school on Bladensburg road were received as follows: Pavarini & Greer, $28,400 and $29,700. For a 4-room school on Grant road, the same bidders submitted two bids—$27,325 and $28,700.

Berkeley, Cal.—It is stated that University of California is considering the erection of a 3-story fireproof library 250 x 310 ft., having a capacity of at least 1,000,000 volumes. Mr. Rowell, Librarian.

Madison, Wis.—The Board of Regents of the State University is stated to have accepted the plans of J. T. W. Jennings, University of Wisconsin, for the new College of Agriculture, to cost about $150,000.

St. Louis, Mo.—Commissioner of School Buildings Wm. R. Ittner is stated to have completed plans for additions of 6 rooms each to the Washington School, to cost $32,000, and the Grant school, to cost $35,000.

Messina, Fla.—Local press reports state that the Board of Education will open bids Oct. 31 for the erection of a high school. Address W. J. Merrill.

Eureka, Cal.—See "Sewerage and Sewage Disposal."

Worcester, Mass.—Frost, Briggs & Chamberlain, 518 Main St., have prepared plans for the Administration Building for Clark University. Estimated cost, $90,000.

Colorado Springs, Colo.—The Colorado College is stated to have received a gift of $100,000 for the erection of a Science Building. W. F. Slocum, Pres.

Webster City, Ia.—It is stated that bids are wanted Oct. 5 for erecting a school. C. A. Howd, Sec'y School Bd.

Berlin, Wis.—Bids are wanted Oct. 7 for erecting a high school. J. E. Murphy, Supt. Bd. Educ.

Corvallis, Ore.—Bids will be received by the Building Committee of the Board of Regents of the State Agricultural College at Albany, until Oct. 25, for erecting the Agricultural Hall at Corvallis. John D. Daly, Sec'y Bd., Corvallis.

Xenia, O.—It is stated that bids are wanted Oct. 10 for erecting a high school at Xenia. W. Chamberlain & Co., Archts., Birmingham, Ala.

STREET CLEANING AND GARBAGE DISPOSAL.

Milwaukee, Wis.—The Council has decided that contracts for $20,000 worth of equipment for the new garbage crematory will be advertised for by the Board of Public Works, instead of being let by informal contract.

Charleston, S. C.—A resolution is before the Council providing for the building of a garbage crematory.

Hamilton, O.—The Dixon Garbage Crematory Co. of Toledo, bid $11,570 for the erection of a crematory in Hamilton.

Toronto, Ont.—Street Commissioner Jones has reported the estimated cost of needed repairs on two garbage crematories to be about $14,000.

South Bend, Ind.—City Treasurer Rutherford has recommended that the $10,000 to be raised by a new bond issue be spent for a garbage crematory.

Cincinnati, O.—The Health Committee of the Board of Legislation, on Sept. 20, appointed Michael Mullen and James Keenan as a subcommittee to prepare plans and specifications for the collection and distribution of garbage.

GOVERNMENT WORK.

New York, N. Y.—The New York Journal of Commerce states that, according to the final plans and specifications which have been transmitted to Washington for approval, dry dock No. 4 at the N. Y. Navy Yard will be 550 x 90 ft. at the base.

Ft. Washington, Md.—The following bids for furnishing and installing electric light plant at Ft. Washington, were opened at U. S. Engineer Office, Washington, D. C., Sept. 19: W. M. Sheehan, New York, $2,895; time, 75 days. National Electrical Supply Co., Washington, $3,312.20; time, 60 days. Edwin Heaton, New York, $3,403; time, 70 days. J. F. Buchanan & Co., Philadelphia, $3,475; time, 45 days. McCay Engineering Co., Baltimore, Md., $3,598; alternative bid, $3,915; time, 45 days; New Jersey Foundry & Machine Co., New York, $3,695; time, 12 weeks. Samuel B. Libbey, New York, $4,980; time, 60 days.

St. Louis, Mo.—Bids are wanted Oct. 3 for furnishing material and making repairs to the building at the St. Louis Clothing Depot. Address, Lieut.-Col. D. D. Wheeler, Depot Q. M.

Ft. Du Pont, Del.—Bids are wanted Oct. 15 for erecting a pump-house, plumbing and electric wiring of same, and installing pumping machinery, at Ft. Du Pont, Del. Address, Constructing Quartermaster, Delaware City, Del.

Washington, D. C.—The Washington "Post" states that a site has been purchased for the proposed new building for the French Embassy. Construction to begin next spring.

Jeffersonville, Ind.—Separate bids are wanted Oct. 16 for alterations and additions to the central office building, including plumbing, at Jeffersonville Depot. Address, J. M. Marshall, Asst. Q. M. Gen.

Morris, Minn.—Bids will be received by the Commission of Indian Affairs, Washington, D. C., until Oct. 22 for furnishing material and erecting a brick hospital, with plumbing, electric lights and steam heating apparatus, at the Morris School, Minn. Address Edwin Chalcraft, Supervisor in charge, Morris.

Washington, D. C.—Bids are wanted Oct. 15 for furnishing material and erecting one office building for headquarters U. S. Marine Corps, Washington. Col. F. L. Denny, Q. M., U. S. Marine Corps.

Savannah, Ga.—The following bids for dredging in Savannah Harbor (estimated amount of work, 200,000 cu. yds.), were opened Sept. 16 by Capt. Cassius E. Gillette, Corps Engr., U. S. A.: C. D. Collins, Savannah, Ga., 17½ cts. per cu. yd., $35,000; P. Sanford Ross, Jersey City, N. J., 14 9/10 cts. per cu. yd., $29,800 (awarded).

Washington, D. C.—The following bids were opened Sept. 20 at the Department of Interior for steam and exhaust piping, etc., for the Interior Department Buildings: N. Y. Steam Fitting Co., 137 Elm St., New York City, $4,399; time, 28 days (awarded). W. F. Crane, New York City, $5,438; time, 40 days. E. Rutzler, New York City, $5,700; time, 40 days; Frank Dobson, New York City, $5,800; time, 40 days. W. H. McCuen & Co., Washington, $6,309; time, 40 days. Crook, Horner & Co., Baltimore, Md., $6,370; time, 75 days. S. Faith & Co., Philadelphia, Pa., $6,375; time, 40 days. Gillis & Geoghegan, New York City, $8,100; time, 60 days. Materne Mfg. Co., St. Louis, Mo., $8,448; time, 40 days.

MISCELLANEOUS.

Alexandria, La.—Bids will be received by the Board of Commissioners of the Red River, Atchafalaya and Bayou Boeuf Levee District at the Cotton Exchange Bldg., New Orleans, until Oct. 1, for the enlargement of the Mill Bayou to Glen Mary Levee, Avoyelles Parish. J. R. Thornton, Secy., Alexandria.

Roswell, Ga.—Consulting Engrs. Collier & Brown, of Atlanta write that the contract for constructing an addition to a stone dam at Roswell for the Roswell Mfg. Co., has been awarded to Sullivan Bros. and Lewis White, of Roswell, their bid being $1.42½ per cu. yd. for dry laid stone, $2.20 per cu. yd. for cement masonry, $1 per cu. yd. for preparation of foundation and $145.52 for the timber work.

Salinas, Cal.—It is stated that bids are wanted Oct. 8 for constructing jetty work at the San Lucas bridge; also for repairing and extending a jetty above Solendada bridge. J. D. Kaler, Co. Clk.

Cleveland, O.—It is stated that bids are wanted Oct. 2 for furnishing 8,700 ft. of 2-in. black wrought iron pipe and malleable iron fittings in Brookside Park. Chas. P. Salen, Dir. Pub. Wks.

New York, N. Y.—Bids are wanted Oct. 4 for dredging on the North River, between the Battery and W. 159th St., for building a wooden pier, with appurtenances, at the foot of 5th St., East River, and for furnishing granite stones for bulkhead or river wall, Boro. of Manhattan. J. Sergeant Cram, Dock Commr., Dept. of Docks & Ferries.

Boston, Mass.—Bids are wanted Oct. 1 for building a sea wall and other work at Moon Island, Boston Harbor, Mass. B. T. Wheeler, Supt. of Streets.

Indianapolis, Ind.—Bids are wanted Oct. 7 for building wall and making fill on Westfield Road, North of Broad Ripple. Harry B. Smith, Co. Aud.

Philadelphia, Pa.—Local press reports state that the contract for deepening the Delaware and Schuylkill River channels has been awarded to the American Dredging Co., Philadelphia. For bids received, see The Engineering Record of Sept. 21.

NEW INDUSTRIAL PLANTS.

The D. A. Tompkins Co., Charlotte, N. C., is erecting a 3-story and basement, 40 x 180-ft., shop, in which a number of new machine tools will be installed. The plant will be run by electricity.

W. J. Stierwalt, Fremont, O., will erect a boat factory this fall, having about 10,000 sq. ft. floor surface, and expects later to use about 50 H.-P.

The Terre Haute, Ind., Brewing Co., will install a new plant of 1,920 H.-P.

The Lombard Iron Works & Supply Co., Augusta, Ga., is erecting a 220 x 110-ft. boiler shop to run from its own water-power plant and to be equipped with a 25-ton traveling crane.

The Kentucky Lumber & Veneer Co., Jackson, Ky., expects to erect a 110 x 40-ft. sawmill having a daily capacity of 40,000 to 50,000 ft., and a 57 x 20-ft. engine and boiler house.

Geo. T. Houston & Co., 22d St. and Center Ave., Chicago, Ill., expect to erect a saw and veneer mill at Vicksburg, Miss., and install, in the latter, a power plant to include two 1,000-H.-P. engines, numerous other engines, and a battery of boilers sufficient to furnish steam for the combined plant.

The Woodstock Iron Works, Anniston, Ala., will rebuild their No. 3 furnace at once, bringing its capacity up to 300 tons, to be equipped with automatic skip hoist and every modern improvement. The capacity of the power plant to be used will be about 2,500 H.-P.

The Rettig Brewing Co., Pottsville, Pa., will erect a brick addition to cost about $60,000, and install new machinery.

S. D. Garlington, Garlington, S. C., writes that plans are being prepared for a $25,000 furniture factory.

Benjamin T. Leuzarder, Milwaukee, Wis., is interested in the erection of a plant, for which plans are not fully matured, for the manufacture of mining machinery, including machinery for the equipment of milling plants.

The Monarch Elevator Co., Motley, Minn., will erect a 35,000-bush. elevator to be run by a gasoline engine.

J. M. Johnson, Fristoe, Ky., will be ready, about Nov. 8, to buy an engine of about 30 H.-P. and a boiler of about 40 H.-P. for a flour mill he is erecting at Benton, Ky.

The Grand Rapids, Mich., Refrigerator Co. is erecting a 7-story addition, 100 ft. square, and will purchase a 150 to 200-H.-P. engine.

BUSINESS NOTES.

The York Mfg. Co., York, Pa., reports receiving the following orders: A 30-ton ice plant for the Marietta, Ga., Ice Co.; a 20-ton refrigerating and cold-storage plant for the Medico-Chirurgical Hospital, Philadelphia; a 20-ton refrigerating plant for the asylum and hospital of the Central Poor District of Luzerne County at Retreat, Pa.; a 20-ton addition to the refrigerating plant of the Washington, Pa., Brewery, installed by the company a year ago; a 20-ton ammonia-condensing and brine-cooler system for the Gautier Packing Co., Bristol, Tenn.; a 225-ton refrigerating machine and compression side for the Green Tree Brewery of the St. Louis, Mo.. Brewing Assn., removing the double-acting compressors from two machines at the Klausman Brewery branch and from one machine at the Hyde Park branch and replacing same with single-acting compressors; a 5-ton water-cooling plant for the Arrott Building, Pittsburg; a 25-ton ice plant for the Mt. Vernon, O., Cold-Storage Co., and a 100-ton refrigerating machine and piping for the Central Brewing Co., East St. Louis, Ill.

The John A. Roebling's Sons Co., Trenton, N. J., furnished the 6,400 feet of ⅞-inch plow-steel cables which were used in the 4,427-foot span of the electric transmission line of the Bay Counties Power Co., of San Francisco, across Carquinez Straits, described in The Engineering Record of June 22.

The following firms were represented with exhibits at the convention of the New England Water-Works Association at Portland, Me.: National Meter Co., New York; Hersey Meter Co., Boston; Union Water Meter Co., Worcester, Mass.; Neptune Meter Co., New York; Thomson Meter Co., New York; H. Mueller Mfg. Co., Decatur, Ill.; Lead Lined Iron Pipe Co., Wakefield, Mass.; Garlock Packing Co., Palmyra, N. Y.; Coffin Valve Co., Boston, Mass.; J. B. Campbell Brass Works, Erie, Pa.; A. P. Smith Mfg. Co., Newark, N. J.

The new plant of the Wellston, O., Portland Cement Co. has been started and is making between 400 and 500 bbls. of cement daily.

Stamsen & Blome, cement contractors, Unity Bldg., Chicago, report the following more important contracts awarded them during the last 30 days: Concrete work on the Auditorium Annex Hotel, comprising some 130,000 ft. of concrete floors; concrete work of the Brock & Rankin Bldg.; concrete foundations and floors of the Moxley butterine plant; concrete foundations, floors and sidewalk of the 48-drum Bullen & Co. malthouse, all of Chicago. Also 12,000 ft. of combined curb and gutter for the city of Kewanee, Ill., and the concrete fireproof construction and cement floors of the Western Tube Works plant at the same place; the concrete foundations of a large stockhouse for the Gund Brewing Co., La Crosse, Wis.; 148,000 ft. of cement sidewalks at Birmingham, Ala., and additional contracts for walks at La Porte, Ind., making the total of contracts there 200,000 ft.

U. S. Consul-General Frank M. Mason, at Berlin, Germany, writes that Johann Alexander & Co., 57 Bülow Strasse, Berlin, wish to be put in communication with American manufacturers of electrical machinery and supplies desiring an agent in that city.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Oct. 1.	Burlington, Ia Adv., Eng. Record June 29.	June 29
Oct. 1.	New York, N. Y	Sept. 14
Oct. 3.	Tunnel, Newark, N. J	Sept. 14
Oct. 3.	Cambridge, Wis.	Sept. 28
Oct. 4.	Dam, Centralia, Ill	Sept. 21
Oct. 4.	Meter, Troy, N. Y	Sept. 28
Oct. 4.	Winnipeg, Man Adv., Eng. Record, Sept. 28.	Sept. 28
Oct. 5.	Water Gates, Washington, D. C Adv., Eng. Record, Aug. 3.	Aug. 3
Oct. 5.	Lakewood, O	Sept. 21
Oct. 7.	Salisbury, N. C	Sept. 28
Oct. 9.	Weatherford, Okla Adv., Eng. Record, Sept. 28.	Sept. 28
Nov. 1.	Greenwood, Miss Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
	SEWERAGE AND SEWAGE DISPOSAL.	
Sept. 30.	Rochester, Ind Adv., Eng. Record, Sept. 14.	Sept. 14
Sept. 30.	Westboro, Mass	Sept 28
Sept. 30.	Rankin, Pa	Sept. 28
Oct. 1.	Kankakee, Ill	Sept. 14
Oct. 1.	Columbia, Mo Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 1.	Canyon City, Colo	Aug. 24
Oct. 1.	Leicester, England	Sept. 7
Oct. 1.	Hartford, Conn	Sept. 7
Oct. 1.	Bedford, Ind	Sept. 14
Oct. 1.	Elizabeth, N. J	Sept. 14
Oct. 1.	Kendallville, Ind	Sept. 28
Oct. 1.	Hammond, Ind	Sept. 28
Oct. 2.	Thomaston, Me	Sept. 28
Oct. 2.	Indianapolis, Ind	Sept. 28
Oct. 2.	Davenport, Ia	Sept. 28
Oct. 5.	Washington, D. C Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 5.	Lakewood, O	Sept. 21
Oct. 5.	Monticello, Ind	Sept. 28
Oct. 7.	Anaconda, Montana	Sept. 21
Oct. 7.	Barberton, O	Sept. 21
Oct. 7.	Plainfield, N. J	Sept. 21
Oct. 7.	Wausau, Wis	Sept. 21
Oct. 7.	Knox, Ind	Sept. 28
Oct. 8.	Conneaut, O	Sept 14
Oct. 8.	Cleveland, O	Sept. 14
Oct. 8.	Boston, Mass Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Oct. 8.	Cincinnati, O	Sept. 28
Oct. 9.	New York, N. Y	Sept. 28
Oct. 16.	Logansport, Ind	Sept 14
Oct. 17.	Xenia, O	Sept. 21
Oct. 21.	Santiago, Cuba Adv., Eng. Record, Sept. 14 to 28.	Sept. 14
Oct. 23.	Havana, Cuba Adv., Eng. Record, June 29 to July 20, Sept. 28.	June 29
Nov. 1.	Greenwood, Miss Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
——	Canon City, Colo Adv., Eng. Record, Sept. 28.	Sept. 28
	BRIDGES.	
Sept. 30.	Fredericton, N. B Adv., Eng. Record, Aug. 17 to Sept. 21.	Aug. 17
Sept. 30.	Des Plaines, Ill	Sept. 28
Sept. 30.	Westminster, Md	Sept. 28
Sept. 30.	Victoria, B. C	Sept 28
Sept. 30.	Grand Rapids Minn	Sept. 28
Sept. 30.	Ravenna, O	Sept. 28
Oct. 1.	San Mateo Cal	Sept. 14
Oct. 1.	Morton, Minn	Sept. 14
Oct. 5.	Iron City, Tenn	Sept. 14
Oct. 7.	Roswell, New Mex	Sept. 14
Oct. 7.	Mankato, Kan	Sept. 21
Oct. 7.	Jersey City, N. J	Sept. 28
Oct. 7.	Madison, Ark	Sept. 28
Oct. 7.	Indianapolis, Ind	Sept. 28
Oct. 9.	Vicksburg, Miss	Sept. 14
Oct. 12.	Washington, D C Adv., Eng. Record, Sept 28	Sept. 28
Oct. 14.	Reading, Pa	Sept. 28
Oct. 21.	Victoria, B. C	Sept. 28
Nov. 1.	Milwaukee, Wis	Sept 7
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept. '02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Sept. 30.	Windsor, Conn	Sept. 28
Sept. 30.	Barnesville, O	Sept. 28
Sept. 30.	Southington, Conn	Sept. 28
Sept. 30.	Bay City, Mich	Sept. 28
Sept. 30.	Albany, N. Y	Sept. 28
Oct. 1.	Gallipolis, O	Sept. 14
Oct. 1.	Steubenville, O	Sept. 28
Oct. 2.	Cleveland, O	Sept. 14
Oct. 2.	North Canaan, Conn	Sept. 28
Oct. 2.	Buffalo, N. Y	Sept. 28
Oct. 2.	Weehawken, N. J	Sept. 28
Oct. 3.	Grading, Swissvale, Pa	Sept. 28
Oct. 3.	New York, N. Y	Sept. 28
Oct. 3.	Park work, New York, N. Y	Sept. 28
Oct. 4.	Indianapolis, Ind	Sept. 28
Oct. 7.	Swissvale, Pa	Sept. 28
Oct. 7.	Knox, Ind	Sept. 28
Oct. 7.	New Haven, Conn	Sept. 28
Oct. 12.	St. Marys, O	Sept. 28
Oct. 11.	Sullivan, Ind	Sept. 21
Oct. 14.	Toledo, O	Sept. 14
Oct. 14.	Michigan City, Ind	Sept. 14
Oct. 14.	Barberton, O	Sept. 28
Oct. 16.	Cleveland, O	Sept. 21
Oct. 21.	Cincinnati, O	Sept. 28
Oct. 23.	Havana, Cuba Adv., Eng. Record, June 29 to July 20, Sept. 28.	June 29
Nov. 4.	Roseburg, Ore	Sept. 21
	POWER, GAS AND ELECTRICITY.	
Oct. 1.	Brazil, Ind Adv., Eng. Record, Sept. 14.	Sept. 14
Oct. 1.	Thomaston, Ga	Sept. 21
Oct. 5.	Washington, D. C Adv., Eng. Record, Sept. 28.	Sept. 28
Oct. 5.	Conneaut, O	Sept. 21
Oct. 7.	Atkinson, Ill	Sept. 28
Oct. 7.	Holley, N. Y	Sept. 28
Oct. 8.	London, England	Aug. 31
Oct. 8.	London, England	Sept. 7
Oct. 9.	Weatherford, Okla Ter Adv., Eng. Record, Sept. 28.	Sept. 28
Nov. 1.	Hazelhurst, Miss	Sept. 28
Nov. 1.	Burlington, Ia Adv., Eng. Record, Sept. 28	Sept. 28
Nov. 11.	El. light plant franchise, Yazoo, Miss	Sept. 14
	GOVERNMENT WORK.	
Sept. 30.	Louisville, Ky Adv., Eng. Record, Sept. 7 to 28.	Sept. 7
Sept. 30.	Governor's Island, N. Y. Harbor Adv. Eng. Record, Aug. 31 to Sept. 21.	Aug. 31
Sept. 30.	Ft. Caswell, N. C	Sept. 7
Sept. 30.	Carrollton, Ky Adv., Eng. Record, Sept. 14, 21.	Sept. 14
Oct. 1.	Galveston, Tex Adv., Eng Record, Aug. 10 to Sept. 28.	Aug. 10
Oct. 1.	Ft. H G. Wright, N. Y	Sept. 21
Oct. 1.	Norfolk, Va	Sept. 21
Oct. 1.	Annapolis, Md	Sept. 21
Oct. 2.	Gas and elec. fixtures, Portland, Ore	Aug. 24
Oct. 3.	Creston, Ia Adv., Eng. Record, Sept. 7, 14.	Sept. 7
Oct. 3.	St. Louis, Mo	Sept. 28
Oct. 4.	Omaha, Neb Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Oct. 7.	Chilocco, Okla. Ter	Sept. 21
Oct. 8.	Keshena, Wis	Sept. 21
Oct. 9.	Ft. D. A. Russell, Wyo	Sept. 14
Oct. 10.	Elmira, N. Y Adv. Eng. Record, Sept. 14, 21.	Sept. 14
Oct. 12.	New York, N Y	Aug. 31
Oct. 12.	Building, New York, N. Y	Sept. 21
Oct. 14.	Philadelphia, Pa	Sept. 21
Oct. 15.	Ft. Du Pont, Del	Sept. 28
Oct. 15.	Building, Washington, D. C	Sept. 28
Oct. 16.	Electric elevator, Washington, D. C Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Oct. 16.	Bldg. additions, etc., Jeffersonville, Ind	Sept. 28
Oct. 21.	Stockton, Cal Adv., Eng. Record, Sept. 14, 21.	Sept. 14
Oct. 21.	Santiago, Cuba Adv., Eng. Record, Sept. 14 to 28.	Sept. 14
Oct. 22.	Stockton, Cal Adv., Eng. Record, Sept. 21, 28.	Sept. 21
Oct. 22.	Hospital, Morris, Minn	Sept. 28
Oct. 26.	Coaling plant, Washington, D. C	Sept. 21
Oct. 28.	West Point, N. Y Adv., Eng. Record, Sept. 28.	Sept. 28
Nov. 7.	New York, N. Y Adv., Eng Record, Sept. 28.	Sept. 28
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
	BUILDINGS.	
Sept. 30.	Municipal bldg. plans, Jacksonville, Fla	Sept. 7
Sept. 30.	School plans, Boise, Idaho	Sept. 21
Sept. 30.	Htg., etc., in hospital, Boston, Mass	Sept. 28
Sept. 30.	Hose house, Syracuse, N. Y	Sept. 28
Sept. 30.	Fire house, Atlantic City, N. J	Sept. 28
Sept. 30.	Pub. bldg., Middletown, N. Y	Sept. 28
Oct 1.	Bank plans, San Antonio, Tex	Aug. 24
Oct. 1.	Htg. quarantine station, St. John, N. B.	Sept. 28
Oct. 1.	Htg. pub. bldg., Hochelaga, Que	Sept. 28
Oct. 1.	Htg. pub. bldg., Paris, Ont	Sept. 28
Oct. 2.	Fixtures, etc., in pub. bldg., Indianapolis, Ind	Sept. 28
Oct. 2.	Hospital, Huntington, W. Va	Aug. 31
Oct. 3.	R. R. station, Ft. Washington, Pa	Sept. 28
Oct. 4.	Hospital bldgs., Farmington, Mo	Sept. 28
Oct. 4.	Police headquarters, Jacksonville, Fla.	Sept. 21
Oct. 5.	School, Webster City, Ia	Sept. 28
Oct. 5.	Jail, McRae, Ga	Sept. 28
Oct. 5	Jail addition, Deadwood, S. D	Sept 28
Oct. 7.	Town hall, Yondota, O	Sept. 28
Oct. 7.	Court house, Hazlehurst, Miss	Sept. 28
Oct. 7.	Boiler house, etc., Little Rock, Ark	Sept. 28
Oct. 7.	School, Berlin, Wis	Sept. 28
Oct. 7.	Htg. court house, Martinsville, Ind	Sept. 14
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Oct. 7.	Plumbing, etc, in City Hall, Connellsville, Pa	Sept 28
Oct. 8.	House of refuge, Whitby, Ont	Sept. 28
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Oct. 10.	Jail, Pipestone, Minn	Sept. 28
Oct. 10.	School, Xenia, O	Sept. 28
Oct. 10.	Jail, Marysville, Kan	Sept. 28
Oct. 15.	Court house, Bainbridge, Ga	Sept. 14
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——	Church, Braddock, Pa	Sept. 28
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Legal Regulation of Engineering Practice.

At the recent annual convention of the American Society of Civil Engineers, at Niagara Falls, there was a discussion of the advisability of requiring civil engineers to give evidences of satisfactory ability before admitting them to the practice of the profession. The discussion, although far from being the introduction of this subject to the attention of engineers, deserves mention; it was reviewed in The Engineering Record of June 29 and has been printed in full in the Society's "Proceedings" for August. Engineering bodies and prominent members of the profession have debated the subject from time to time for a considerable number of years. At the recent International Engineering Congress at Glasgow, President Mansergh, of the Institution of Civil Engineers, referred to "the stubborn refusal of the English spirit to admit the necessity of any formal qualifications on the part of those who claim to be of the profession." It is obviously a topic of sufficient weight to engage the serious attention of professional men fitted to judge of the needs of the proposed legal qualifications for practice.

Undoubtedly there are men calling themselves civil engineers, and undertaking to do what only well-qualified engineers should attempt, who possess neither the preparation of experience nor of educational training requisite to perform professional service. At the present time there is in this country absolutely nothing whatever in the way of charlatans of this character attempting to do business under the name of engineers. Nor is engineering peculiar among the professions in this respect, except that in the others there are certain protective formalities, some legal, and some not. The question, then, in one of its aspects amounts to this; shall the profession of civil engineering strive to enforce for its members certain general protective formalities, like the professions of law and medicine? At the convention of the American Society of Civil Engineers both sides of the question found active advocates.

Probably every member of the profession would welcome every legal safeguard of a rational character that can be thrown about his professional practice, and yet there has always been great diversity of opinion as to methods of accomplishing that end. One member of the Society proposed at the Niagara Falls convention to establish in each State of the Union a State Board of Examiners, composed of civil engineers, who should be charged with the duties of examining applicants, and should possess authority to issue licenses after satisfactory examinations. This board of examiners would be constituted to perform its functions under an accurate definition of the term "Civil Engineering," so that it might exercise its powers to cover only that professional practice. In accordance with this proposition there would be three classes of licenses, one for the younger members of the profession, including recent graduates of professional schools, one for those eminent in their profession in consequence of special skill and marked attainments, and one for all between those limits. In addition to these provisions there would naturally be penalties for violation of the statutes pertaining to the execution of this system, and the board would be given power to revoke licenses for adequate cause. These provisions are obviously sufficient to make a perfectly clean-cut and well-defined system of procedure, although it is altogether probable that there would be found many practitioners whom it would be difficult to classify in respect to the proposed licenses. Nor is it quite clear just how such a system would actually operate, or what its actual value would be to the public at large. A man able to tell whether he needs an engineer of the first, second or third class is surely able to secure good professional advice even when there is no system of engineering licenses in force. A man unable to tell whether he needs an engineer of the first, second or third class is just as bad off as before. The application of the system would be simple enough in a case of the first class of licenses, as they would be issued to those about to begin their professional work; but it is different with the other two classes. By the nature of the proposed provisions, the applicants could only receive their licenses after having performed professional work of a character, in one case, to make them eminent in their profession, and yet, by the fundamental principle of this system, they would be in effect disqualified from such practice until their licenses were received. Or it might be the purpose of the provision that the second and third classes of licenses should be issued in addition to the first. If the latter interpretation of the provision is correct, there would be grave danger of committing error and producing bad feeling under the issue particularly of the third class of licenses. Besides, as one member of the Society argued at the convention, it might be necessary under such a view to impose successive examinations to determine, for the benefit of the public, just what professional service the various members of the profession would be qualified to render.

Other members of the Society seemed to be of the opinion that no regulation whatever is advisable, although their specific objections were directed against the proposed system of determining professional qualifications. Apparently they were of opinion that any parties, either individuals or corporations, who might need the service of engineers, would naturally possess sufficient power of discrimination to determine by personal conference whether any particular engineer might be qualified for the desired service. Such an observation, however, involves the very point at issue, viz., that parties seeking a professional adviser hazard too much in basing their selection on their own judgment only, and consequently they would receive valuable aid if all engineers worthy to practice were, as a class, differentiated from others by legal or other suitable regulations.

The Engineering Record does not presume at this time to attempt to discuss thoroughly that specific question, but it would appear that the propositions made at the Niagara Falls convention are too complicated. The qualifying formalities imposed on members of other professions are quite simple, one application only being made, and that under circumstances usually belonging to the early years of practical life. The successful submission to those formalities indicates only the possession of a certain general preparation for the beginning of practice, which has no definite relation to ripe professional skill and experience. If the profession of civil engineering is to be similarly regulated, it must doubtless be done by correspondingly simple and suitable means; more than that will probably be found not only impracticable of accomplishment, but wholly unnecessary for the purpose.

The New Plant of the Alpha Portland Cement Company at Alpha, N. J.

The Alpha Portland Cement Company was one of the earlier plants in the now well-known Lehigh Valley region. It was established in 1882-1883 by Mr. Thos. D. Whitaker and friends under the name of the Whitaker Cement Company, and in 1895 the Alpha Portland Cement Company was formed to take over the property. The plant grew with the progress of the industry in this region, until it reached an output of 2,000 barrels per day, when it was resolved to add an entirely new and independent mill of like capacity adjoining the old one. The new mill, known as No. 2, is the subject of this article.

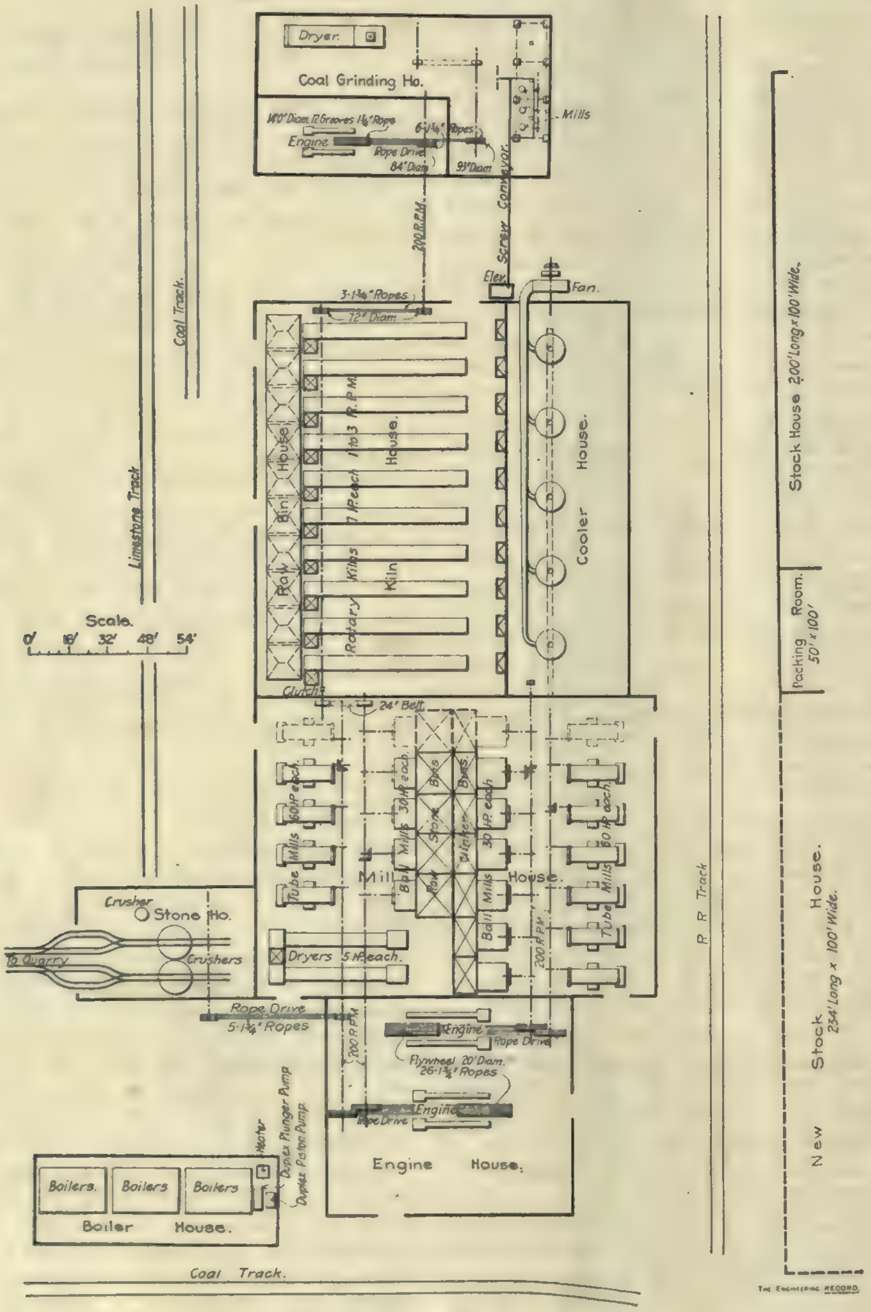
The plant is located at Alpha, about five miles from Easton, on the main line of the Lehigh Valley Railroad. The company owns about 200 acres of land, most of which is underlaid with the cement rock, which lies within a few feet of the surface and extends to an unknown depth. Borings have been made for some 200 feet, without showing any change in the character of the deposit. The analyses of this rock and of the finished product average as follows:

	Rock.	Cement.
Silica	12.90	20.68
Oxide of iron and alumina	8.70	10.60
Carbonate of lime	72.70	63.63
Carbonate of magnesia	2.79	2.86

The small amount of stripping necessary to expose the cement rock is done by parties who lease the privilege, using the clay for making brick in a brickyard adjoining the cement works. The water supply is pumped from the Delaware River, about 1½ miles away, to a cement-lined storage reservoir of 2,000,000 gallons capacity on the company's property, about 300 yards distant from the mill and on a slight elevation. This method of supply is not considered economical enough to justify the use of condensers with the engines without the aid of artificial cooling, the installation of such apparatus being contemplated for the power plant of the new mill. This scarcity of water, together with the accessibility of a certain amount of water power on the Delaware River, has led the management to partly replace the scattered and somewhat out of date steam engines in the Number 1 plant with alternating current motors, the current being transmitted some 2½ miles under high tension from the plant of the Lehigh Power Company at Raubsville. The ultimate intention is to run the Number 1 mill entirely by electricity, thus affording ample water for the steam plant of the Number 2 mill, which, with the installation of condensing and cooling apparatus, will be of the most modern type.

The ground plan of the Number 2 mill is shown in the accompanying drawing. The buildings consist of a main mill 120 x 163 feet, containing all the ball and tube mills for both the raw and the finished material. Abutting this on one side are the raw material bin room, the kiln room and the cooler room, 28 feet, 73 feet and 50 feet wide respectively, and all 160 feet long. On the other side of the mill house and separated from it by a brick wall, unbroken except for the shafting holes, is the engine room, 67 x 100 feet, and a detached boiler room 34 x 96 feet. The stone house, 72 x 45 feet, forms an ell on one corner of the mill house, and beyond the kiln room is a detached coal house 120 x 70 feet, containing also the engine driving the coal grinding machinery and the rotary kilns. Parallel to the mill house and cooler building is a storage warehouse 484 x 100 feet, half of which is now complete, the rest being under construction. All of these buildings have steel frames covered with galvanized iron, except the engine room and stock room, which are of brick and concrete, and the stone house, which is frame. On both sides of the stock house there are shipping tracks, and there are two tracks elevated on trestles on the other side of the main mill, one serving to bring the limestone, and the other the coal for the rotary kilns. There is also a trestle over which coal is supplied to the boiler house.

General View of the New Alpha Cement Works.

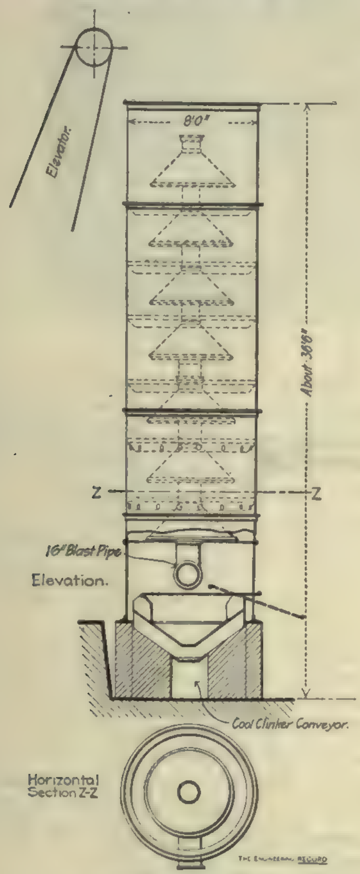


General Plan of the New Works.

The quarry, which is cut into the hillside, has been excavated deep enough to expose a face nearly 100 feet high, supplies stone to both mills, each one using from 500 to 600 tons per day. The drilling is done by compressed air, supplied by a 100 horse-power Ingersoll-Sergent compressor of the straight-line type, the drills being of the same make. The stone is loaded into self-dumping cars by a Vulcan Iron Works steam shovel, the capacity of the bucket being 1¼ cubic yards. The loaded cars are hauled up a slope by a wire rope leading to the drums of a Flory hoisting engine, to the stone house, where the rope is automatically detached and the car runs onto one of two weighing scales, above which are hoppers containing the ground limestone. The requisite proportion, about 10 or 12 per cent., is added, and the car is dumped into the hopper of one of the two Number 6 Gates crushers just beyond. The limestone, which is brought in by rail, is crushed in a Number 3 Gates crusher at one side of the stone house, and elevated to the charging hoppers before mentioned. The crushed materials are delivered to a small hopper feeding the dryers. There are two of these, of the cylinder type, built by the Bethlehem Foundry and Machine Company, set in a pit about 4 feet below the floor of the raw material mill, and fired with coal at the discharge end. From these the stone passes to four large storage hoppers, holding altogether 48 hours' supply, and so placed as to discharge by an automatic feed device into four Krupp ball mills. From these the stone is taken to small hoppers over the tube mills, of which there are four, made by Thos. E. Prosser & Sons, under the Krupp patents. As will be seen on the ground plan, there is room for another ball and tube mill on both the raw material and finishing sides. From the tube mills the pulverized stone is conveyed to the hoppers feeding the rotary kilns. These hold pulverized stone for 36 hours, the object in providing this ample storage capacity here and in the raw stone mill being to enable the quarry and dryers to work in the daytime only, without piling up raw stone in the stone house in order to supply the rotary kilns, which are operated continuously. There are 10 of these, 60 feet in length and 5½ and 6½ feet in diameter at the entrance and discharge ends respectively. The stone is fed to them by a screw working in a cast-iron jacket, and their speed of rotation is controlled by a regulating device, as shown in the illustration. The essential characteristic of this device is a pair of concave-faced pulleys of variable diameter, driven by a built-up leather belt. Each pulley consists of two skeleton frames of iron, in the form of a truncated cone, the ribs of which correspond to elements of the cone, secured on a shaft so that the ribs interlock, the exposed portions of their curved surfaces forming a concave-faced pulley, whose diameter increases or diminishes as the two cones approach each other or recede. The power for driving the kilns is transmitted through these pulleys, and the speed of the feed screw is subject to the same regulation. The kilns are fired with powdered bituminous coal, the apparatus being of the Alpha Company's own device.

The clinker from the kilns is discharged into an elevator boot and elevated to the top of the clinker coolers, which are five in number, one serving for each two kilns. They consist of a cylindrical steel shell 8 feet in diameter and 34 feet high, having an internal blast pipe extending up the center and baffle plates which cause the hot clinker entering at the top to follow a zig-zag course on its way down, it being meanwhile exposed to the cooling action of the air blast from a number of holes in the central blast pipe, the heated air escaping from the cylinder through a row of holes in the outer shell corresponding to each baffle plate. The air is supplied by a 110-inch Sturtevant blower placed just outside the cooler building, from which a supply pipe is taken, having a branch to the bottom of each cooler. The kilns, regulating device and clinker coolers were supplied by W. F. Mosser & Son, of Allentown, Pa. After passing through a Clarke automatic weighing scale where the requisite amount of gypsum is added, the clinker is delivered to storage hoppers over the ball mills. These are 6 in number, one for each ball mill, and have a capacity for 36 hours' supply. The finishing is done in the tube mills, and from these it is conveyed to the stock house.

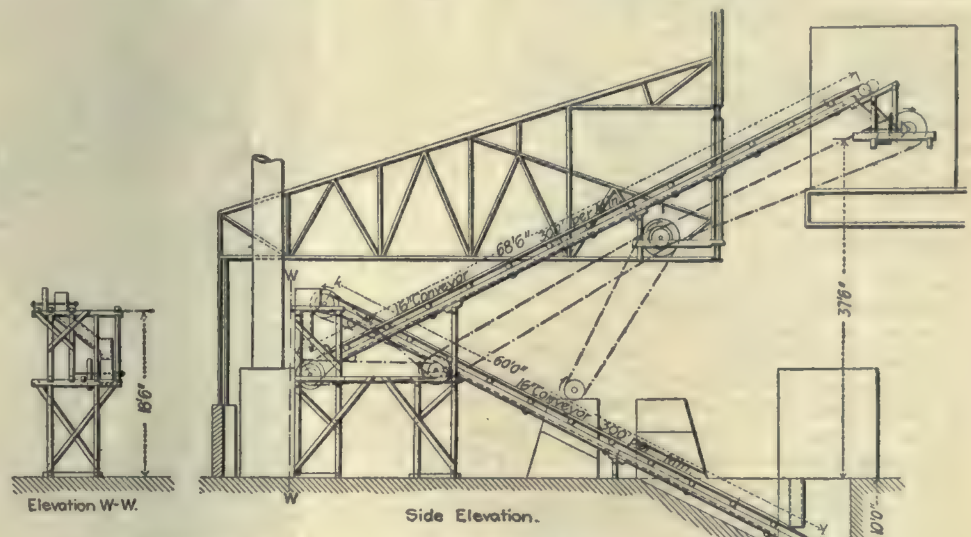
Speed Regulating Device.



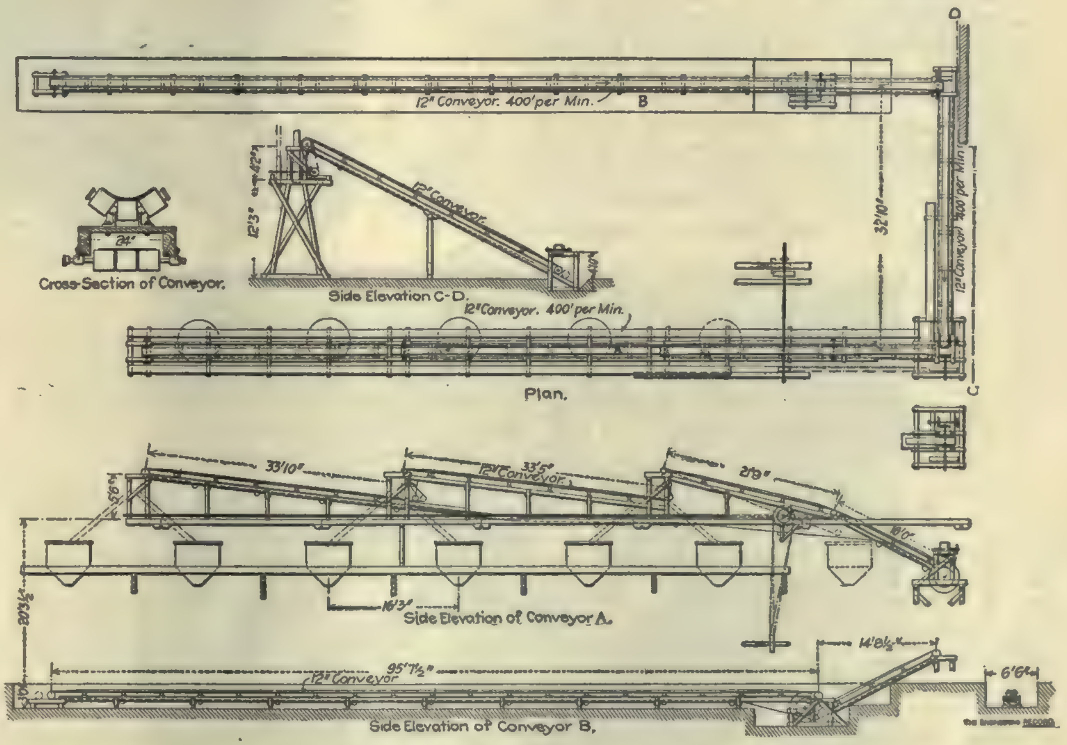
Clinker Cooler.

The coal house is calculated to grind 150 tons of coal per day. The coal is passed through a Cummer dryer, having a cylinder 44 inches in diameter and 28 feet long. It is then reduced by three 30-inch Griffin mills. To drive the above there is a 300-horse-power Fitchburg cross-compound engine, having cylinders 14 and 26 inches in diameter by 36 inches stroke, making 90 turns per minute, supplied with steam from the main boiler house. This engine also serves to drive the rotary kilns, in case the main engine is shut down.

One of the principal features of interest in the plant is the unusual degree in which belt conveyors are employed, not only to convey the material horizontally, but also to elevate it as well. This type of conveyor was selected for the reason that it was believed to require much less power than the usual screw conveyor and bucket elevator, and what is of more importance in a plant of this kind, to be less subject to break downs. All the belt conveyors were supplied by the Robins Conveying Belt Company, 21 Park Row, New York. The crushed raw materials are deposited upon a 16-inch belt, inclined at an angle of about 27 degrees from the horizontal, which elevates them to a hopper over the dryers. The discharge from both dryers is elevated successively by two 16-inch belt conveyors, one doubling back upon the other, with a third 16-inch belt running horizontally to hoppers over the ball mills. The two elevating belts are inclined at an angle of 25 degrees, the upper end of the first elevating belt discharging upon the lower end of the second. The elevation of these belts is shown in one of the figures. The four bins over the ball mills are about 16 feet square in horizontal cross section and about 18 feet deep. To fill them uniformly an automatic tripper moving back and forth along the line of the belt conveyor is used. A screw conveyor passing under the ball mills carries their discharge to a bucket elevator from which a screw conveyor distributes it to the tube mill hoppers. A single belt conveyor elevates the discharge from the tube mills to a point over the kilns, where it is fed to a screw conveyor delivering it to the ground raw material stock bins. These are 13 by 15 feet in plan and 20 feet deep.



Belt Conveyors from Dryer to Bin over Ball Mills.


D
12" Conveyor. 400' per Min.
B
32'10"
12" Conveyor 400' per Min.
4'2"
12'3"
12" Conveyor
24"
Cross-Section of Conveyor.
Side Elevation C-D.
12" Conveyor. 400' per Min.
Plan.
C
33'10"
33'5"
12" Conveyor
21'9"
9'8"
16'0"
16'3"
Side Elevation of Conveyor A.
20'3½"
95'7½"
12" Conveyor
14'8½"
6'6"
Side Elevation of Conveyor B.
The Engineering Record.

Belt Conveyors between Ball and Tube Mills.

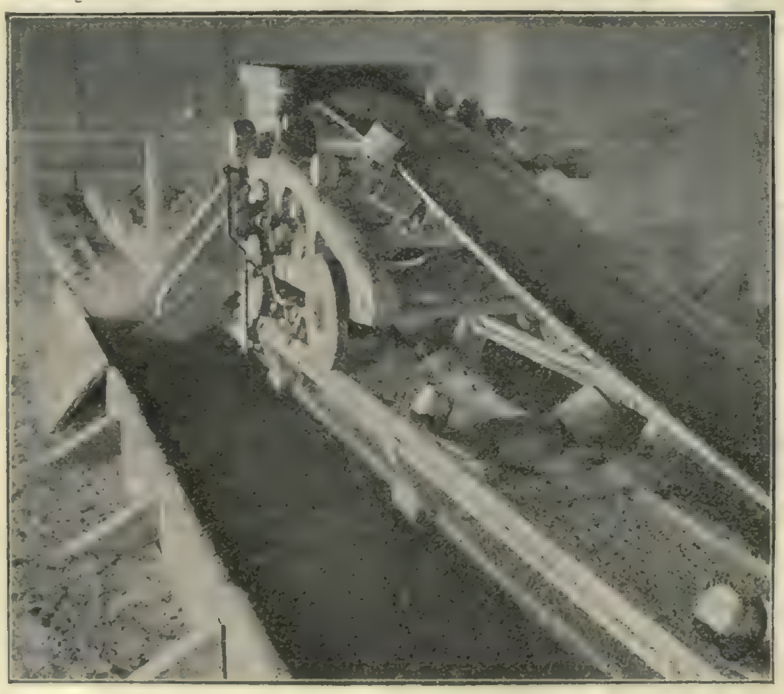
The clinker from each pair of kilns is elevated to a cooler by a bucket elevator. From the cooler the clinker falls upon a belt conveyor located beneath them and delivering the clinker to an automatic weighing scale. From the scale a 16-inch belt inclined at 18 degrees, running 300 feet per minute and located next to the wall of the cooler room, elevates the clinker to a bin, where it is chuted through a hole in the wall to a second belt conveyor elevating it still more to a horizontal belt delivering it finally to clinker bins over the ball mills by means of an automatic tripper.

The arrangement of belts to carry the product from the ball mills to the tube mills is one of the most interesting applications of this type of conveyor; it is shown in one of the figures. Three 12-inch belts are used, the middle one elevating the material. There are six tube mill hoppers arranged in pairs, so that each pair can be served by one of three fixed trippers. The change in the direction of the carrying belt, in the shape of the letter S, made by running it around two fixed pulleys, causes the material to be chuted into a hopper from which spouts lead to closed stock bins. When the bin, spout and the hopper become filled, the material falls upon the belt again and passes on to the next tripper. Slides in the spout are provided to prevent material from passing into any bin when desired. The screw conveyor taking the discharge from the tube mills deposits it upon the belt conveyor running in a tunnel under the railroad track between the stock house and the mill building, elevating the material to the stock house, where it is delivered to a second belt distributing it over the floor of the stock house. This latter conveyor runs through the roof truss. The cement is stored in bulk upon the floor of the stock house. Three screw conveyors set in the floor and running lengthwise of the building discharge into a cross conveyor leading to a bucket elevator supplying a screw conveyor which distributes the seasoned product to overhead bins for barrel and bag packers.

Coal is handled by various types of conveyors. It is dumped in a pile outside of the coal mill. Along the wall of this mill, in a trench constructed for the purpose, is a belt conveyor, so arranged that the coal can be shovelled directly upon it. This delivers coal to a second belt 16 inches wide, carrying it to the dryer, from which a third belt elevates it to a screw conveyor delivering the dried coal to a stock bin over the Griffin mills. From these a screw conveyor elevates it to bucket elevators from which a second screw conveyor elevates it to the kilns.

The steam is supplied by six 250-horse-power Stirling boilers, set two in a battery, generating steam at 150 pounds pressure. Each boiler has a separate guyed steel stack about 36 inches in diameter by 85 feet high, and they burn pea coal delivered on the railroad trestle adjoining the boiler house. The feed pumps, which are of the Wilson-Snyder pattern, and a 2,000-horse-power Webster open heater, are placed in the end of the building.

Coal Conveyor Alongside the Coal House.



Tripper on Coal Conveyor.

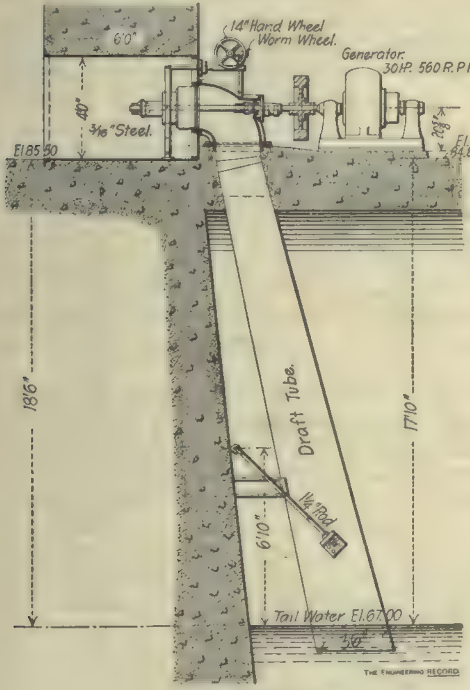
There are two main engines of 800 horse-power apiece, of the cross-compound type, built by the Fitchburg Steam Engine Company. They have cylinders 22 and 38 inches in diameter and 48 inches stroke, and make 90 revolutions per minute. They are placed facing in opposite directions, and each one has a rope wheel 20 feet in diameter grooved for 26 1¾-inch ropes, which drive rope wheels on four main-line shafts, two for each engine, the speed of these shafts being 200 turns per minute. As may be seen by reference to the plan, these four lines of shafting run from the engine room across the main mill building between the ball and tube mills of the raw material side and those of the finishing side. Each one of the mills is driven from a bevel gear mounted on a quill on the main shaft, and is provided with a friction cut-off coupling, so that each mill is independent of all the others. The dryers are driven from the ball mill shaft on the raw material side, and the end of this shaft also supplies power to drive the rotary kilns. The conveyors between the mills are driven from the shafting on the same side of the mill, so that they can take care of the material as long as the mill can run. The machinery in the stone house is driven by a rope drive of five 1¾-inch ropes from the raw material mill shafting. There is also a drive of one 1¾-inch rope from the finishing mill to the distributing conveyor in the stock-house. The screw conveyors which bring the aged cement to the packing machines are driven by an 8 x 9-inch Westinghouse Junior engine. The shafting, clutches and rope drives were furnished by the Hill Clutch Company. The system of chemical control on the raw material side consists of an analysis of the average of the drillings for each blast made in the quarry, and one of the ground stone on its way to the kilns, taken five times per day. On the finished side the product is tested for fineness and setting once every two hours, and an average sample of each 24 hours' run is subjected to complete chemical and physical tests. One a month samples are laid aside for a 10-years' test.

The officials of the Alpha Portland Cement Company, to whom the Engineering Record is indebted for the data contained in this article, are Mr. W. M. McKelvey, president; Mr. A. F. Gersteel, vice-president and general manager; Mr. G. S. Brown, secretary and treasurer; Mr. H. Heitzel, superintendent; Mr. O. C. Brooks, assistant superintendent, and Mr. Harry Drew, chemist.

Steam Heat and Electricity are transmitted in Dresden to some twenty Government buildings, the castle, cathedral, etc., through tunnels which have an elaborate equipment of apparatus. Wires are mostly bare, on one side of the tunnel behind wire netting, but where necessary armored lead cables have been used. Thermostats have been provided to give warning by means of a telephone connection when the temperature rises too high in the tunnel. It is stated that so far a temperature of 75 degrees Fahrenheit has never been exceeded. Electric indicators for the water and steam pressure and floats which mark electrically the level of the condensed water in the return pipes from the heated buildings are also used.

The Plant of the Lehigh Power Company at Raubsville, Pa.

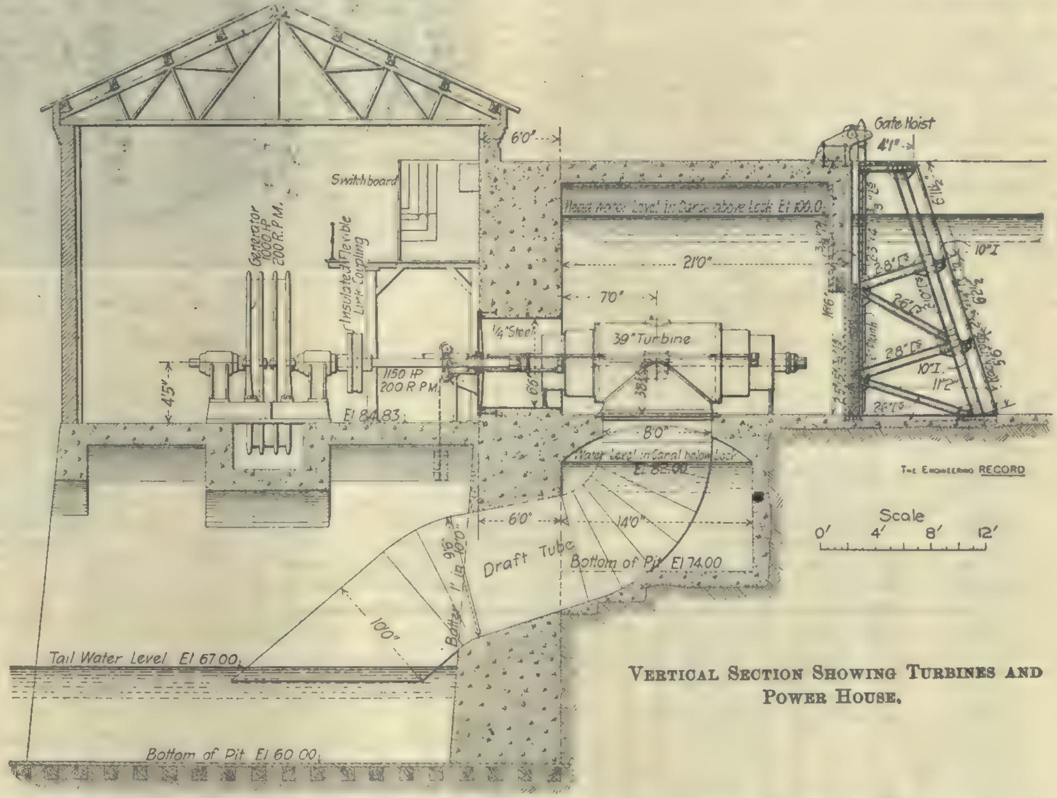
The plant of the Lehigh Power Company, of which Mr. Geo. A. Griffith of New York is president, is located at Raubsville, Pa., on the western bank of the Delaware River, about six miles south of Easton. It was designed by the present general manager of the company, Mr. L. I. Fletcher, of Easton, to supply alternating current for lighting and power distribution in and around that place, but its whole output is now contracted for by the Alpha Portland Cement Company for use in their works some 3½ miles away. The principal source of power is the water of the Delaware division canal of the Lehigh Coal & Navigation Company, which runs parallel to the river at this point and has a lock but a few yards west of the power house. There is also an auxiliary steam plant in course of erection. The fall at the lock is about 18 feet, the lower level being fed from the upper, which in turn is fed from the Lehigh River at a point farther up stream. As is shown in the accompanying plan the head race draws from the upper level and the tail race discharges to the lower level, so that the water needed in the latter can be passed through a turbine, giving an effective head of 18 feet. The surplus water is passed through another turbine, the tail race of which communicates with the Delaware River, the effective head being 33 feet. The limit to the power supply is, of course, the rate of flow in the upper level of the canal that can be maintained without interfering with navigation, which in this case is about 2 miles per hour. The power is further limited by the necessity of supplying the lower level through the 18-foot fall, before the 33-foot fall can be used, but the plant nevertheless develops 1,500 horse-power for eight months of the year, and about 1,000 for the remainder, from the water power alone. The steam auxiliary, which was added after it was found that the demand for power exceeded that which could be derived from the water power, is of 600 horse-power capacity.



Exciter Turbine.

The power house itself is a brick building 68 feet long and 33 feet wide, having a steel-trussed roof covered with galvanized iron, 22½ feet high to the eaves. It stands directly on the river bank and has foundations of arched concrete.

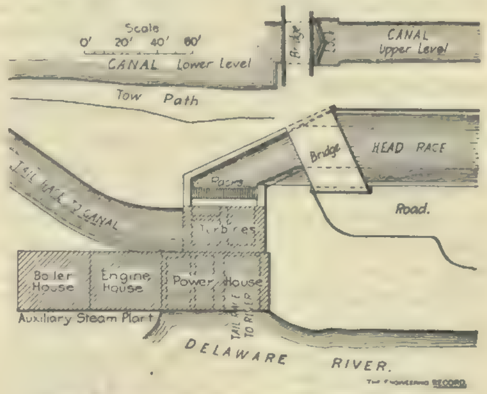
The head race is taken out from the canal about 250 feet above the station and is lined with concrete; the water passes through an inclined rack of iron rods to the head gates, which are of the ordinary vertical lift pattern, worked by a rack and pinion. There are two turbine chambers, having massive concrete walls, in the first of which is placed a pair of 39-inch horizontal McCormick turbines, made by the S. Morgan Smith Company; these work under the 33-foot head, the tail race passing underneath the power house to the river. In the second turbine chamber is a pair of 42-inch turbines of the same make, for the 18-foot head, the tail race from which passes parallel to the power house to the lower level of the canal. These turbines are direct connected to Stanley three-phase alternators, built on the S. K. C. system, supplying current of 12,000 volts at 7,200 alternations per minute. The generator operating under the low head is of 375 kilowatts capacity at 120 revolutions, and that on the high head is of 750 kilowatts capacity at 200 revolutions, each being controlled by a Lombard governor. A vertical section through the 750-kilowatt unit is shown in the illustration. The two generators are placed side by side on the floor of the power house, the gallery for the switchboards projecting from the west wall of the building above the shafts connecting the turbines and generators. Each of these shafts is divided, and in it there is an insulating coupling which consists of a pair of flanges about 38 inches in diameter, keyed to the ends of the shaft and set about four inches apart from each other. Into the space between the flange faces project steel pins, alternately attached to either flange, and connecting each pair of these pins are links of hydraulically compressed leather, which serve to transmit the motion of the shaft, at the same time entirely insulating the turbines from the generators. This coupling also allows a certain amount of deflection in the shaft, without causing trouble in the bearings.



Vertical Section Showing Turbines and Power House.

The exciting current for the generators is furnished by two 20-kilowatt Northern Electric generators direct-connected to two auxiliary turbines 12 inches in diameter. These are placed side by side between the two main generators, and both are acted upon by the 33-foot head, their draft tubes leading to the river tail race underneath the building. The turbines are rated at 30 horse-power, making 560 turns per minute, and a cross-section of one, showing the method of supporting the draft tube, is given in the illustration.

The switchboard is placed in the gallery along the west side of the building, about 12 feet above the floor. The connections are so made that each machine can be run separately, or they can be run in parallel, there being two sets of bus bars. There are 13 panels in all, of which three are for each machine and six for the feeder circuits, the remaining panel serving for the exciters. The main switches, with which the machine and feeder panels are provided, are of the plug pattern, there being two sockets on each board, side by side, one for each set of bus bars. Of the machine panels, one has two ammeters, one a volt meter and rheostat, and one an ammeter field switch and pilot lamp, there being the same for each machine. There are four of the feeder panels in use, these being provided with static ground detectors and ammeters.



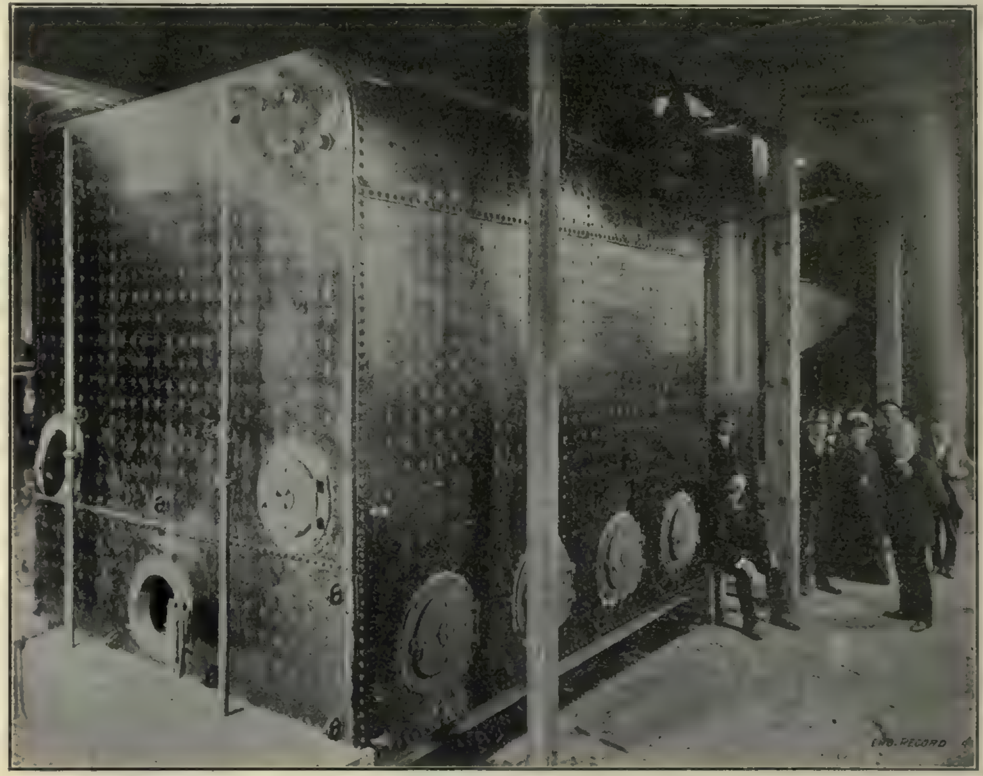
Plan Showing Canal and Power House.

The auxiliary steam plant will be installed in an extension of the present power house 80 feet in length, and of similar construction. There will be three 150-horse-power return tubular boilers, made by the Phoenix Iron Works, of Meadville, Pa., built to stand 150 pounds pressure, although only 115 will usually be carried. Boilers of the return tubular type were selected, because they were thought to give better service on the local water, which is hard. Draft is supplied by a guyed steel plate stack 66 inches in diameter and 80 feet high. The engine will be of 600 indicated horse-power, of the Dick & Church type, and will be horizontal cross-compound. It will be provided with a Dean horizontal jet condenser, and will be belted direct to a 400-kilowatt Stanley alternator of the same voltage as the others. The necessary switchboard connections will be placed on panels added to the present board.

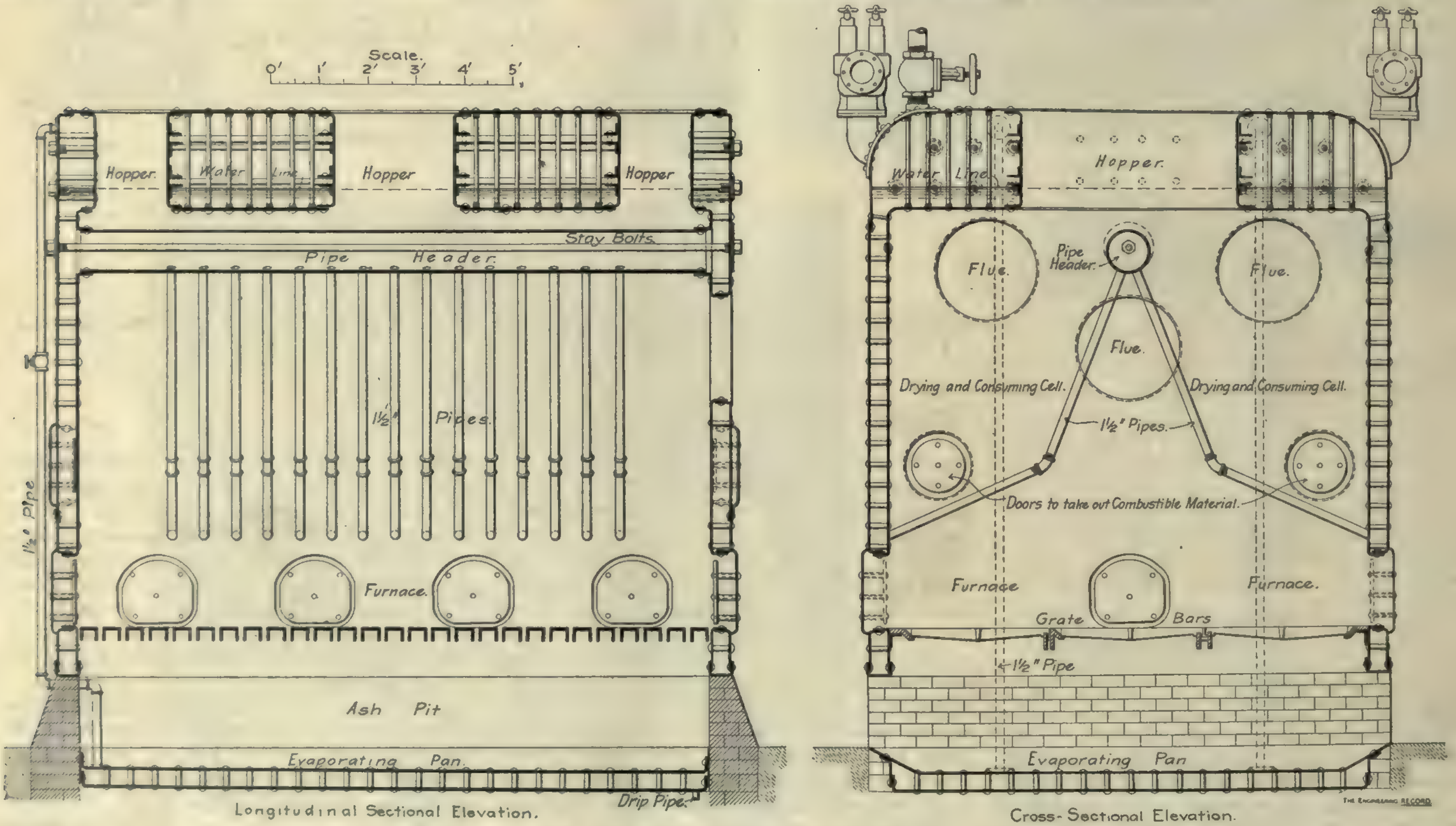
The Decarie Garbage Crematory at Minneapolis.

About eight years ago Mr. F. L. Decarie, then connected with the engineering department of the Montreal water-works, built a small garbage crematory for the Gregory farm near that city. It was a box-like affair about 5 feet on a side, but it was able to burn a ton of garbage an hour and furnish steam for the electric generating set which lighted the property. Later he built a crematory of much larger size in one of the suburbs of the city. It is 9 x 10 feet in plan and 11 feet high, and for six months was used to incinerate the garbage of Westmount, which it did succesfully, no coal being required in the process. At the expiration of this short run, the council of the town learned that no law prevented dumping the refuse outside the town boundaries, and as it was cheaper to haul it to a neighboring village than to pay for its cremation, Cote St. Paul has been made the garbage dump for Westmount.

Some months ago the authorities of Minneapolis decided to cremate the garbage of that city, and after an investigation of various systems adopted that of Mr. Decarie, who furnished plans and specifications for the plant, which was built by Mr. William Bros, of Minneapolis, under the general direction of the Board of Health. As it is the first crematory of the kind in the United States, the following notes concerning its arrangement are given here.



ONE OF THE DECARIE INCINERATORS AT MINNEAPOLIS.



Longitudinal Sectional Elevation.

Cross-Sectional Elevation.

SECTIONS OF ONE OF THE DECARIE GARBAGE FURNACES AT MINNEAPOLIS, MINN.

There are two cells, each rated at 50 tons of mixed garbage in 24 hours. Each cell is a water-tube boiler arranged as shown in the illustrations, the garbage remaining on the tubes until it is sufficiently dried to fall down to the grates. The liquids which are not converted into steam drip into a pan at the bottom of the cell and are there evaporated by steam admitted to the hollow space of the pan through two pipes, shown in the outline drawings and in the exterior view.

Each cell is 14 feet 1 inch long, 10 feet 11 inches wide and 11 feet 10 inches high. It has four doors on each side, each measuring 20 x 18 inches. These enable the men to rake the fires on the lower grate and also to reach the garbage on the water tubes with long rods inserted through the doors on the opposite side to that where the refuse needs stirring. At each end there is a 20 x 18-inch door at the lower grate level, and two 17-inch round doors placed high enough to allow the garbage on the tubes to be well stirred. The back end also has three large flue openings into the uptake to the stack.

The garbage is dumped into the cell through three hoppers, that in the center being 54 x 30 inches and those at the sides 54 x 18 inches. A quarter-inch steel shell runs from these holes to the dumping floor above, where the garbage is stored before it is fed into the furnaces. The building housing the plant is a wooden structure and the dumping platform is merely a board floor, although Mr. Decarie wisely advised a masonry platform.

The outside plating is flange steel 11/32 inch thick on the sides and top and ⅜ inch on the ends; the inside plating is everywhere 11/32-inch marine firebox steel. The header is a heavy lapwelded pipe 10 inches in diameter, from which 31 pipes 1½ inches in diameter run downward to the sides as shown, the bend being made by a 45-degree elbow. The pipes running to one side enter the header at points midway between those to the other side. In other respects, the furnaces conform in materials and workmanship to marine boiler practice. Each cell has two pairs of 4-inch safety valves, a 4-inch gate valve, steam and water gauges and a gauge glass.

The gases from the cell pass through a curved uptake to a steel stack about 100 feet high. The uptake is lined with brick and furnished near its entrance into the chimney with a small grate on which a fire can be maintained to destroy any odorous fumes that may be given off. The necessity of such secondary fires has not yet been apparent.

When the crematory was completed, it was found that the well from which the water for the furnaces was to be secured was of insufficient capacity to furnish the necessary supply for running both cells at their rated capacity. This might have proved a serious matter but for the amusing situation confronting the authorities when the plant was ready for test. Although they had a crematory which was apparently able to handle all the garbage of the city, they had made no provision for getting the garbage to it. The refuse of Minneapolis is removed by private agreement between householders and the contractors, and it was necessary to make another agreement with some of these contractors before any could be obtained. Before the official trial was made, Mr. H. W. Atwater, who is associated with Mr. Decarie, gave the furnaces a short run, with such good results that on the first public run he directed the start to be made with nothing but cold garbage in the furnace. The final trials were made a few days ago, when the city had succeeded in getting together 25 tons of refuse. One of the cells burned this, with a light wood fire at the outset, in less than 12 hours, and as this is within the designer's guaranty the plant has been declared satisfactory. The steam pressure was 60 to 90 pounds.

An Important Bridge Competition is announced by the City Council of St. Petersburg, Russia. Plans are wanted for two bridges over the Great Neva River and their approaches, about a year being given for their preparation. Full particulars of the terms of the competition can be obtained by addressing St. Petersburg Gorodskaja Uprawa.

Clogging of an Intake Screen on the hydraulic-power plant at Birr Castle was recently remedied by the Earl of Ross in the following manner: The output of the plant, a small one of 15 horse-power, on an 8-foot fall, was generally reduced one-half in less than an hour of unattended operation, during the autumn, by the accumulation of leaves on the screen. The latter had an area of nearly 100 square feet. The remedy was found in a wire-cloth cylinder 4 feet in diameter and 4½ feet high, set in an opening in a vertical diaphragm extending across the supply drain, and revolving twice in a minute or so round a vertical axis. The current flows through the gauze cylinder in a horizontal direction. The leaves attach themselves under pressure of the stream, and are carried round until they reach the diaphragm, which on that side is double, with an intervening space of some 10 inches, which is connected with the tail race. At this point the current through the gauze being reversed relatively to the cylinder, the leaves are detached and are carried by a portion of the water toward the tail race. Four or five per cent. of the supply is ample for conveying the leaves; probably much less would suffice.

The Mechanical Plant of the Cornell Medical College, New York.

The Medical College of Cornell University has now occupied for about a year a large new building on First Avenue in New York City. It has been planned with much attention to engineering matters, and the choice of equipment and apparatus and the provision of conveniences were apparently given much consideration in the design of the building. Among other things it has a ventilating, heating and cooling plant of large proportions and remarkable completeness, and includes in its mechanical side an isolated steam power plant. From this are operated an extensive electric lighting system, an interesting refrigerating plant and a hydraulic elevator installation. The plumbing in the building, which presents a number of special features and details of construction, was described in The Engineering Record of October 20 of last year. The portion of the basement occupied by the mechanical plant impresses the visitor with its general well-lighted appearance, being in the first story below pavement level, and thereby receiving considerable light through sidewalk area lights, and being finished with a cream-colored floor of large tiles and white enameled brick walls.

The ventilating and heating plant is a combined plenum and exhaust one, employing three plenum fresh-air blowers and three disk exhaust fans, and requiring in the galvanized-iron work for ducts and flues about 120 tons of sheet metal. The air distribution is for ventilation, and heating is obtained, that is, the heat losses through the walls and windows are compensated, by direct radiation. The fresh air is, of course, tempered in cold weather, and air filters are provided. For work in some rooms during summer months cooling coils are used, this portion of the plant forming a very interesting feature of the installation. The direct radiation is connected on a two-pipe low-pressure system, with a supply largely from basement mains.

The building is a six-story steel structure, with granite base course, stone exterior through first story and pressed brick with stone trimmings above; it extends along First Avenue from Twenty-seventh to Twenty-eighth Street, 200 x 100 feet in extreme dimensions. It is devoted chiefly to lecture and class rooms, laboratories and operating and demonstrating rooms. Plans of the first and fifth floors are given among the accompanying drawings, as are also plans of the sixth or attic and of the basement plans, the latter chiefly to indicate the scheme of ventilation.

Referring to the first-floor plan, it will be seen that there are two entrances into the building, one toward the right end, that is, toward Twenty-eighth Street, leading to the office, and the other, toward the left end, to the general dispensary. At the head of the latter is a large waiting room extending through two stories and containing a large gallery on the second-floor level, set apart also as a waiting room for departments of the dispensary located on the second floor. The rooms given up to the dispensary are grouped into a number of different departments, as indicated in the drawing, all reached by corridor or lobby from the waiting room. The office of the dispensary is located on one side of the room and an apothecary shop at a front corner. The rest of the first floor is given up largely to faculty rooms and offices and to a large auditorium. This part of the building contains the main stair hall, which is served with a passenger elevator running to the various floors. The auditorium is arranged with rows of seats on successive steps and the space under the back part of the room is divided up into a number of rooms on the first-floor level, as indicated on the first-floor plan.

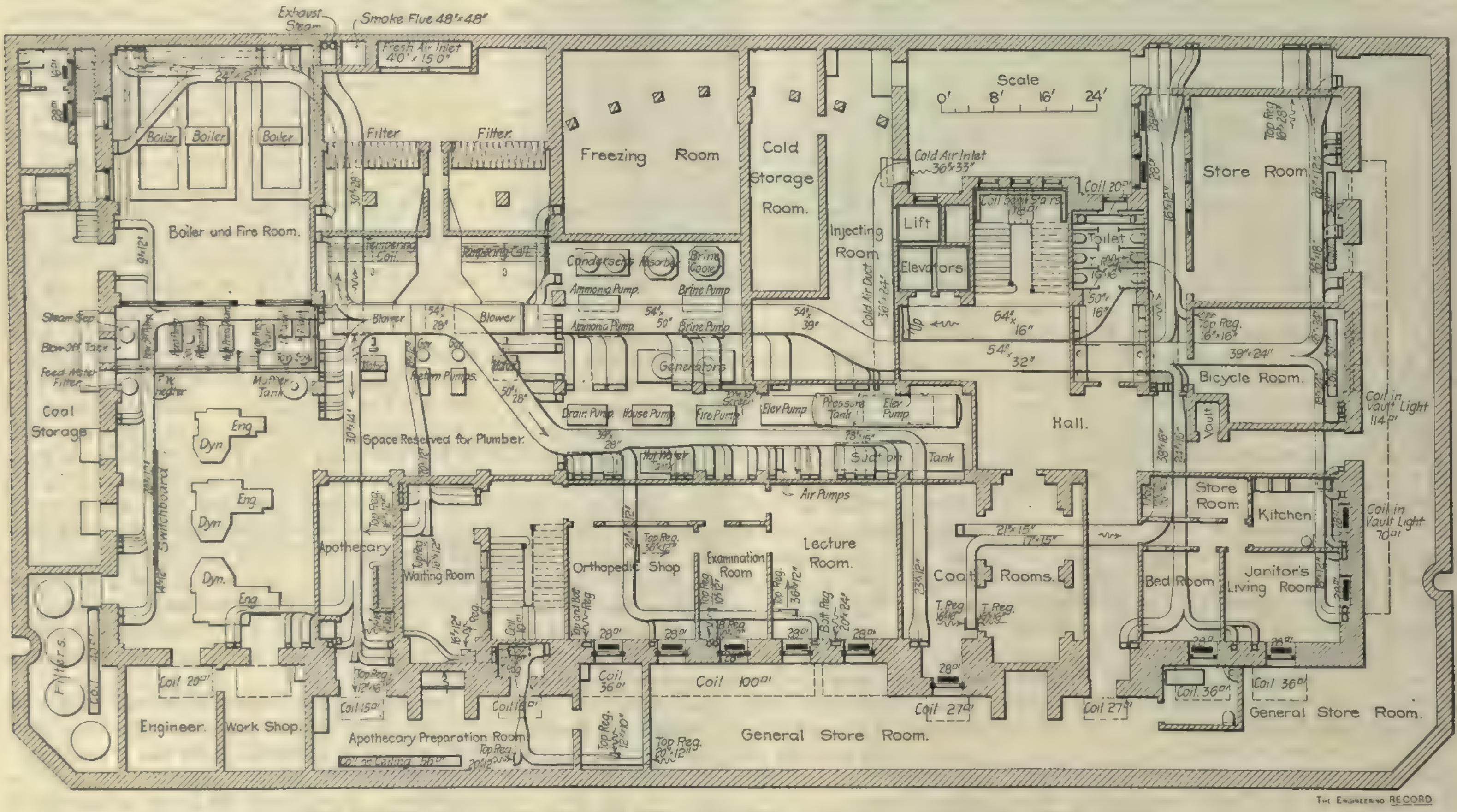
In the second story, as stated, are more rooms of the dispensary department, occupying the same amount of floor space, and there are four recitation rooms and a clinical microscopy room over the faculty rooms. The second-story space over the lobby on the first floor at the main auditorium is utilized for the department of eyes, ears, nose and throat, where dark rooms are needed. It is divided up into 22 separate stalls, each of which had to have provision for the escape of vitiated air, and a false ceiling was accordingly suspended 15 inches down through which to pass ducts collecting from the numerous outlets in the stalls.

The third floor contains a number of the departments of the college proper, including the main chemical laboratory and a chemistry and physics theater, the latter rising through the fourth story. The large space over the main auditorium, which is extended through the second story, is devoted to an anatomy and physiology amphitheater. This also occupies two stories, the lower part at the third-floor level and entered from a preparation room, and the upper part at the fourth floor, for the students' entrance to seats. The preparation room is served from a lift rising through the building from the basement. A plan of this amphitheater is included among the accompanying drawings. The fourth floor otherwise is largely given up to the bacteriological department, a large class room and a library.

The fifth floor is given up almost entirely to a large dissecting room opening at one end into a post-graduate dissecting room, intended largely for use during the summer, and at the other into a room for operative surgery. The roof of the building is of the mansard type, starting from the fifth-floor level, and the dissecting room has sunlight through ceiling skylights. The post-graduate dissecting room, as stated, has provisions for cooling the air within it. The sixth story, which is really an attic, contains a long corridor connecting various fan chambers. Cages are kept here for different animals under experiment, and there is a photograph room and a room for bone boiling. The basement, besides the mechanical plant, contains the janitor's living apartments and bicycle and store rooms and a cold storage and freezing department for bodies for the dissecting room.

The boilers are located at a rear corner of the basement, conveniently near the coal storage, which is provided under the Twenty-seventh Street sidewalk and near the ash hoist to the street. The boilers are three in number, of the Babcock & Wilcox water-tube manufacture, two erected in one battery and the third independent. Each boiler has an aggregate of 1,553 square feet of heating surface and 43.2 square feet of grate surface. The clear height from boiler-room floor to under side of first-floor girders is 17 feet, and each boiler is composed of 10 sections, each of seven charcoal-iron 4-inch tubes, 18 feet long. The top of the boiler proper is 13 feet 4½ inches above the floor. There are two steam and water drums to each boiler, 30 inches in diameter and 20 feet 4 inches long, and each pair of drums is provided with a cross pipe which has an 8-inch steam outlet. Buckwheat coal is burned on McClave grates, and an overhead trolley and traveling bucket made by the George Focht Sons Iron Works, at Hoboken, is used to handle coal and ashes. The trolley just within the boiler room has a floating section attached to weighing scales, and a record is kept of daily consumption and percentage of ash; the capacity of the coal storage, which is filled directly from sidewalk coal holes, is about 100 tons. A steam pressure of 100 pounds is carried.

The 8-inch steam pipes feed a 10-inch header over the firing space, which is supported high enough to allow tubes drawn out of the boiler setting to clear. The steam pipe is carried 10 inches in size into the engine room, which, it may be mentioned, is divided from the boiler room by a wood and glass partition which affords the boiler room considerable light. In the engine room the 10-inch main passes first through a steam separator, provided with the usual by-pass, before feeding the engines, each of which also has a separator, and then besides a small main for several pumps in the engine room subdivides into two 8-inch mains, one for the three engines and the other for the rest of the pumps in the mechanical plant, including those of the refrigerating system, and also for a system of risers through the building supplied with medium-pressure steam through a pressure-reducing valve in the engine room, and for feeding the low-pressure heating system when necessary. All individual branches to engines, pumps, etc., as well as the branches from boilers, have two valves, and the power mains are supported from below on pipe columns.



THE MECHANICAL PLANT OF THE CORNELL MEDICAL COLLEGE, NEW YORK.

M'KIM, MEAD & WHITE, ARCHITECTS; ALFRED R. WOLFF, HEATING ENGINEER; G. A. SUTER & CO., HEATING CONTRACTORS.

The electric generating equipment consists of three direct-connected units, of 50, 75 and 100 kilowatts capacity, respectively. The engines are Harrisburg Standard simple engines, and the generators 118-volt direct-current Crocker-Wheeler dynamos. The largest engine has a 17 x 16-inch cylinder and runs at a speed of 225 revolutions per minute; the middle size engine, a 15 x 14-inch cylinder and a speed of 250 revolutions per minute, and the smallest engine, a 12 x 12-inch cylinder and a speed of 265 revolutions. The electric distribution is a two-wire one, and is controlled from a marble switchboard of three panels in the engine room. The center panel is for the generator connections, while that on one side is for power circuits and that on the other for light. Each generator has a single-throw three-pole switch, which includes the equalizer connection, and has a circuit breaker and an ammeter. There are two voltmeters, one for use as a galvanometer and the other as a voltmeter and ground detector. The ammeters are Queen-Wirt instruments, and the voltmeters, Weston instruments. There are 18 light feeders, connected to the bus bars by single-throw double-pole switches on the light panel, and eight power feeders, six for fan motors of the ventilating system and two yet unused. Both the light and the power panels have an ammeter and a recording wattmeter. A daily log is reported by the chief engineer to the office of the College, and on this is kept a record of what boilers, dynamos, motors and pumps are operated, and how long each is run, of the back pressure on the heating system, of the power used in both light and power circuits, of the temperatures of brine, freezing room and the outside atmosphere, of the coal used and ashes remaining, and of the reading of the gas and water meters.

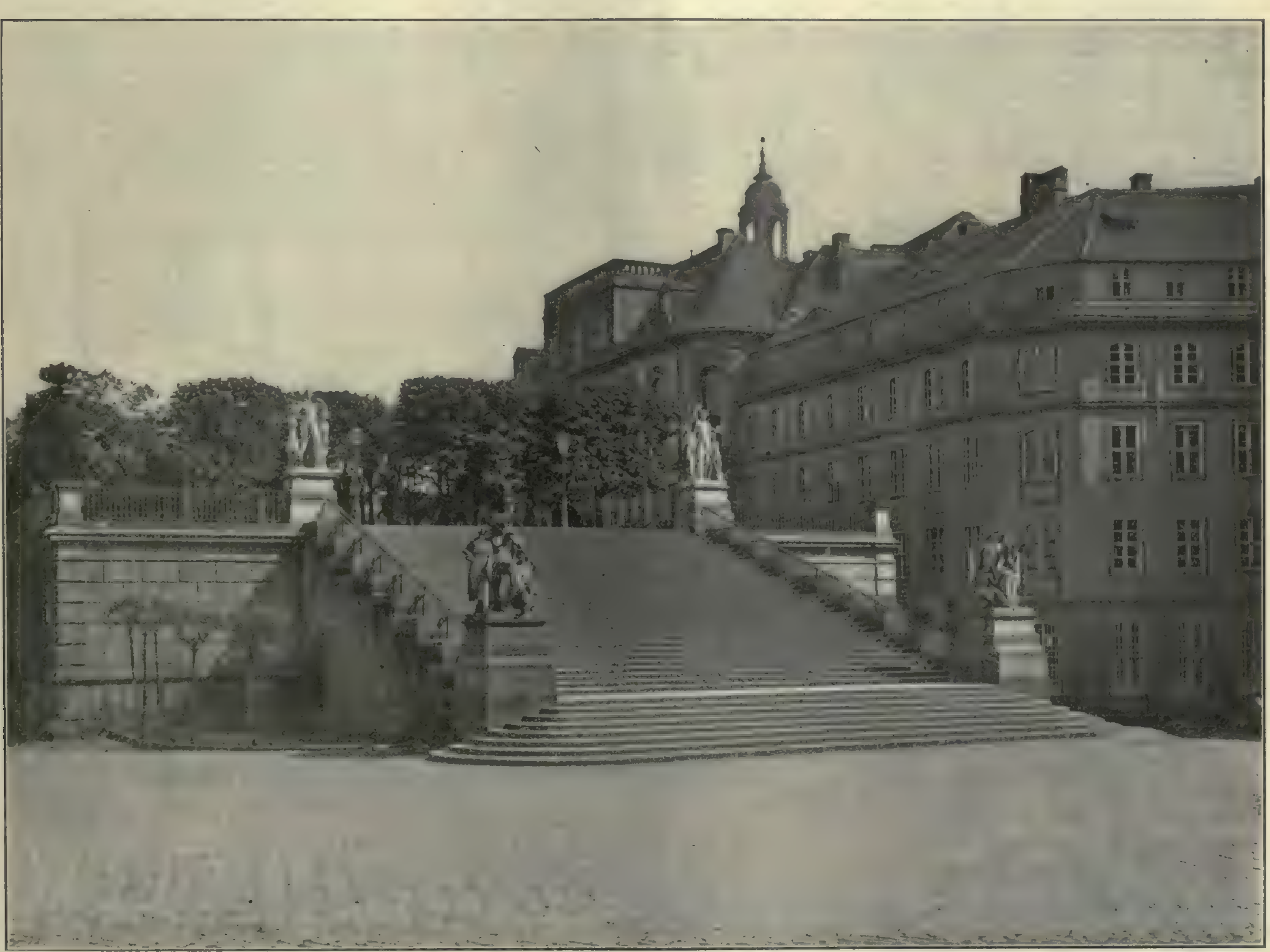
Some of the 17 pumps, which there are in the basement plant, are, as mentioned, located in the engine room. The engine floor is three feet or so higher than the boiler-room floor, and these pumps are located at the boiler-floor level, but between the partition and the engine floor. There are five pumps, of the Blake and of the Worthington type, and three tanks, the blow-off tank and two drip tanks, one for clean water from high-pressure connections and the other for oil or grease-laden water from engines and low-pressure drips. Each of these tanks is provided with a pump, the two coupled with the drip tanks under the control of Kieley pump governors. The remaining two pumps are arranged in duplicate for boiler feeding; one is under the control of a pump governor connected to the heating return, and the other is used under the control of a float largely for emptying a sump below the boiler-room floor.

The exhaust steam from the engines is carried in floor trenches to a muffler tank in the engine room, 3 feet 6 inches in diameter and 6 feet long, containing 24 galvanized-wire disks and provided with 12-inch steam inlet and outlet for the exhaust steam. To the muffler are brought also the exhaust steam from the pumps and the refrigerating plant, and from it are taken a 5-inch line to two hot-water generators near the refrigerating apparatus, a 10-inch line to the feed-water heater, a 12-inch line to the heating system and a 10-inch connection to a free exhaust riser carried up in a flue alongside the smoke flue the full height of the building. This latter pipe has a back-pressure valve near the muffler tank. The feed-water heater is a Berryman heater with single exhaust connection, and has 160 square feet of heating surface in 2-inch seamless brass pipe.

The 12-inch main from the muffler tank, which, as stated, is for heating purposes, subdivides into two 8-inch mains; one of these passes through the engine room and around the basement, supplying all told about 31 risers, and 17 basement ceiling coils, the latter aggregating about 850 square feet of surface, and the other main runs to the shaft through which the exhaust riser extends, passing up alongside the exhaust pipe to the attic, where it supplies the heating apparatus of the fifth or dissecting-room floor. A live-steam connection is made to the heating apparatus through a reducing valve, as mentioned; this is located near the muffler tank and the 12-inch main from the muffler tank and the 12-inch main from the outlet of the reducing valve are cross-connected, so that exhaust or live steam may be used at will in the heating system.

Throughout the building, radiator connections to and from risers are in general run underneath the finished floor, and are encased their entire length by a galvanized-iron sleeve. The air valves are connected by a system of air lines leading to different receptacles in the basement. The control of the return water is, as stated, under Kieley governors, and the return mains are carried below the water line; the return risers and the relief pipes from steam risers connect into the return mains. The direct radiation is largely under thermostatic control, 206 radiators controlled by 124 themostats and 21 skylight coils by 13 pneumatic valves, all on the Johnson system, supplied from two steam air compressors.

The refrigerating apparatus is of the ammonia absorption type, built by the Carbondale Machine Company, and is of 50 tons capacity. It comprises a generator, with analyzer and exchanger, rectifiers at the basement ceiling, two condensers, a brine cooler and an absorber, and a duplicate installation of brine and ammonia pumps. The condensing water is utilized as much as possible, particularly during summer months, as feed water. From the refrigerating apparatus it is brought into a compartment of a tank located nearby, which, in total dimensions is about 7 feet wide, 15 feet long and 6 feet high. The tank has a transverse partition in it 5 feet from one end, and the smaller compartment, which thus has a capacity for about 1,650 gallons, is used for the temporary storage of the cooling water from the refrigerating machinery; the other compartment, of 3,300 gallons capacity, is used to receive water for the building, the house pump suction being connected to it.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXVI, DRESDEN, APPROACH TO AUGUSTUS BRIDGE.

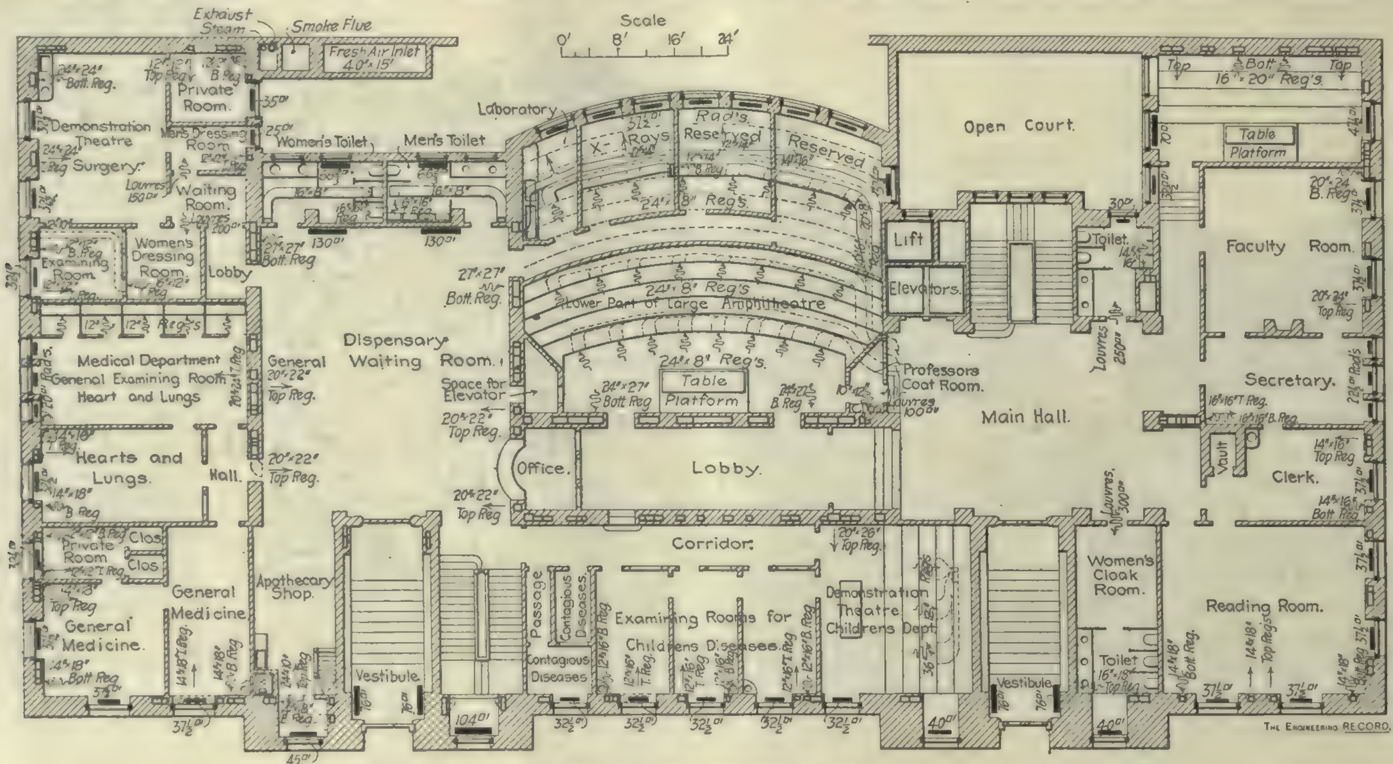
The staircase giving approach to the Bruehl Terrace near the abutment of the Augustus bridge on the old city side. It was built in 1814 by Prince Repnin, the Russian governor.

The house pump is cross-connected with the fire pump, both of which are Worthington duplex pumps 12 x 7 x 10 inches in cylinder sizes. The fire pump, which has a larger air chamber, has a rated capacity of 320 gallons of water at a speed of 60 revolutions per minute when discharging a 1⅛-inch smooth or 1-inch good nozzle stream. The elevator equipment, which is of the Otis hydraulic type, includes two duplex compound pumps of 12 and 18.5-inch steam cylinders, 8.5-inch stroke and 10-inch water plungers. The pressure tanks, which are kept at 150 pounds pressure, are vertical, two in number, each 4.5 feet in diameter and 12 feet high. The surge tank is 4 x 9 x 10.5 feet in cubic dimensions.

The high-pressure steam and return piping is covered with Keasbey's magnesia sectional covering, while the low-pressure work, including feed and drain pipes and the main air pipes is wrapped in Valleau-Costigan magnesia-asbestos sectional covering. The feed-water heater, the muffler, blow-off and drip tanks, the pump governors and other appliances, and the steam cylinders, chests and heads of all pumps, are all covered with 1½-inch magnesia blocks, the latter encased with Russia sheet iron. The smoke connections have blocks of same thickness fixed to leave a 2-inch air space. The casings of the tempering coils have magnesia-asbestos blocks 1 inch thick. All the blowers and ducts in the basement, all exposed flues and the supply ducts in the attic, are covered with asbestos air-cell covering. A non-conducting ceiling was built over the boiler room, consisting of magnesia-asbestos blocks, 2 inches thick, with wire lath and hard finishing plaster, the blocks supported by 1-inch T-irons hung from the floor beams above to form an air space of 4 inches between blocks and beams.

The distribution of air is effected by plenum and exhaust fans, as stated, Sturtevant centrifugal fans for the plenum, two of which deliver to all floors except the fifth, or dissecting-room floor, which is supplied by a third fan on a separate system, and Howard & Morse disk fans for the exhaust. The two fans for the former system are located in the basement, and are of the single-inlet type, directly driven by electric motors, and have a single discharge outlet. Each fan has a 9-foot blast wheel 4.5 feet wide, and runs normally at 135 revolutions per minute, for which conditions 18-horse-power C & C motors were installed. Each fan has a capacity at the normal speed of about 45,000 cubic feet per minute, and as the apparatus is of the class in which the tempering coils are on the suction side, about 40,000 cubic feet are drawn into the building for each of this pair of fans. The air is admitted at second-story level through louvre openings and is brought downward to the basement in a brick shaft 60 square feet in cross-section, making the velocity through the shaft about 22 feet per second. At its base the shaft empties into a settling chamber, which is about 12 x 35 feet in plan and 15 feet high, thus giving in cubical contents about 6,300 cubic feet and offering an area in the direction of air flow of about 525 square feet, reducing the velocity to about 2.5 feet per second.

Cheese cloth filters are provided in front of the tempering coils, consisting of wooden frames in galvanized-iron supports set zig-zag, with the cheese cloth stretched against large mesh galvanized wire in the frames. Through these the air supply is divided for each blower, the settling chamber being reached by a passageway ending at the chamber and separating the filter panels into two groups. Each filter presents about 900 square feet of filter area, so that the average velocity through the cloth is about 1 foot per second. Within the filter there is space enough in front of the tempering coils to swing doors, which are used to shut off the flow of air to the coils, and for removing the sections of the filter for cleaning, for which purpose they will be passed through a door to be made in the partition wall between the tempering chamber and the boiler room and brushed off at ash-pit doors of the boilers.



PLAN OF THE FIRST FLOOR.

The tempering coils for each blower have about 2,350 square feet of heating surface. They are enclosed in each case in a sheet-iron casing about 13.5 feet from side to side, and the coils are arranged in double sections 6 feet wide. They are 7 feet high and are divided into five groups, three of two rows each and two of four rows each, making the coils 14 rows deep in all, staggered. The design of the pipe coils is unusual, the cast-iron headers for the steam connections being vertical and the return headers horizontal. The pipes, which are, as usual, 1 inch in diameter, are carried horizontally from the header toward the center of the air passage, and then drop to the return header, each pipe from steam header to return header making a right angle, which has the longest length for the top and center pipes and the shortest length for that pipe starting from the lowest outlet on the steam header and entering the outlet nearest the outside of the air passage on the return header. This gives the greatest length of pipe to the part where the velocity of flow is probably greatest, and is said to have effected a satisfactory circulation of steam through every part.

The steam for the coils, as stated, is supplied through a 10-inch main. This subdivides into two 8-inch pipes, one for each set of coils, and these are each subdivided again for convenience of connections into a 5-inch and a 6-inch header, the former supplying the sections of the coils first to catch the incoming air. Each double section has one steam valve, the steam pipe for the section on the opposite side from the central passageway passing through underneath the coils.

One blower supplies the smaller rooms of the center portion of the building, and all the rooms provided with fresh air in the end of the building including the dispensary, and the other supplies the large spaces, the main auditorium for example, and the end of the building in which are the offices of the College. The outlet of each blower is 54 x 60 inches in size, so that on the basis of 45,000 cubic feet delivery per minute, the outlet velocity is 2,000 feet per minute. The tempering coils are under thermostatic control, the two outside sections by thermostats placed in the cold-air inlet and the three inside sections by a thermostat in the warm-air duct, the latter of the quick-acting relay type. Besides the ordinary direct-reading thermometer, a Bristol recording thermometer has also been placed in connection with each main warm air duct and it has been found that the variation in temperature resulting from the use of the quick-acting relay on the thermostat is not more than about ½ degree Fahrenheit. The ducts are covered as described and painted white, and every branch duct has in large black characters the location of the room supplied.

The fresh-air system for the dissecting and other rooms of the fifth floor is shown in the plans of the fifth and attic floors. The air is admitted 10 feet above the roof line through a shaft and hood of 24-ounce copper, passes through a filter of similar construction to that described, offering about 600 square feet of filter surface, and finally reaches a centrifugal blower through a tempering coil immediately behind the filter, the arrangement being that of the basement plenum systems. The tempering coil for this system presents about 1,120 square feet of surface, divided into 5 groups of single sections, like the double sections of the basement system. The fan has a diameter of 6 feet and a width of 3 feet, and is driven directly from a 6-horse-power motor at a speed of 165 revolutions per minute. It is depended on to deliver under these conditions about 18,000 cubic feet per minute.

The main discharge from the fan, which had to be given two outlets, is 3 feet square and extends under the tempering coil, through the cold-air chamber and along over the sloping ceiling of the dissecting room. Through this it feeds 12 registers, each 3 feet square in gross area, discharging toward the outside wall of the room, and it drops at the end of the ceiling of the fifth story, where it feeds horizontal ducts for the rooms at that end of the floor. Another discharge duct leads to the inside wall of the post-graduate dissecting room which, as was stated, is arranged especially for use during summer. The air from the fan through this pipe may, instead of going directly to that room, be passed through a mass of brine coils enclosed in the attic. Early in the arrangement of the dissecting rooms provision was made for lockers all about the outside walls, and ducts were planned to give each locker an independent supply of fresh air at the bottom and an exhaust connection at the top. These are indicated in the plan of the fifth floor, but were not put in, as the lockers were replaced by shelving.

The air is removed from the post-graduate dissecting room through four exhaust registers, of practically equal size, and a pair of these in diagonally opposite corners, together with the dampers controlling the by-pass around the enclosed cooling coil, are operated automatically by a thermostat. In addition to the fresh air, which may be cooled below the temperature of the outside atmosphere by the brine coils mentioned and in addition to the closure of half of the exhaust-air passages, in the event in summer, for example, of too great a rise in temperature, there is a large collection of brine pipes in the attic space above the ceiling of the post-graduate room, by means of which an internal circulation may be set up in the room at the expense of the highest possible degree of ventilation, but under good conditions for obtaining a desired comparatively low temperature. A section through the attic of this room is shown among the accompanying drawings. These brine coils are grouped on each side, and the general utilization of space is very interesting, including the inclined lightway from roof to ceiling skylight, ducts for the passage of vitiated air, steam and brine pipes and electric conduits.

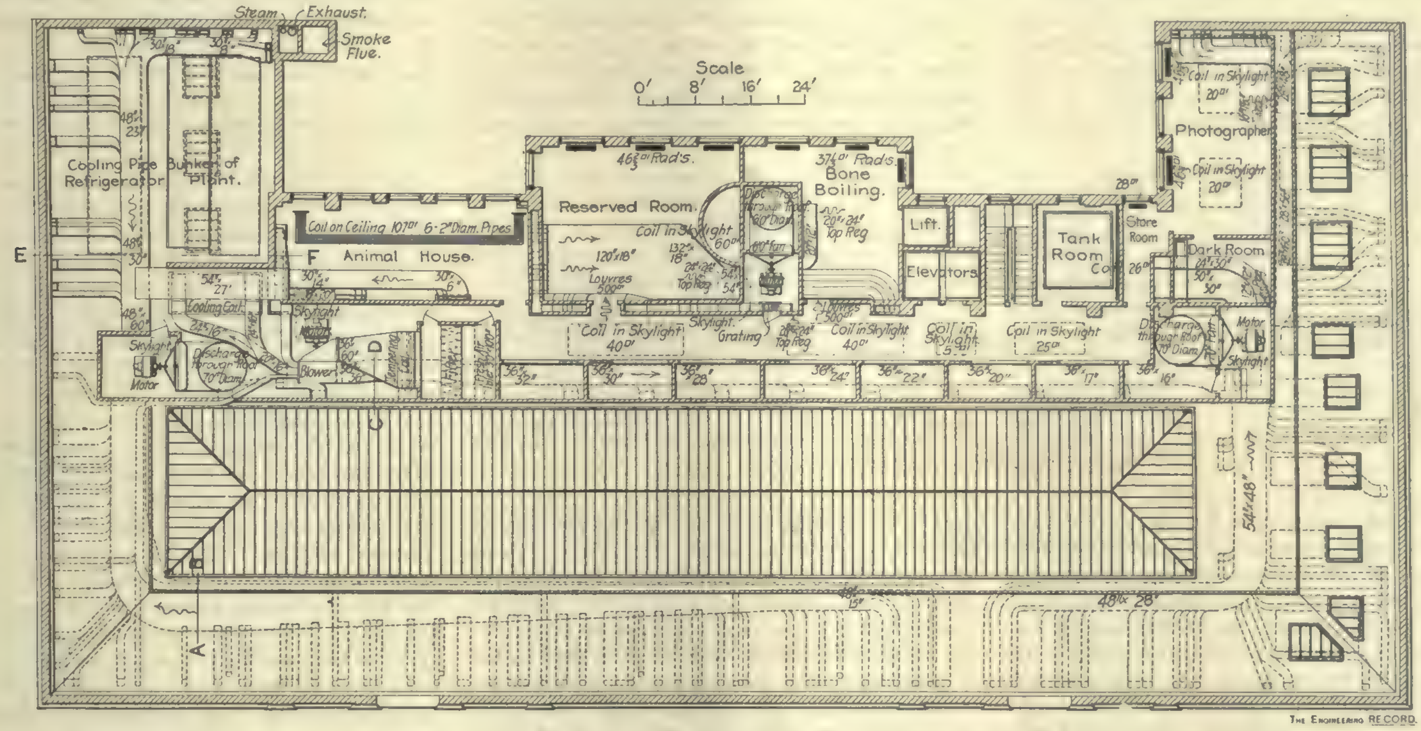
Interesting data on the performance of the cooling apparatus for this room were obtained early in the summer, and from these figures a calculation has been made which will give an insight into the requirements for cooling a room of the size in question. At the third annual commencement of the College, in June, 1901, and the first at which the present building was available, exercises were held in the main dissecting room on the fifth floor. The weather was uncomfortably warm, and it was decided to keep down the temperature of the large room as much as possible, as would be particularly desirable after the room should become pretty well filled with people, by forcing air into it from the post-graduate room. For that purpose the four exhaust outlets of the post-graduate were closed, the supply of fresh air from the centrifugal fan in the attic forced through the bunker of indirect cooling coils and the cool air allowed free passage from the post-graduate room into the large room.

The accompanying table gives the temperatures at different times, from 12:30 o'clock in the afternoon until 11 o'clock in the night. As many as 1,500 persons were present at one time in the main dissecting room, which, it is to be remembered, has no side windows; and being warmer than the post-graduate dissecting room, raised the temperature of the latter room to some extent. The outside temperatures were obtained from a thermometer in a shaded position, and the humidity was ascertained from weather bureau records. During the experiment a marked difference existed between the ends of the large room, and, it is stated, was pleasantly noted by all.

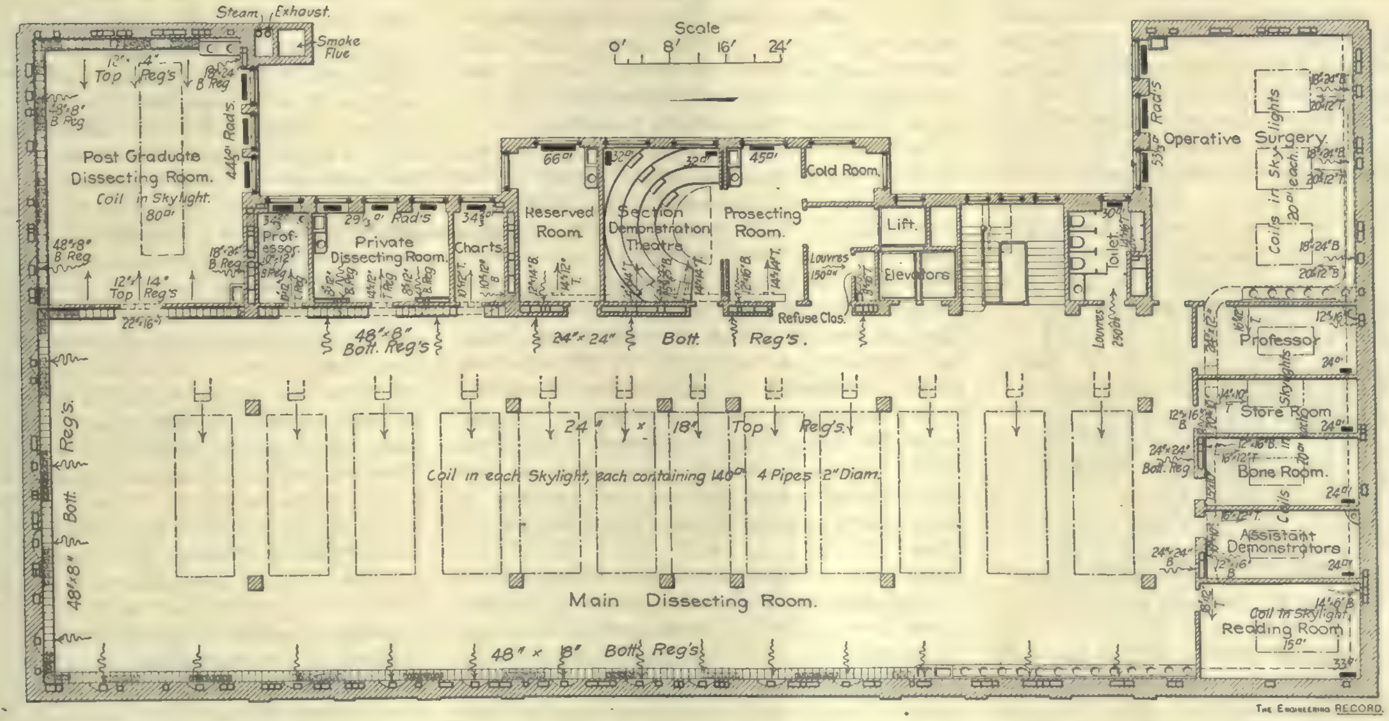
Test of Cooling Apparatus for Post-Graduate Dissecting Room.

Time.	Temp. Outside deg. F.	Humidity per cent.	Temp. Coil Bunker deg. F.	Temp. Post-Grad. Room deg. F.	Temp. Main Distg. Room deg. F.
8:00 A. M.	..	55	..	..	..
12:30 P. M.	[illegible]	..	38	62	90
2:15	87	..	44	64	[illegible]
3:00	87	..	41	66	88
5:30	82	..	42	64	84
8:30	81	71	39	66	86
10:00	81	..	38	69	87
11:00	79	..	38	69	89

To investigate, so far as possible, the cooling effect of the apparatus, it may be best to take the temperatures recorded at 8:30 in the evening, when the outside humidity was 0.71. The ventilating plant was designed to discharge through the brine coil bunker for the post-graduate room 1,500 cubic feet of air per minute. At the time in question, then, 90,000 cubic feet of air were being cooled per hour from 81 degrees, the outside temperature, to 39 degrees, the bunker temperature. The heat equivalent of one British thermal unit being that represented by the change of 55 cubic feet of air through one degree Fahrenheit, the total number of British thermal units to be absorbed by the brine pipes is $90{,}000 \times (81 - 39) \times 0.019 = 71{,}820$. Air at 81 degrees Fahr., however, contains 11.275 grains of moisture per cubic foot, saturated, and thus 8.005 grains, at 71 per cent. humidity, all of which must be cooled and such of it as is condensed relieved of the heat given off in condensation. Air at 39 degrees Fahrenheit contains, when saturated, 2.746 grains per cubic foot. After the air is cooled it will leave the pipe bunker at 100 per cent. humidity, that is, saturated, and will deposit $8.005 - 2.746 =$



PLAN OF THE ATTIC.



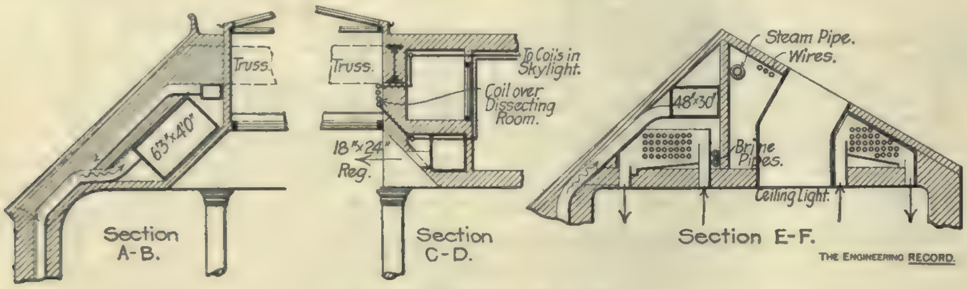
PLAN OF THE FIFTH FLOOR.

5.259 grains per cubic foot on the brine pipes. For the 90,000 cubic feet of air, this means 90,000 × 5.259 = 473,310 grains, which is equal to 473,310 ÷ 7,000 = 67.6 pounds. To condense and freeze one pound of moisture on the brine pipes from and at 81 degrees Fahrenheit to, say, 15 degrees, will require:

Cooling moisture from 81 to 32 deg......	49	B.T.U.
Latent heat of vaporization...............	965.7	B.T.U.
To freeze to ice on pipes.................	142	B.T.U.
To cool from 32 to 15 deg (17 x 0.5).......	8.5	B.T.U.
	1,165.2	B.T.U.

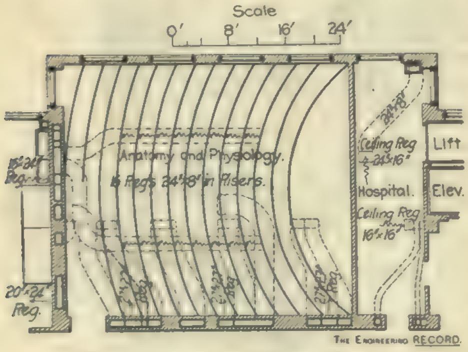
For the 67.6 pounds it will require 67.6 × 1,165.2 = 78,680 British thermal units.

The cooling effect of the direct cooling coils in the space over the ceiling of the post-graduate dissecting room, which have a total surface of about 400 square feet, is as follows: If it is assumed that a cooling efficiency of 60 British thermal units per square foot of surface per hour is obtained, the total cooling effect of these pipes will be about 400 × 60 = 24,000 British thermal units per hour. This added to the heat units required in cooling the air for ventilation, that is, the 71,820 units per hour for cooling the air and the 78,680 units per hour for condensing and freezing the moisture, makes a total requisition in the refrigerating plant for about 174,500 heat units. Allowing for 15 per cent. loss in the refrigerating apparatus and in transmission from machinery to point of effect, it will be seen that a total refrigerating capacity of about 205,000 heat units per hour are required, that is, about 17 tons, under conditions which are perhaps not the severest, for a room the cubical contents of which are about 17,000 cubic feet.



Sections through the Attic.

The vitiated air from the whole building is handled by three exhaust disk fans in the attic, two 7 feet in diameter, receiving the air from opposite ends of the building and the third 6 feet in diameter, handling air from the rear central part. The fans are all mounted on horizontal shafts, and in the side wall of a room into which all the flues and ducts feeding that fan are terminated. They are directly connected to electric motors; the 7-foot fans are arranged to be driven at a maximum speed of 250 revolutions per minute and the 6-foot fan at 300 revolutions. The discharge from each fan is upward through an elbow bending upward of 24-ounce copper the full diameter of the fan. Each discharge projects a short distance above the roof and is capped with a protecting copper hood. Sections through the attic space over the main dissecting room are also shown, and serve to show in this instance how the ducts were carried. The large vent duct had to be placed with one edge down, and is made strong enough to enable an inspector to pass through whenever necessary to do so to regulate by dampers the outflow from small flues connecting with it. The section at the inner side shows the fresh-air register connections for the dissecting room and the location of the ceiling light coils. These are as much depended on to melt snow from the upper glass as to prevent down drafts from the lower glass surface.



Amphitheater in Fourth Story.

On the arrangement and general size of registers, both fresh air and exhaust, for the various rooms, it will only be possible to refer to two or three of the cases for larger rooms. Among these may be included first the main auditorium on the first floor. This has seats arranged on 13 steps, the highest of which is about 14 feet above the floor line. The cubical contents of the room are about 60,000 cubic feet. The fresh air is admitted through four registers at the top of the room in the inside wall, each 36 x 30 inches in gross area. The exhaust scheme first adopted is indicated in the first-floor plan; instead of drawing the more or less vitiated air through the numerous small exhaust registers distributed over the risers of three steps, only those in two steps were installed, the center one being omitted. In addition to these, there are also two 24 x 27-inch registers at the floor line, one on each side of the speaker's platform.

The anatomy and physiology amphitheater, which is shown in a separate drawing, is, like the main auditorium, arranged with steps rising above and curved about the center or speaker's space. It has a cubical contents of about 29,000 cubic feet. The fresh air is in this case also discharged from the inner wall toward the outside, three top registers, each 27 inches square, serving this room. A register 24 x 27 inches in area at the floor line in the inside corner of the lecturer's arena provides for the exit of the foul air at that point, while for the rest of the room 16 registers in the risers of the steps and each 24 x 8 inches in area, are designed to carry off the required amount of air, in the manner indicated.

The chemical laboratory on the third floor is a rectangular room about 25 x 68 feet in plan and about 28,000 cubic feet in contents. It is provided with two fresh-air registers, 2 x 2 feet in size, and three exhaust-air registers, one 2 x 2 feet and the others 16 x 24 inches. Besides these there are four hoods provided with terra cotta exhaust flues, and all flues are located in the outside walls.

The main dissecting room is 52 feet wide and 165 feet long, and has a cubical contents of about 145,000 cubic feet. The fresh air is received, as stated, through 12 registers, each 18 x 24 inches in area, and offering altogether in free area of flow about 27 square feet. The outside walls of the dissecting room are lined with shelves behind glass doors, and the shelves are divided into cases, between adjacent ones of which are placed exhaust registers. These are 8 x 48 inches in size and are 16 in number; they aggregate about 30 square feet in free area. Besides these there are nine registers 24 x 24 inches in size spaced about the rest of the room, as shown in the fifth-floor plan. The total free area of these registers is about 25 square feet, so that for the 27 square feet in inlet area there are over 35 square feet for the exhaust.

The building was erected from the plans of Messrs. McKim, Mead & White, and the heating, ventilation and cooling were designed by Mr. Alfred R. Wolff, of New York City. Messrs. G. A. Suter & Company, of New York, installed the heating and ventilating apparatus. Mr. J. C. Jurgensen is the chief engineer of the plant.

Recent Experiences with Wood Pavements.

Extracts from a paper presented to the American Society of Municipal Improvements by Mr. B. T. Wheeler, Superintendent of Streets, Boston, Mass.

Boston's business district is compressed into a comparatively small area, with densely-crowded thoroughfares, outside and surrounding which is a large suburban district containing the homes of her workers. Until within very recent years her business section has been paved with granite blocks, her residential streets have been of macadam. Of the 491.85 miles of public highways within the limits of the city on February 1, 1901, 292 miles are still of macadam and 86 of gravel. Within recent years there have been laid some areas of asphalt pavement—only 14.76 miles in all—in an attempt to give the residential district closely adjoining the business section a permanent pavement which would bear the travel imposed upon it, without the noise of granite blocks or the dirtiness of macadam. Asphalt pavement has, however, never appealed strongly to the popular mind. Those who use the streets protest against it in the business sections; it is not desired by the pleasure-driving public in the suburban districts.

The problem of the street department has been for some years to provide a pavement which should be more noiseless than granite blocks, less slippery than, and as durable as, asphalt, and more permanent as to its wearing surface. During a previous incumbency of the office of superintendent of streets, six years ago, this problem was forced home to me. The Back Bay district of the city, so-called, was densely populated with the homes of the wealthy class. Only a few years previous these citizens, protesting against the laying of an asphalt pavement in a boulevard known as Commonwealth Avenue, had raised a fund, with the interest from which they are paying for a portion of the repairs of the macadam surface which was laid at their request. In 1895 a body of these citizens, upon another street in this district, had protested against an asphalt pavement, preferring macadam, and their desires were gratified; but during the five years since then a change has come to many of these. The popular mind is not more inclined toward asphalt, and still complains of its slipperiness; but it is less inclined to endure the dust which dry weather, and the mud which wet weather produces upon a macadam surface, and granite-block pavement, even, is sometimes asked for in preference to either.

This city is particularly fortunate, because of its location, in the character of the granite-block pavements which it lays. Surrounded by some of the finest granite quarries of the world, she is enabled to obtain the best and smoothest blocks which nature helps to produce. These are laid, in recent years, upon a 6-inch American cement concrete base, with a 2-inch sand bed, and the joints are filled with either road pitch and pebbles, or, during my control of her streets, with Portland cement grout. I believe to-day that Boston has the smoothest granite-block pavements in this country, if not in the world; but such pavement, while withstanding the wear of traffic and of time, is not fitted for the ear of tired human nature. Macadam has not permanency, is expensive to maintain in good repair, is unsanitary, and disagreeable under the varying conditions of climate. Asphalt, to which large numbers of the cities of this country turn as an expedient and satisfactory pavement for residential and lightly-traveled streets, does not fully meet the requirements of our city. Situated on the sea, and traversed by its estuaries, with widely varying temperatures during all seasons, her climate is one for which asphalt seems less adapted than for that of any other large city of this country, because of the condensations of vapor which these climatic changes cause. Whether this moisture upon the surface remains fluid, or is frozen by the morning chill, almost equal slipperiness is produced; and it is necessary, during a surprisingly large number of mornings of the year, to sand completely all well-traveled asphalt streets where laid upon the slightest grades—and Boston, built upon the rugged contours of Massachusetts, having in her business section the three hills which first caught the eye of the voyager of the fifteenth century, has very little area of level street surface.

Until last year, when I again assumed control of the street department, no forms of pavement had been attempted beside those mentioned, except unsatisfactory experiments with brick and coal-tar concrete. Neither brick nor coal-tar products can withstand the traffic of even our densely populated suburban districts. In an attempt to solve the problem thus presented, some experiments have recently been made in the laying of wooden pavements, after noting the results achieved in the few sections of this country in which they have been laid.

Treated wooden-block paving has been used in London for over thirty years on both her finest and most heavily traveled roadways. Paris has nearly four times as many square yards of it in use as of asphalt. There had been laid in 1891 484,000 square meters, and in 1898 1,165,000 square meters of wooden blocks, there being at that time 382,600 square meters of asphalt and 1,348,000 square meters of macadam.

Foreign growths of wood are, however, practically prohibited for use in this country by reason of their large cost. To produce a pavement at moderate and justifiable expense a native wood must be used, so treated, if possible, as to harden its fiber, make it practically impervious to moisture, and not readily susceptible to the varying conditions of heat and cold. There is no gauge of durability by which the attempts to produce such results can now be judged. Practice has not yet demonstrated in this country what our natural products can create in the way of a permanent pavement of this character.

There were laid last year in this city, for experimental purposes, in the midst of the otherwise asphalted surface of a busy, but lightly trafficked thoroughfare, two small areas of wooden blocks, 1,360 yards in all, treated by the so-called creo-resinate process. These areas were laid in the steepest grades thereof, and in one case for only half the width of the street, the other half being of asphalt, that the relative merits of the two might be compared.

This pavement was prepared and laid in the following manner:

The blocks were uniformly 4 inches wide, 4 inches deep and 8 inches long, of long-leaf Georgia yellow pine, free from sap, loose or rotten knots, and with no second-growth timber allowed. These blocks were placed in an air-tight cylinder, and the dry heat was raised to 215 degrees Fahrenheit, without pressure, for one hour, for the purpose of expelling the moisture. The heat was then increased, pressure was applied, and the degree of both was raised gradually, in order to avoid injury to the fiber, during a period of two hours, until the heat had reached 285 degrees, and the pressure about 90 pounds, and both were then held at that point for one hour. The heat was then shut off and the tanks allowed to cool gradually for one hour. At the end of this time the heat had been reduced to 250 degrees, and the pressure to about 40 pounds. The pressure was then blown off and the heat still further reduced. Vacuum was then applied until about 26 inches was reached; and while under vacuum the creo-resinate mixture was run into the cylinders at a temperature of from 175 to 200 degrees, and hydraulic pressure was then applied, reaching 200 pounds per square inch, and kept at this point until from 21 to 22 pounds of the mixture per cubic foot had been absorbed. The liquid was then run off, and the wood placed in another cylinder, and milk of lime, at a temperature of 150 degrees, was run in, and hydraulic pressure of about 200 pounds was applied for one hour.

The blocks were laid, with the grain vertical, upon a foundation consisting of American cement concrete 6 inches in depth, with a 1-inch cushion of clean, screened sand, and were driven tightly together at every sixth row. The joints were then filled with dry, screened sand, and the pavement rolled with a 5-ton steam roller until the blocks presented a firm, uniform and unyielding surface. The joints were then filled with a creo-resinate mixture of road pitch, heated to 300 degrees Fahrenheit, and the whole covered temporarily with ¼-inch dressing of clean, screened, sharp sand.

It is apparent, after a year's experience with this pavement, that it is satisfactory as so laid in every respect except with regard to slipperiness, and that, as so laid, an almost absolutely noiseless pavement was obtained, the surface of which, under use, became so unified that the joints were indistinguishable, and the pavement consequently slippery. No wear has yet been apparent. The surface remains perfect, and, in comparison with the asphalt adjoining it, it is preferable in all respects, except that of slipperiness, in which, practically, it does not differ; and, upon the grade of 4 per cent. at which it was laid, it has nothing to recommend it in this respect.

I have this year laid an area of 7,940 square yards upon a level street, in the same manner as above described, which I believe will be eminently satisfactory in every respect, and am about to lay, this fall, another area of 6,640 square yards upon a nearly level street, where I expect the same results; but the problem of a noiseless, non-slippery and permanent pavement, which can be laid upon grades exceeding 2 per cent., has not yet been satisfactorily solved. With the hope of more satisfactory results in this respect, however, I have laid upon a 3 per cent. grade an area of 2,000 square yards of wooden blocks, so recently put down as not to permit me to make any statement of the results obtained. This was laid from blocks prepared as above mentioned, differing only in shape and in the character of the joint. From each block, 4 x 4 x 8 inches, there was removed from one side, at the top, a section ¼ inch in thickness for the length of the block, and 1½ inches in depth. When these blocks were laid as above described, and driven closely, there was a ¼-inch opening, or joint, remaining, extending clear across the street with each width of block. These joints were filled with Portland cement grout. It is my expectation that this material upon the surface of the street every 4 inches will remove the slippery conditions which would otherwise exist, and furnish better foothold for horses.

There is in my charge, as commissioner having the care, with a representative of the adjoining city of Cambridge, of those bridges crossing the Charles River and connecting the two municipalities, a bridge, called Harvard Bridge, having a roadway area of 11,425 square yards. This bridge was built in 1891, within an insufficient appropriation, and in a manner which has proved to be a falsely economical one. In order to diminish the cost, the structure was lightened, and designed only to carry a wooden floor of 4-inch deck and 2-inch sheathing. Traffic upon this bridge has rapidly increased, and it has been necessary for some years to resheathe it annually; and it has now become apparent that two resheathings each year will only suffice. As the deck of the structure now shows signs of decay, it has been decided to redeck this entire structure with a hard-pine deck, treated by the same creo-resinate process as are the blocks, and directly upon this the wooden-block pavement will be laid, closely driven, and without joints; and a contract for this work is now being executed by the United States Wood Preserving Company, of New York, which controls the creo-resinate process. What has for years had many of the characteristics of an uneven corduroy roadway, caused by the rapid wearing of the sheathing plank, will soon present an even, noiseless, smoothly-riding surface, which will not subject the two cities to the cost of annual repairs. Wooden blocks have therefore filled a unique place in furnishing a permanent and satisfactory pavement, placed upon a structure which was not designed to carry the load of any other form of permanent pavement known.

I was brought to the execution of this work by the experience of the city of Chicago in laying a wooden pavement—treated, however, by another process—upon the Rush Street bridge, which carried a large part of the freight traffic of an important railroad terminal, and which had required, therefore, many renewals annually of the wooden wearing surface of plank. This pavement had been laid over two years and a half, I think, when I last saw it, and was still apparently in first-class condition. Wooden pavement has, therefore, it seems to me, a field peculiarly its own in replacing the plank surface of bridges in an economical and satisfactory manner.

The only question, aside from the desirability of laying such pavement upon steep grades, which I have already referred to, and which has not yet been satisfactorily demonstrated, is then one of durability, which time alone can determine; but the company which has laid this pavement has, for the protection of the city which I represent, given a good and sufficient guarantee to keep the same in condition satisfactory to the superintendent of streets for a period of ten years.

Central Station Heating was discussed in the recent convention of the National Electric Light Association. Mr. Chas. R. Maunsell said that a combined central steam heating and electric plant in Topeka, Kan., which includes 52,257 square feet of radiating surface and 8,500 square feet of covered pipe surface, brought a revenue from the heating service during the first year of operation of 55 per cent. of the cost of coal during the heating season; during the second year, 60 per cent.; during the third year, 72 per cent.; during the fourth year, 90 per cent. Mr. F. N. Jewett, of Chicago, described a hot-water system in use at Albert Lea, Minn. In mild weather, when the water can be circulated at 135 to 140 degrees Fahrenheit, the plant, he said, maintains a vacuum of 20 to 23 inches on the engines; in extreme weather, the vacuum may be decreased to about 10 inches and the water circulated at 175 to 180 degrees.

The Boys' Industrial School at Lancaster, Ohio.

One of the largest as well as one of the most interesting institutions of its kind in the country is the Boys' Industrial School at Lancaster, Ohio. This was one of the first reformatory institutions in the country to be built on the segregate plan and was established in 1858, the first buildings therefore being of old-style construction, without sanitary equipment and arranged on the grounds without regard to any general scheme of central heating. In 1896 the institution had reached such proportions that the defective sanitary conditions became a menace to the health of the inmates, and realizing this, the trustees concluded to overhaul the entire plant, employing architects and engineers to prepare topographical plats of the grounds and plans for water-works, sewage disposal, electric light and heating plants. In the preparation of these plans it was necessary to conform in a measure to the arrangement that would utilize to the best advantage the old buildings, still in a fair state of preservation, and retain such portions of the old drives and avenues as had been improved and beautified by shade trees and shrubbery. Fortunately, most of the old buildings were situated on the high ground, although no other point seems to have been considered in their location. However, their location was a very minor difficulty in the construction of tunnels, sewers, etc., as compared to the obstacle presented by the general topography and the fact that an excavation of 2 to 5 feet below the surface strikes solid rock.

The accompanying plat is drawn to scale and shows the institution as it is contemplated when completed. The high point of the grounds is elevation 524; the power house is at elevation 495; and the elevation of the first filter bed is about 330.

The buildings, it will be seen, are located on a divide from which the water flows in all directions, and deep ravines extend between them in such a manner as to make it impossible to run the tunnels and sewer lines in a direct line between the points it is desired to reach.

At present natural gas is the fuel used, but should it become necessary to resort to coal, it is expected to extend a branch of the electric road to the power house to supply fuel.

All the buildings are heated by steam and supplied with hot water from the central power house, except the Administration Building, which has its own hot-water heating system with thermostatic regulation. The heating system is of the low-pressure gravity type, and in laying it out provision was made for the installation of a vacuum system in case coal is to be used for fuel. The dynamos and engines are located in the north wing of the power house, and all exhaust steam from the plant is turned back into the heating lines.

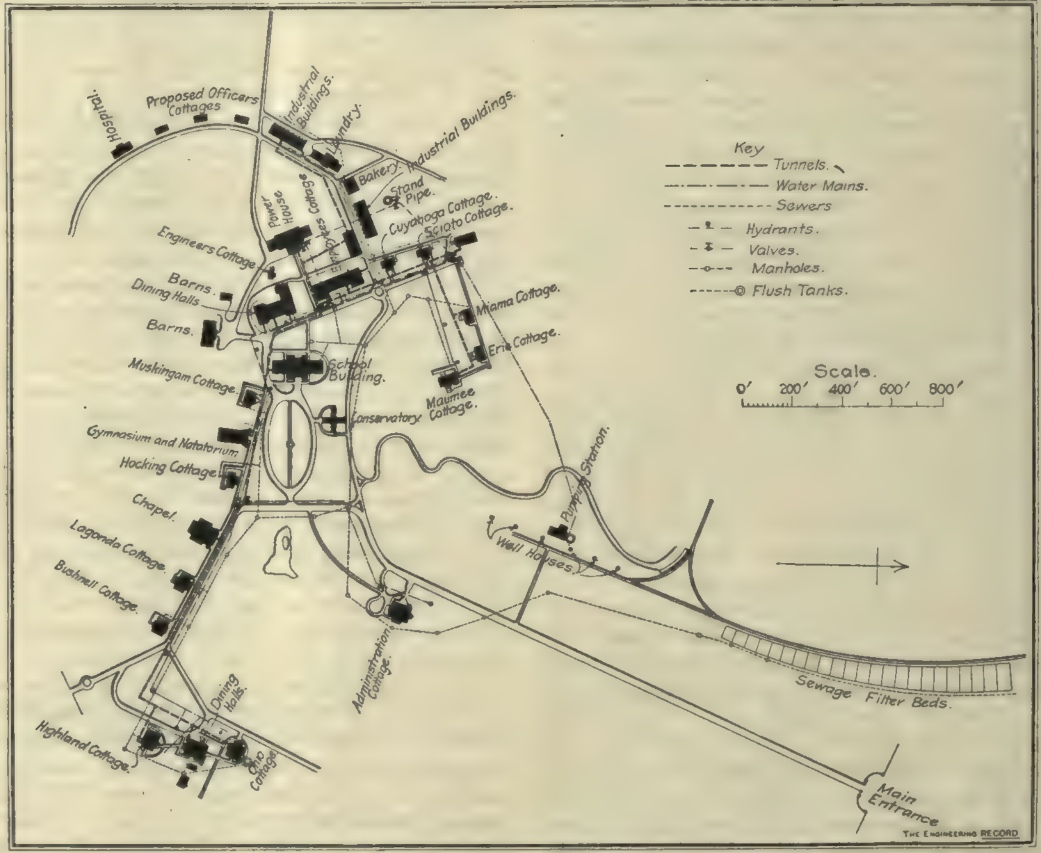
The boilers, for which provision has been made for 1,000 horse-power, are located in the central section of the power house, the pumps, hot-water tanks, receiving tanks in the east wing, and the fuel room in the south wing. The type of boiler used is the horizontal tubular, size 72 inches by 18 feet, set in four batteries of two boilers each.

A tunnel extends from the east wing of the power house out to the main drive, 300 feet in front of the power house, and branches at this point, reaching all the buildings on the grounds. This tunnel is 4½ feet wide and 6½ feet high, and fully one-half of it is cut through solid rock. In it are carried the high and low-pressure steam lines, the hot-water lines, and provision is made on the ceiling of the tunnel for electric light wires. At each angle in the tunnel there is a large cast-iron door in the top for the purpose of taking in long sections of pipe, and every 75 feet in the length of the tunnel is a 24-inch manhole.

The main heating line is a 12-inch pipe from the boiler house to the first branch. At this point the south branch is reduced to 10 inches and the north to 7 inches, and from these points it is reduced to meet the requirements.

Hot water is furnished to the buildings on the grounds from two large enclosed heaters containing steam coils through which is passed the exhaust steam or the live steam, as the occasion requires. These tanks are equipped with automatic regulation and the circulation of the water is kept up in the lines by means of a small pump located close to the tanks in the boiler house.

Although the power house is located at a point below all the other buildings on the grounds, it was impracticable to maintain a perfect grade in the tunnel line through the hill east of the power house, and thus secure a gravity return to the receiving tank, owing to the large amount of solid rock excavation and the great depth to which it would be necessary to cut. Therefore, the grade of the tunnel was fixed to secure a gravity return from as far east as Muskingum Cottage, and at the low point between the Chapel and Loganda Cottage is located a pump pit in which are placed duplicate automatic pumps and receivers. The condensation from Jennings Hall and all buildings to the east of this point returns by gravity to these pumps and receivers, and is by them forced back over the hill to the large receiving tank in the boiler house.



Plan of the Boys' Industrial School, Lancaster, Ohio.

Although, as above stated, the plant was laid out with the expectation of installing a vacuum system, the operation has been so satisfactory that thus far it has not been thought advisable to do so. The system heats the buildings on the grounds satisfactorily with less than a pound pressure on the lines.

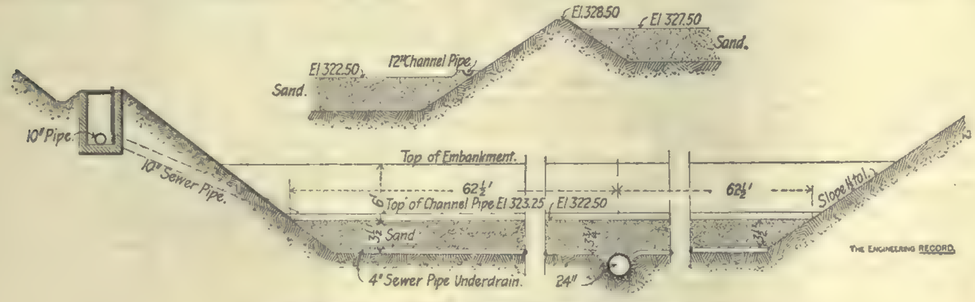
The new buildings on the grounds are equipped with the fan system of heating and ventilation, and the old buildings are being equipped, so far as practicable, with the same system. The fans are run by electric motors, a double system of ducts is used, and in this manner a satisfactory system of heating and ventilating is maintained

Light and power is furnished to the institution at present by two 75-kilowatt direct-connected generating sets located in the north wing of the power house. Provision has been made for more than doubling this capacity when required. The system in use is 250-volt direct-current. Crocker-Wheeler dynamos and Russell engines are used. It is the expectation to eventually run all the machinery in the manual training department with electric motors.

Water is furnished to the institution from six wells, each about 410 feet deep, equipped with deep-well pumps which force the water into a covered reservoir of 100,000 gallons capacity, located near the pumping station. From this reservoir it is forced by two horizontal compound duplex pumps, of one-half million gallons capacity each, direct to the standpipe, and there distributed to the various hydrants and buildings over the grounds. The standpipe holds 360,000 gallons and is so located that the second story of the highest building on the grounds gets a water pressure of about 30 pounds. The water comes from the sandstone, is soft and one of the purest supplies furnished by any system in the State.

The sewage of the institution is disposed of by intermittent filtration. A large number of filter beds were required, for, owing to the lay of the ground, no area of great width suitably located and sufficiently level for the purpose was available. The beds range from 50 x 75 to 50 x 125 feet and are constructed as shown by the accompanying drawings. The total effective area of filters is two acres. These beds are located along the railroad track extending out to the institution, and have been in use for over two years with entire satisfaction. Sand for the filter beds was secured by quarrying and crushing the sandstone in the side hill immediately adjoining the point where the filter beds are located.

Of the buildings on the grounds, the Dining Hall at the east side, the Engineer's Cottage, barns, standpipe, Ohio, Hocking, Muskingum, Cuyahoga, Scioto, Miami, Erie and Maumee cottages are old and have been in use for many years. The new buildings completed at the present time are the Administration Cottage, Chapel, Jennings Hall, which is marked on the drawings as gymnasium and natatorium, power house, bakery, pumping station, well house, conservatory, Highland, Bushnell and Lagonda cottages. Those under construction at present are the large central Dining Hall, laundry and employees' building. The proposed buildings not as yet started are the school building, two cottages for boys, band pavilion, two industrial buildings, hospital and officers' cottages. It might be interesting to add that those buildings labeled cottages for which no special use is designated are occupied by the boys as their homes. Each of these accommodates from 50 to 80 boys and the officers in charge, generally two or three to the cottage. These buildings contain well-lighted and well-ventilated basements in which are located wash rooms, recreation rooms, heating apparatus and water closets, a few of them being equipped with private shower baths. The first floor contains a suite of four rooms and a private bath for the officers, a large school room or sitting room for boys, and the second floor contains the dormitories. The Administration Cottage is occupied by the superintendent and steward as the main offices of the institution and as their living quarters. The chapel is also used as a general assembly hall for the institution and has a seating capacity of 1,200; it also contains a large room for library purposes. Jennings Hall contains a large and well-equipped gymnasium, in which are held classes in physical culture several days in each week. In the basement of this building is located the general bathing department of the institution, consisting of showers and a plunge bath 20 feet wide and 80 feet long.



Details of Filters for Sewage Disposal.

In the industrial buildings, well-equipped workshops in all lines are operated, which supply the institution with repairs of all kinds, and in which a large portion of the material used in all the trades in constructing the buildings is manufactured or prepared. Brick for the buildings is manufactured on the grounds, and stone is quarried for all ordinary purposes on the premises.

The architects of the institution in charge of the improvements are Messrs. Richards, McCarty & Bulford, of Columbus, Ohio. Mr. John P. Force, of Columbus, was the designing and constructing sanitary engineer of the sewerage and water-works systems. The installation of the steam heating plant, sewerage and waterworks was under the personal supervision of Mr. Geo. A. Sterling, now assistant superintendent of the Institution.

Mr. C. D. Hilles is the superintendent, and to him is due the credit of having brought this institution to the front rank in equipment and management.

Over ten thousand lads have involuntarily adopted this institution as their alma mater, and the carefully compiled statistics show that 63 per cent. of them have become useful citizens. The institution, in addition to being the guardian of the criminally inclined youth of Ohio, has recently been designated as the place of custody of young offenders against Federal laws. There are 850 inmates in the institution, and the average annual cost of maintenance is $130 per boy. Forty per cent. of the boys received last year were of dissolute parents, and more than half were of foreign parentage.

Plumbing in the Connecticut Mutual Life Building, Hartford.

The plumbing in the offices of the Connecticut Mutual Life Insurance Company, at Hartford, Conn., includes the systems in the old and new buildings, which have been connected together and operated as one system, with pumps, tanks, etc., located in the new building. The original building, 72 x 104 feet in plan, on the corner of Pearl and Main Streets, was at first five stories high, and afterward raised to seven stories. The new building, which is 140 x 103 feet in ground dimensions, and adjacent to it on Pearl Street, has eight stories, equaling in height the seven stories of the old building. The new building has two rear wings separated by a 33 x 55-foot center court. Two separate 4-inch supplies are taken from different street mains, brought through the basements of the old and new buildings, metered, and joined in a 5-inch pipe, which supplies a No. 104 double-cylinder Loomis filter seated on a foundation pier with white enameled brick face and cut blue-stone cap.

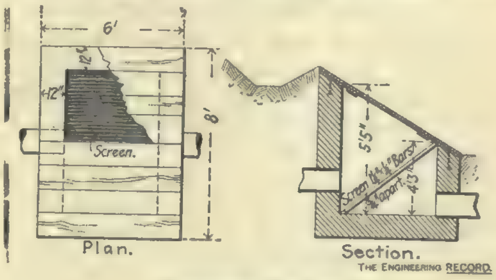
The filter discharges under street pressure through a 3-inch and a 4-inch balanced float valve, into a 5 x 12-foot suction tank 5 feet high. The float-valves are set on a header that is provided with valves so that it can be supplied direct from the street mains and allow the filter to be cut out for cleaning or repairs. The tank is made of 5/16-inch steel, reinforced at the screwed pipe connections and has a steel-plate cover bolted on, with an 18-inch hand-hole and hinged cover over the ball-cocks. The discharge outlet is connected by valve to a 7-inch suction main with short 5-inch valve connections for the two house and fire pumps, beyond which it is reduced to 4 inches to the boiler feed and return pumps, which it supplies through 3-inch connections.

The discharge pipes from all these pumps are cross connected together so as to make them interchangeable and allow any one to be cut out, and are connected to a 4-inch main from which two 3-inch branches are run on the basement ceiling to, and terminate in, 3-inch stand-pipes. The house and fire pumps are controlled by automatic regulators, which turn the stream on and off according to variations in the pressure, and the other pumps are started and stopped by automatic float devices.

One stand-pipe rises vertically in each main wing of the building, and their tops are connected by horizontal 3-inch pipes over the furred-down ceiling of the seventh story, which unite in a 5-inch supply to the house tank. This is 5 feet wide, 12 feet long and 8 feet high, made of ¼-inch steel plates, braced, and covered with a sectional removable top of ⅞-inch matched and planed pine boards on an oak frame. It has no safe, but is supported on I-beams over the waterproofed floor of the deck house, and any leakage is drained through a floor strainer to a seventh-story sink. The tank is filled through two 3-inch automatic balanced Ludlow float-valves, with hush pipes to the bottom of the tank. There is an overflow connected to the emptying pipe outside its valve, and both discharge through the latter with a tagged flap-valve in the engineer's sink, where it serves as a tell-tale. There are two 5-inch main valved connections to the bottom of the tank; one of them is for the down supply for house service, and the other is branched to the tops of the two 3-inch stand-pipes. All pipe connections to the tank are flanged. Access to the ball-cocks is had through a covered 18-inch hand-hole in the wooden top, which is located directly under a roof scuttle.

Adjacent to the main tank, but higher, is a similar 3½ x 6-foot steel tank 3 feet high to afford a separate supply for the janitor's apartments. It is set in a 3/16-inch steel safe-pan 6 inches deep, which is dripped to the seventh-story slop-sink. This tank is filled through a 3-inch ball-cock on a branch from the supply to the main house tank, which terminates with an air valve at the highest point. The supply to the janitor's apartments has an independent valved branch to the main tank which is normally closed. Pressure pipes are run from both tanks to engine-room gauges, which indicate their respective water levels.

The two 3-inch stand-pipes are used both as pump risers and as fire-lines, and each has a gate-valve, check-valve and emptying pipe at the bottom and a gate-valve and check-valve at the top. The bottom check-valve closes toward the pump, and prevents the tank water from escaping to the general distribution system. The top check-valve closes toward the tank and prevents the escape of water under fire pressure into the tank. Branches with gate-valves and check-valves are taken from the feet of the stand-pipes to siamese connections in both streets for fire engines, and in the basement, and in every story, and on the roof each stand-pipe has a 2-inch outlet, nineteen in all, and 75 feet of 2-inch Eureka Fire Underwriters' best linen hose on a Cliff & Guibert non-automatic reel.



Screening Chamber.

The 5-inch down supply from the main tank has no branches, is valved top and bottom, has a vent pipe at the top and terminates in the basement in a horizontal cold water distributing drum, which is connected also with the street pressure supply. It has seven valve outlets, from which pipes are run on the basement ceiling to supply all the basement fixtures and about 18 riser lines to groups of fixtures in the upper stories. The branches are from ¾-inch to 2-inches in diameter and generally cross the building transversely to the different rows of columns and then run longitudinally alongside them with ¾-inch to 1½-inch riser lines, carried up close to the columns inside their fireproof jackets. Each riser is valved at the bottom and has an air chamber on top; a hot water riser and its return circulation pipe are generally carried up alongside the riser.

A 3-inch brass pipe from the cold-water drum supplies the hot-water heater, and in order to utilize the waste heat from the steam plant, it is arranged, as shown in a conventional diagram herewith, to connect with coils in the drip tank and blow-off tank before reaching the heater, which is supplied with the usual steam coil and high and low-pressure steam connections. By-passes are so arranged that the coils in the two tanks may be cut out or used independently, or that the water after passing through them may be admitted directly to the hot-water distributing drum without passing through the heater. A check-valve is set to prevent the water backing up from the tanks to the cold-water drum, and a connection is made with the street pressure main so that the heater may be supplied direct from the meter or filters if the tank supply is cut off.

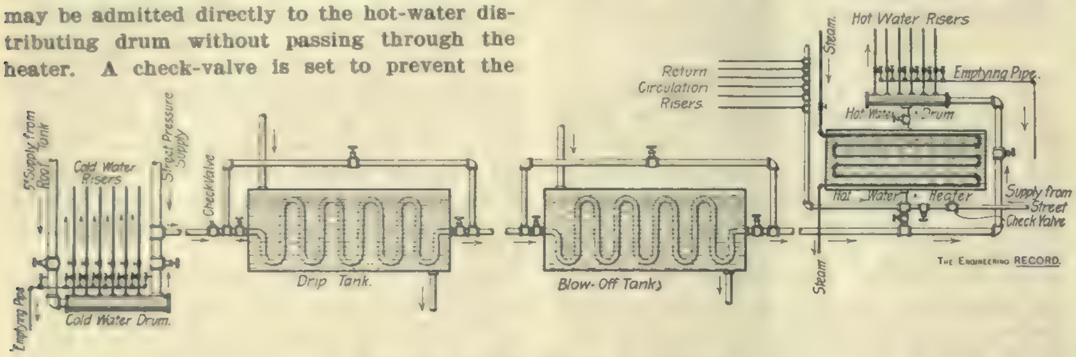
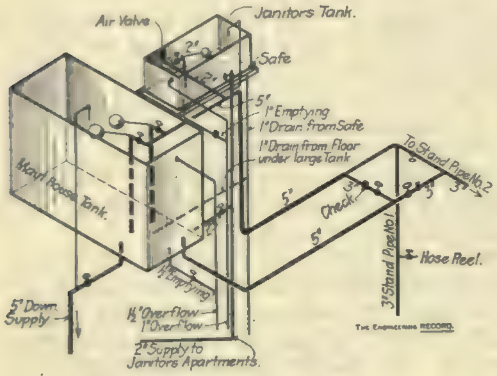


Diagram of Hot Water Apparatus.



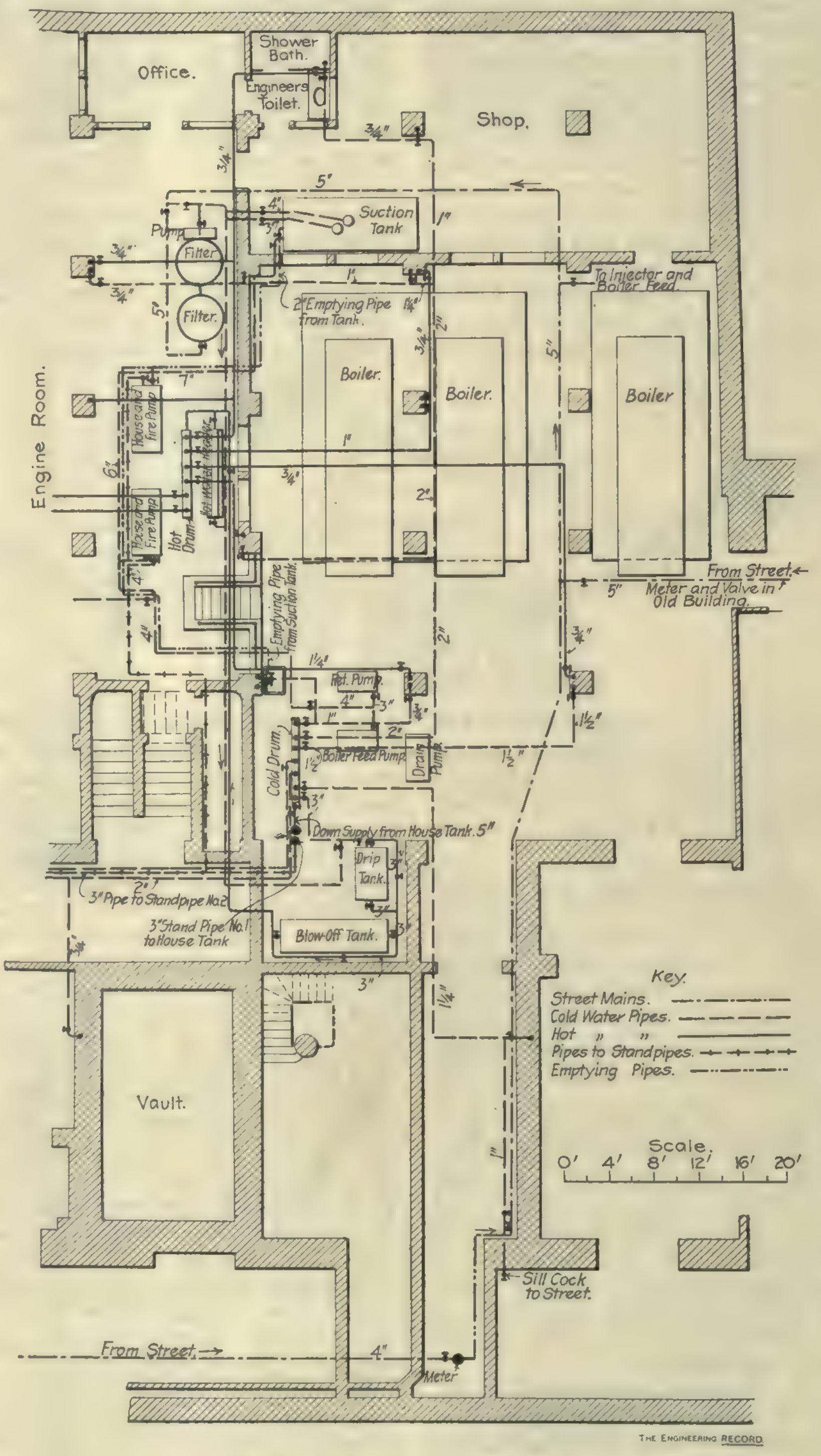
Roof Tanks.

The hot water from the heater flows into a distributing drum with six valved outlets, from which branches are run to the basement fixtures and to the riser lines for the upper stories. These are all valved at the foot and at the top are connected with return circulation pipes which enter a basement header connected to the inlet of the heater. There is an expansion pipe from the highest point of the system to a point above the main house tank. All hot-water pipes are of brass and have expansion loops in the vertical risers. The hot-water system in the janitor's apartments on the roof is connected to the main house supply, and to the range boiler in the kitchen. The hot-water tank is provided with a thermostat to regulate the steam supply automatically, and was tested to a hydrostatic pressure of 150 pounds per square inch. It is covered with Keasbey's magnesia blocks, 1½ inches thick, wired on, and a jacket of No. 10 canvas, painted three coats of white fireproof paint. Independently of the high and low-pressure steam connections to its coil, the heating tank is designed to be operated by a Tobey automatic heater, which is not shown in the diagram.

There are, in the new building, about 300 fixtures, including 50 water closets, 37 urinals, 182 wash-basins, 3 sinks, 16 slop-sinks, 1 bath-tub, 2 wash-tubs, 1 refrigerator, 1 range, 1 range boiler and 1 shower-bath. All are set open, and each is supplied through ¾-inch hot and cold-water branches with air chambers and cut-off valves close to the fixtures. In the lower stories the valves are throttled to reduce the excessive pressure from the house tank. Local vents from the water-closets are connected to the ventilation ducts from the toilet rooms, which lead to a roof chamber where an exhaust fan is installed.

All soil and drain pipes are accessible throughout, with clean-outs having extra heavy brass screw-caps. All connections to soil and waste risers are made with T-Y fittings, and all iron fixture traps are porcelain lined. Valves under 2 inches in diameter are brass globe-valves; all larger ones are gate-valves, made of steam metal and having iron bodies for sizes above 4 inches. All valves and cocks, except those close to their respective fixtures, are tagged and numbered to correspond with a framed chart. All hot-water pipes and such cold-water pipes as are very near to them or are exposed to frost, are covered with best quality hair felt and No. 10 canvas sewed on, finished with brass rings and painted two coats of white lead. Where such jacketing is not practicable these pipes and exposed leaders are packed with mineral wool in galvanized-iron boxes with slip covers.

The basement and areas have floor strainers over cast-iron boxes, which are trapped into buried cast-iron pipes discharging into collecting tanks, which are, in turn, emptied into the sewer by drain-pumps and ejectors with automatic operating devices. All drain and vent pipes were tested by filling with water to the roof level, and where practicable by an air pressure of 20 inches of mercury, which was required to be maintained without further pumping for five minutes without showing more than ½-inch fall in the mercury column. After all fixtures were set, the whole system was finally tested with peppermint. The fixtures in the original building have been removed and the pipes connected with the apparatus here described in the new building, without interrupting the daily service to offices and tenants.



Plan of Water Distribution System.

Messrs. Ernest Flagg and George M. Bartlett were the architects, Mr. O. F. Semsch was the architects' designing engineer for the plumbing, heating, electric lighting and power plants. Mr. W. A. Payne was the architects' superintendent, and Mr. John Boyd, of New York, was the contractor for the plumbing.

Trade Publications.

> "The working engineer's library is sometimes largely composed of manufacturers' ephemeral catalogues and lists of prices current of materials." James Mansergh, president, Institution of Civil Engineers.

The Ideal boilers made by the American Radiator Co., Chicago, are described in a handsomely published catalogue of 72 pages which is unusually well illustrated. The company refuses under any circumstances to furnish plans or estimates of heating plants for owner, architect or contractor, and its catalogue is confined almost wholly, in consequence, to an explanation of its product, which ranges from small tank heaters to large boilers; there is, however, an interesting chapter on chimney construction.

The concrete mixer manufactured by T. L. Smith, 134 Tenth St., Milwaukee, is well described in a new circular he has just issued. The mixer is a drum formed by placing two truncated cones base to base, and fitting the interior with blades. On revolving the drum, the blades mix the materials fed in at one end and transfer them to the other. The apparatus is made in three sizes and mounted in various ways for stationary or portable use.

The Herculean arch of semi-porous terra-cotta blocks, bedded in concrete and strengthened with T-iron, and the Phoenix terra-cotta partitions, strengthened with strap iron, are described in a pamphlet issued by Henry Maurer & Son, 420 East 23d St., New York. The results of a number of tests of the strength of these systems of construction are also given.

The many varieties of steam hot-blast heating and drying apparatus made by the B. F. Sturtevant Co., Boston, are described in a 54-page circular just out. It is 30 years since Mr. Sturtevant built his first hot-blast equipment, and since then the system has been improved and extended until the mere list of types is a long one. In addition to describing these the new catalogue contains many tables useful in designing hot-blast plants.

The new Walker boiler for hot-water and steam heating, made by the Walker & Pratt Mfg. Co., 31-35 Union St., Boston, is described in a well-illustrated catalogue explaining its construction in much detail. It is made in three widths of firebox, and 19 sizes are listed, while others can be supplied if desired. The sections are connected by tapered push-nipples of malleable iron, covered with a copper coating, and no drums are employed.

The Whitlock Coil Pipe Co., Hartford, Conn., has issued a number of folders concerning steam specialties of interest to engineers and architects. One describes a heater for warming water by either live or exhaust steam, and ranging in capacity from 150 to 2,000 gallons per hour, raised to the temperatures usually required in hotels, paper mills and like situations. Other folders describe the American separators and American Standard feed-water heaters.

People interested in the early history of science, when it was hardly worthy of the name, should read a well-printed little brochure to be had from Baker & Co., Newark, N. J., on the alchemistic symbols. It was written by Jas. Lewis Howe, of Washington and Lee University.

The Dimmick Pipe Co., Birmingham, Ala., has issued a folder giving the dimensions and weights of its standard cast-iron bell and spigot pipe. In the case of water pipe the thicknesses are given for heads of 100, 200 and 300 feet, and the amount of hemp and lead per joint are also stated.

A catalogue describing many varieties of wire rope for different purposes has just been issued by the Hazard Mfg. Co., Wilkes-Barre, Pa., which also contains a number of excellent engravings of structures fitted with these ropes, such as inclined planes, enormous cranes and various vessels, among the last being the yacht Constitution. The company recently extended its works, established in 1848, so as to make bare copper wire and insulated wire and cables, and another catalogue gives some interesting views of the rooms and apparatus employed for the purpose.

The milling machine is probably the tool which is now receiving the greatest attention from shop managers, for its utility in jobbing work has only recently been given due consideration. A valuable catalogue of numerous types of these tools, profusely illustrated, has just been issued by the Kempsmith Mfg. Co., Milwaukee, Wis.

The Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York, has issued a number of booklets which deserve mention, although the company says they are simply intended to bring about business correspondence. Two refer to air lift installations for raising water, one describes different types of channelers and quarrying machinery, two are devoted to rock drills, and four contain useful articles on the use of compressed air in shops.

The Darling Pump & Mfg. Co., Williamsport, Pa., has issued a 24-page bulletin containing the portions of its forthcoming catalogue referring to gate valves of 300 pounds test pressure, fitted with double revolving gate disks, compound equalizing wedges and parallel seats. The construction of the special features is fully described and full dimensions given.

The Fort Wayne Electric Works, Fort Wayne, Ind., have issued a well-illustrated bulletin describing different types of searchlight projectors, and another on series enclosed arc lamps for direct-current circuits. The latter will be found particularly useful by all who have occasion to use strong lights indoors, as it describes, among other types, lamps designed particularly for shop and mill use.

Personal Notes.

Mr. C. J. Randall has joined the engineering corps of the Pittsburg & Lake Erie Railroad.

Mr. Jeremiah O'Shaughnessy has been appointed superintendent of water-works of Columbus, O.

Mr. Francis B. DeGress has been appointed manager of the New York offices of the Crocker-Wheeler Company at 39 Cortlandt Street.

Mr. W. G. Gregory has resigned as city engineer of Shenandoah, Pa., and is succeeded by Mr. M. D. Bowman, of Mahanoy City, Pa.

Mr. Harry Moore, formerly president of the Pittsburg & Birmingham Traction Company, has been appointed superintendent of the Bureau of Highways and Sewers of Pittsburg.

Mr. N. M. Peterson, who has been in charge of the Columbus plant of the National Steel Company for the past thirteen years, has been appointed superintendent of the Bellaire and Mingo Junction, O., plants of the United States Steel Corporation.

Mr. F. D. Casanave has resigned as superintendent of motive power of the Pennsylvania Railroad lines east of Pittsburg and Erie to become mechanical superintendent of the Baltimore & Ohio system, with headquarters at Mount Clare Station, Baltimore. He succeeds Mr. I. N. Barr, who is now mechanical superintendent of the Erie Railroad.

The following nominations have been made by the nominating committee of the American Society of Civil Engineers for officers to be elected January 15, 1902: President, Robert Moore, St. Louis; vice-presidents, Charles C. Schneider, New York, and John R. Freeman, Providence; treasurer, Joseph M. Knap, New York; directors, W. J. Wilgus, New York; George H. Pegram, New York; Richard S. Buck, New York; William Jackson, Boston; E. F. Van Hoesen, Amsterdam, N. Y.; James L. Frazier, San Francisco.

The following candidates for admission to the different grades of membership in the American Society of Civil Engineers were announced elected October 2: Members: H. R. Asserson, chief engineer of sewers, Brooklyn; F. E. Baxter, engineer, Rio Grande Western Railway, Springville, Utah; O. Claussen, city engineer, St. Paul, Minn.; J. F. Coleman, Coleman & Malochée, New Orleans; T. L. Condron, Chicago; H. S. Crocker, Board of Public Works, Denver; A. L. Dabney, Yazoo Delta Levee District, Clarksdale, Miss.; A. R. Eldridge, Chicago, Burlington & Quincy Railroad, Chicago; C. L. Fitch, New York City; E. G. Harris, University of Missouri, Rolla, Mo.; Henry Holgate, Toronto, Ont.; F. M. Kerr, assistant State engineer, New Orleans; C. A. Knowlton, Santiago de Cuba; J. A. McKim, Haugh-Noelke Iron Works, Indianapolis; H. C. Smith, Philadelphia, Wilmington & Baltimore Railroad, Media, Pa.; C. H. Snyder, Milliken Bros., Honolulu, T. of H.; L. B. Stillwell, Rapid Transit Subway Construction Co., New York; C. W. Sturtevant, U. S. assistant engineer, Memphis, Tenn.; T. U. Taylor, University of Texas, Austin, Tex.; C. H. Tutton, Grattan & Jennings, Buffalo, N. Y.; H. H. Wadsworth, U. S. assistant engineer, West Superior, Wis.; Paul Willis, Kenwood Bridge Co., Chicago. Associate members: C. M. Ayres, Black Warrior River Construction, Tidewater, Ala.; J. W. Cowper, Jas. Stewart & Co., Manchester, England; Harold Davis, Brennan Construction Co., Washington, D. C.; D. Y. Dimon, American Bridge Co., Pencoyd, Pa.; J. N. Ferguson, Metropolitan Water-Works, Boston; C. C. FitzGerald, Cincinnati, New Orleans & Texas Pacific Railway, Lexington, Ky.; R. P. Garrett, Board of Public Improvements, St. Louis, Mo.; A. H. Green, Chicago, Milwaukee & St. Paul Railway, Chicago; Alexander Haring, Detroit Bridge & Iron Works, Detroit; Curtis Hill, R. H. Phillips, St. Louis; J. J. Knoch, University of Arkansas, Fayetteville, Ark.; R. G. Manning, American Bridge Co., Toledo, O.; F. L. Marston, Bangor, Me.; J. W. Miles, Alvarado Railway, Vera Cruz, Mexico; C. H. Moritz, Shawinigan Water & Power Co., Shawinigan Falls, Que.; E. W. Myers, North Carolina Geological Survey, Chapel Hill, N. C.; O. S. Osborn, Kansas City, Mexico & Orient Railway, Chihuahua, Mex.; A. A. Robbins, Rapid Transit Subway Construction Co., New York; J. A. Sargent, Department of Cuba, Havana; A. H. Smith, American Bridge Co., Toledo, O.; W. M. Smith, U. S. Engineer Office, Portland, Me.; A. M. Todd, Yazoo Levee District, Greenville, Miss.; J. W. Tower, Great Northern Paper Co., Millinocket, Me.; Willis Whited, Department Public Works, Pittsburg; W. D. Wiggins, Cincinnati & Muskingum Valley Railroad, Zanesville, O.; C. P. Williams, Ft. Williams, Portland, Me. Associates: I. P. Church, Cornell University, Ithaca, N. Y.; A. V. Saph, Cornell University, Ithaca; S. M. Turrill, Ithaca. Juniors: Arthur Adams, Ithaca; C. B. Brown, Ithaca; W. C. Bunnel, Charleston, S. C.; M. W. Hall, New York; E. C. Hayden, Everett, Mass.; J. Y. Higginson, New York; C. S. Lambie, Pittsburg; C. J. Myers, Atlantic City, N. J.; C. W. J. Neville, Ithaca, N. Y.; E. W. Schoder, Ithaca; M. deK. Smith, Jr., Chestertown Md.; W. A. Thompson, Mobile, Ala.; W. H. Waugh, Havana, Cuba; J. R. Whelpley, Washington, D. C.; H. S. Wilgus, Buffalo; R. B. Williams, Jr., Ithaca.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND
MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Newark, N. J.—Bids are wanted Oct. 17 for constructing an outlet tunnel from Cedar Grove Reservoir, in Vernon and Montclair, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Oct. 26 for furnishing and erecting pumps for vertical triple-expansion pumping engine, as advertised in The Engineering Record.

Lexington, Mass.—Bids are wanted Oct. 11 for building a collecting basin, a dug well and laying cast iron water pipes, as advertised in The Engineering Record.

Cleveland, O.—Bids are wanted Oct. 10 for furnishing and erecting a traveling crane, having 25 tons capacity, in the engine house of the Kirtland St. pumping station. Bids will also be received Oct. 24 for furnishing material and building a brick chimney and connecting same with smoke flue in boiler house No. 4, Division St. pumping station. Chas. P. Salen, Dir. Pub. Wks.

Guthrie, Okla. Ter.—City Engr. T. A. White writes that he will receive bids until Oct. 10 for the construction of 3 wells 20 ft. in diameter and 40 ft. deep; also repairs to one well now in use. Wells to have steel shoe and brick crib and be connected by drain pipe, syphon or pump.

Nampa, Idaho.—City Clk. John H. Hart writes that it was voted Sept. 24 to issue $9,000 bonds for water-works.

Oakland, Ore.—City Recorder P. Beckely writes that a preliminary survey has been made for the proposed water-works.

Port Dickinson, N. Y.—Village Clk. E. H. Smith writes that on Sept. 28 it was voted to issue $10,000 bonds for the purpose of purchasing and laying water pipes.

Fullerton, Neb.—City Clk. C. F. Bake writes that it was voted on Sept. 23 to issue $6,000 bonds for water-works extensions.

Milwaukee, Wis.—City Engr. Chas. J. Poetsch writes that the contract, for furnishing 600 tons of 3, 6 and 12-in. cast iron pipe for water mains, has been awarded to the U. S. C. I. Pipe & Fdy. Co., of Chicago, at $26.50 per ton; the contract for 50 tons of 8-in. pipe was awarded to the same firm at the same price.

Garretson, S. D.—City Aud. E. E. Rodabaugh writes that the contract for constructing water-works has been awarded to J. L. White, of Peru, Ill.

Rockhampton, Queensland, Australia.—Plans and estimates, prepared by City Engr. Herbert E. Bellamy for a new water supply, were adopted Aug. 21. They call for 5,874 tons of 15 and 18-in. pipe; 130 tons pig lead, sand filters of a daily capacity of 1,500,000 imperial gals.; a 2,-500,000-gal. reservoir; a dam estimated to cost $102,500, and a pumping plant to cost $67,500.

Russell, Mass.—Henry L. Norton, of Springfield, Mass., Engr. in Charge, writes that bids will be wanted very soon for the construction of water-works, estimated to cost $8,000.

Marion, Va.—W. G. McDonald, of Lexington, has made a survey for water-works for this place.

Cambridge, Minn.—Village Recorder P. M. Torell writes that it was voted Sept. 17 to issue $11,500 bonds for a water system.

Dickson, Tenn.—Mayor G. A. Slayden writes that on Sept. 24 it was voted to issue $35,000 bonds for water-works and an electric light plant.

Chisholm, Minn.—This vallage has engaged Thos. G. McGilvray, of Duluth, to draw plans and specifications for its new water system.

El Dorado Springs. Mo.—This place has voted bonds for the construction of a system of water-works and sewers. Burns & McDonnell, Cons. Engrs., Kansas City, Mo.

Marysville, Wash.—The Council has granted S. T. Smith a 50-year water-works franchise.

Spokane, Wash.—Articles of incorporation have been filed by the Wallace Light & Water Co., with a capital of $125,000. The headquarters of the company will be at Spokane. Incorporators: E. J. Dyer, Robert E. Straborn, and R. J. Danson.

Winona, Minn.—The Council Committee is stated to have estimated the cost of water-works at Sugar Loaf as $23,000, for meters $1,000, and water main extensions at $5,000.

Buffalo, Minn.—There is talk of a village water-works and electric light plant.

Plymouth, O.—J. E. Weddell, of Mansfield, O., is stated to have been engaged to prepare plans and specifications for the proposed water-works, for which $20,000 bonds were recently voted. Jno. H. Beelman, Clk.

Wagoner, Ind. Ter.—This town is stated to have voted to issue $100,000 bonds for water-works.

Hazlehurst, Miss.—A correspondent writes that $35,000 bonds have been voted for water-works and an electric light plant. It is probable that bids will be opened about Nov. 1 for the construction of works. E. M. Cook, Mayor.

Atlantic City, N. J.—The issue of $70,000 bonds is stated to have been authorized to build a water station.

Muskogee, Ind. Ter.—Press reports state that $150,000 water-works bonds have been voted.

Wilmington, Del.—The Water Department of Wilmington is said to be preparing plans for a 200,000,000-gal. reservoir to be located in the 9th Ward, and 89 acres of land have been purchased as a site for same; cost, $42,000.

Charlotte, Mich.—City Clk. De Foe writes that at the election held Sept. 30 it was voted to issue $20,000 bonds for the extension and improvement of the water-works and $30,000 bonds for a sewer system.

Lisbon, O.—This place is stated to have voted favorably on the question of issuing $5,000 bonds to improve the water-works system.

Madison, Neb.—City Clk. Clyde G. Rynearson writes that on Sept. 24 it was voted to issue $5,500 bonds for constructing a standpipe and extending water mains.

Oswego, N. Y.—The proposition to bond the city for $550,000 for the purchase of the plant of the Oswego Water-Works Co. was carried at the election held Sept. 24.

Bath, Pa.—The proposition to issue $20,000 water bonds is stated to have carried.

Scammon, Kan.—Burns & McDonnell, of Kansas City, Mo., have been engaged to prepare plans and specifications for a system of water-works for this city.

Farmersville, Tex.—The proposition to issue $12,000 water-works bonds is stated to have carried.

Springfield, O.—Bids are wanted Oct. 16 for furnishing on board cars, at the water-works pumping station, approximately 2,000 lin. ft. of 24-in. double strength salt glazed vitirfied pipe, including the necessary Ys, branches, curves, etc.; 14,000 lin. ft. of 6-in. soft tile pipe; 1,000 lin. ft. of 30-in. light cast iron pipe, including the necessary special castings, and for the laying of said pipe and appurtenances. J. C. Keller, Pres. Water Trustees; J. D. Cook, Consulting Engr., Toledo, O.

Mt. Pleasant, S. C.—Bids are wanted for an artesian well, 1,250 ft. deep, 6-in. at bottom; also for depth of 2,000 ft. 6-in. at bottom; to supply water-works for the town. Address, R. V. Royall, Town Intendant.

Austin, Tex.—Local press reports state that the city has purchased the plant of the Austin Water, Light & Power Co. for $175,000.

Sullivan, Ind.—The City Council has voted to receive propositions for a new water supply. It is proposed to pipe water from Wabash River, 10 miles west of the city.

Springdale, Ark.—It is stated that an engineer is about to be engaged to survey the town for water-works. J. P. Deaver, Chmn. of Com.

Barberton, O.—Press reports state that 5 or 6 artesian wells are to be drilled.

Washington, Pa.—The Citizens' Water Co. is stated to have let the contract for a dam to be erected at a cost of $50,000, about 2½ miles south of town, to Latta & Terry, of Philadelphia.

Waco, Tex.—Chester B. Davis, of New York City, in a recent report on the water supply of Waco, recommends the Bosque River, 3 miles from the city, as the best source, and estimates the cost of building the plant at $305,000.

Reading, Pa.—The Water Board and the Councils' Filtration Committee have decided to recommend for Council's approval the adoption of the slow sand system for the purification of the Antietam water, and request its ratification of the award for the erection of a slow sand filtration plant to H. E. Ahrens & Bro., at $39,713.

Waterloo, Ind.—Press reports state that it is proposed to construct water-works and electric lights.

Dublin, Ga.—Bids are wanted Oct. 10 for $25,-000 water, light and school improvement bonds. A. T. Summerlin, Mayor.

Wickford, R. I.—The Wickford Light & Water Co. has been organized with a capital of $150,-000. Pres., Thos. F. I. McDonnell; Vice-Pres., Dr. Harold Metcalf; Director, J. Herbert Shedd.

Bradford, Pa.—The South Bradford Water Co. has been chartered at Harrisburg. Capital, $10,-000.

Appleton, Wis.—Press reports state that the Water-Works Construction Committee has adopted plans for the new water-works. Work on the plant, which is to cost over $200,000, is to be commenced as soon as possible.

Ft. Collins, Colo.—Local press reports state that the North Poudre Irrigation Co. proposes to make improvements, including the construction of reservoirs and a dam, to cost in all about $200,000.

Washington, D. C.—Local press reports state that the Commissioners D. C., have decided to readvertise for bids for the steam generating plant for Trumbull St. pumping station.

Merrillan, Wis.—Plans and specifications for water-works, an electric light plant and a sewer system are now being prepared by Sturtevant & Todd, Consulting Engineers, 1208 Fisher Bldg., Chicago. The letting will probably be Oct. 22, if a second election, to be held Oct. 15, results favorably.

Denver, Pa.—The following bids for furnishing material and constructing a gravity water-works system, including 250,000-gal. reservoir, were opened Sept. 24 by Borough Council: Hawman Bros., Reading, Pa., $14,437; W. G. Fritz, Quarryville, Pa., $12,231 (awarded); P. Frank Hawman, Reading, Pa., $13,586; J. F. Ward, Harrisburg, Pa., $21,626.

New York, N. Y.—The following bids were opened Oct. 1 by the State Bd. of Commrs. of Quarantine for standpipe, piping to buildings and pumping machinery at the Upper Quarantine Station, Hoffman's Island: Ralph B. Carter, 26 Cortlandt St., N. Y. City, $6,820, to whom award of contract is recommended; Kelly & Kelly, 45 E. 42d St., $6,900; Frank Rinschler, Stapleton, Staten Is., $7,800. The lowest bid provided for deductions of $475, $3,800 and $1,150 if the pump house, standpipe or water supply and hydrants, respectively, were omitted.

SEWERAGE AND SEWAGE DISPOSAL.

Ridgefield, Conn.—Bids are wanted Oct. 16 for constructing a system of sewers, also sewage filter beds and appurtenances, as advertised in The Engineering Record.

Portland, Me.—Bids are wanted Oct. 10 for constructing about 565 ft. of 36 x 54-in. pipe sewer, as advertised in The Engineering Record.

Portland, Me.—Separate bids are wanted Oct. 7 for furnishing 450 casks of cement and 70,000 bricks for use on the Commercial St. intercepting sewer. Geo. N. Feranald, Commr. of Pub. Wks.

Aurora, Ill.—Bids will be received Oct. 7 for a small amount of sewer and water connections, preparatory to the paving in the spring of W. Park Ave. and S. 4th St., comprising about 2 miles of asphalt paving. M. G. Stolp, Public Engr.

Buffalo, N. Y.—Bids are wanted Oct. 10 for 27, 30, 36, 39, 42, 45, 48 and 63-in. brick and 20-in. tile sewer in Mumford and Cumberland Aves. R. G. Parsons, Sec'y Bd. Pub. Wks.

Columbus, O.—Bids are wanted Oct. 8 for constructing 8 and 15-in. pipe sewers in several alleys. Clarence M. Addison, Clk. Bd. Pub. Wks.

Toledo, O.—Bids are wanted Oct. 14 for 8, 10 and 12-in. circular pipe sewers in 3 streets. John E. Connell, City Clk.

Beaumont, Tex.—City Sec'y T. C. King writes that contracts will be let in a few weeks for sewers to cost $75,000.

Torrington, Conn.—Burgess W. H. Dayton writes that the contract for sewer construction, including 3,500 ft. of pipe, 7 manholes and 17 catchbasins, has been awarded to Seymour & Newell, of Springfield, Mass., for $7,652.

Kansas City, Mo.—It is stated that bids are wanted Oct. 9 for constructing sewers in 26 joint sewer districts. Robt. W. Waddell, City Engr.

Phoebus, Va.—Press reports state that contracts are about to be let for the construction of a system of sewerage.

Vermilion, S. D.—Petitions have been circulated asking the City Council to take immediate steps toward establishing a suitable system of drainage for the city.

Kansas City, Mo.—Local papers state that bids have again been asked for constructing the extension of O. K. Creek sewer from 25th St. and Fairmount Ave., a distance of 11,000 ft. Robt. W. Waddell, City Engr.

Muskogee, Ind. Ter.—Press reports state that $25,000 bonds have been voted for sewerage.

Cass City, Mich.—The Village Council has decided to have made a complete survey for a system of sewerage.

Indianapolis, Ind.—The Superintendent of Streets recommends that Kentucky Ave. sewer be extended at a cost of $10,000.

Syracuse, N. Y.—Bids are wanted Oct. 7 for furnishing material and constructing a 12-in. pipe sewer in Pond St. Jos. H. Saunders, City Clk.

Lockport, N. Y.—Bids are wanted Oct. 7 for 3,400 ft. of 10, 12, 15 and 18-in. tile drain in Lock St. and Richmond Ave.; also for 2,150 ft. of 10, 12, 18 and 20-in. drain, including 6-in. water pipe, in Irving and W. High Sts. Julius F. Frehsee, City Engr.

Oelwein, Ia.—The contract for constructing a system of sewers has been awarded to E. L. Du Bois, of Des Moines, for $15,631.

West Haven, Conn.—At a recent citizens' meeting it was voted to engage a competent engineer to prepare plans and make a map for the proposed sewerage system, the septic system of intermittent filtration, having been selected, according to local press reports.

Plain City, O.—The City Council has granted a 20-year franchise to the Ohio Construction Co. to put in a system of sanitary sewerage. It is estimated that between three and four miles of sewers will be required.

Merrillan, Wis.—See "Water."

Medford, Mass.—The Commissioners of Sewers have ordered the construction of a surface sewer for the district north of Pasture Hill. Wm. Gavin Taylor, City Engr.

New York, N. Y.—Bids are wanted Oct. 16 for constructing a sewer and appurtenances in 182d St., Boro. of Bronx; for sewers in several streets in Brooklyn Boro., and for a sewer in Broadway and the erection of a disposal plant in connection with same, Boro. of Queens. Jas. Kane, Commr. of Sewers.

Cincinnati, O.—Bids are wanted Oct. 15 for constructing sewers and drains in a portion of Forest Ave. Geo. F. Holmes, Clk. Bd. Pub. Service.

Wilkinsburg, Pa.—Bids are wanted Oct. 10 for constructing a brick arch culvert on Todd St. and Penn Ave. Frease & Sperling, Boro. Engrs.

St. Paul, Minn.—Bids are wanted Oct. 10 for constructing a sewer in a portion of Charles St. C. H. Bronson, Clk. Bd. Pub. Wks.

Burlington, Ia.—Bids are wanted Nov. 4 for constructing the main Hawkeye sewer from Jefferson to Washington Sts. Emmet Steece, City Engr.

Toronto, Ont.—The Municipal Council has given notice of intention to construct disposal works for pumping sewage from the sewers proposed to be laid in the neighborhood of Indian Road into the existing city sewers at King St., also to construct sewers upon Indian Road, Cherry (Fern) Ave., Fermanagh Ave., and in High Park. This work includes both brick and tile pipe sewers, and the total estimated cost is $31,535. W. A. Littlejohn, City Clk.

Sheridan, Ind.—The Board of Town Trustees has passed a resolution for the construction of a sewer system to include 8,253 ft. of 15 and 24-in. tile main sewers and 4,131 ft. of 10 to 15-in. tile branch sewers. D. J. McMath, Clk.

St. Louis, Mo.—Bids are wanted Oct. 11 for constructing sewers in Fillmore St. Sewer Dist. No. 2, embracing 1,060 ft. of 7-ft., 670 ft. of 6.5-ft., 660 ft. of 5-ft., 1,030 ft. of 3.5 x 4.5-ft., 1,370 ft. of 3 x 4-ft., 3,660 ft. of 2.5 x 3.5, and 1,970 ft. of 2 x 3, brick sewer; and 1,150 ft. of 24-in., 1,510 ft. of 21-in., 5,440 ft. of 18-in., 18,460 ft. of 15-in. and 11,600 ft. of 12-in. pipe sewer. Hiram Phillips, Pres. Bd. Pub. Improvements.

El Dorado Springs, Mo.—See "Water."

Lowell, Mass.—Superintendent Bradley estimates the cost of a brick sewer in Court St. at $7,990, and a brick sewer in Central and Chapel Sts., at $4,076.

Peoria, Ill.—City Engr. H. E. Beasley writes that plans are now being prepared for the construction of the east bluff sewerage system.

Manchester, Conn.—A sanitary and sewer district has been organized under a charter which gives the district the right to construct sewers within the territory covered by the eighth school district. Pres., John T. Robertson; Sec'y, Thomas Ferguson; Treas., W. E. Hibbard. It is stated that an engineer will be engaged to prepare plans and estimates.

Denver, Colo.—Health Commissioner Clough is said to be considering plans for disposing of city sewage, which now flows into the Platte River.

Providence, R. I.—A resolution is before the Council for the construction of a brick tunnel sewer 40 ins. in diameter, 15 to 50 ft. in depth, length 4,000 ft.

Syracuse, N. Y.—The Common Council has taken unanimous action for the construction of a trunk sewer along Onondaga Creek. The diameter of the outlet to be 88 ins.

Roswell, N. Mex.—It is stated that bids are wanted Oct. 31 for $35,000 bonds to be used to construct a sewerage system. Sam'l Atkinson, Town Clk.

Newark, N. J.—The Board of Street & Water Commissioners has passed an ordinance providing for the construction of a brick sewer in Bank and Wickliffe Sts. Geo. M. Ballard, Pres. of Bd.

Jersey City, N. J.—Bids are wanted Oct. 8 for a sewer in Newkirk St. Estimated quantities: 2,430 lin. ft. of 36-in. cast-iron sewer; 810 lin. ft. of 30-in., and 212 lin. ft. of 24-in. circular brick sewer; 500 lin. ft. of 18-in. vitrified pipe sewer; 3 special steel connections; 3,120 cu. yds. rock excavation, etc. Bids will also be received on the same day for a sewer in McAdoo Ave., requiring 1,480 lin. ft. of 24-in. and 800 lin. ft. of 36-in. brick sewer; 20 lin. ft. 18-in. vitrified pipe sewer; 1,500 cu. yds. rock excavation, etc. Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

Charlotte, Mich.—See "Water."

Boston, Mass.—Bids were opened Sept. 27 by the Metropolitan Water & Sewerage Board for building 9 sections of the High Level sewer in Quincy and Milton, and contracts for same have been awarded as follows: To C. G. Belden & Co., of Quincy, Mass., Section 47 at $95,796 and Section 50 at $94,169; to the National Contracting Co., New York City, Section 52 at $167,376, Section 53 at $99,502 and Section 54 at $93,936; to J. W. Bustin & Co., Syracuse, N. Y., Section 57 at $58,849 and Section 60 at $53,453; to Latta & Terry Co., 1001 Chestnut St., Philadelphia, Pa., Section 58 at $81,097; to H. P. Nawn, of Boston, Section 59 at $100,116.

Camden, N. J.—The City Engineer writes that the following bids were opened Sept. 24 for sewer construction in portions of Liberty St., Haddon, Kaighn, Kenwood and Lansdown Aves.: Bidders—A, Aaron Ward; B, P. J. Farley; C, B. F. Sweeten & Son, Camden (awarded); D, Blowe & Mines; E, Wm. Thompson:

Items and Quantities.	A	B	C	D	E
Sewer, 3 ft. 6 in. x 3 ft. 6 in.	$3.91	$3.90	$4.25	$4.31	$5.90
Sewer, 3 ft. 6 in. x 2 ft, 4 in.	2.89	2.92	2.97	3.49	3.60
Sewer, 3 ft. 3 in. x 2 ft. 2 in.	2.13	2.10	1.67	2.21	2.50
Sewer, 3 ft. 0 in. x 2 ft. 0 in.	2.55	2.50	2.18	2.58	2.60
Sewer, 2 ft. 9 in. x 1 ft. 10 in.	2.71	2.80	2.91	3.05	3.50
Pipe, 15-in.	.85	.81	.87	.77	1.10
Pipe, 12-in.	.67	.58	.69	.63	1.00
Pipe, 10-in.	.56	.50	.60	.53	.90
Pipe, 8-in.	.45	.32	.50	.42	.80
Ys, 6-in.	.65	.60	.80	.50	.70
Ys, 8-in.	.95	.80	1.00	.70	.90
Ys, 10-in.	1.25	1.07	1.17	.98	1.00
Ys, 12-in.	1.55	1.35	1.54	1.26	1.25
Ys, 15-in.	2.10	1.90	2.08	1.95	2.00
Slants, 6-in.	.34	.30	.42	.35	.50
Slants, 8-in.	.41	.40	.45	.47	.60
Slants, 10-in.	.55	.73	.80	.77	.70
Slants, 12-in.	.69	.85	1.00	.89	1.00
Slants, 15-in.	.97	1.10	1.30	1.25	1.40
Breeches pipe, 6-in.	.87	.98	1.25	.85	1.00
Breeches pipe, 8-in.	.99	1.12	1.35	1.00	1.20
Manhole	15.00	19.50	20.00	19.50	20.00
Iron inlet	55.00	54.00	58.00	56.00	60.00
Brick inlet	38.00	23.00	35.00	20.00	.....
Concrete, per cu. yd.	4.50	5.50	6.00	7.00	.....
Plank and cradle, 3 ft. 6 in. sewer	.45	.90	1.30	1.50	.....
Plank and cradle not sewer.	.40	.70	1.15	1.00	.....

Other contracts, for which bids were opened at the same time, have been awarded as follows:

To B. F. Sweeten & Son, sewers in portions of five streets at the following prices: sewer, 16 x 24, $1.15; 20 x 30, $1.40 and $1.28; pipe, 12-in., 96 cts., 63 cts. and 69 cts.; 10-in. at 60 cts.; 8-in. at 50 cts.; Ys, 6-in. at 80 cts. and 42 cts.; 8-in., $1; 10-in., $1.17; 12-in., $1.54; manholes, $18 in brick, $21 in pipe; iron inlet, $60; 6-in. slant, 42 cts.

To Aaron Ward, of Camden, sewers in portions of four streets at the following prices: sewer, 20 x 30, $1.09; 16 x 24, $1.05 and $1.03; pipe, 12-in. at 67 cts.; 10-in. at 56 cts.; 8-in. at 45 cts.; Ys, 6-in. at 65 cts.; 8-in., 95 cts.; 10-in., $1.25; 12-in., $1.55; 15, 18 and 20-in. Ys for sewer in one street at $2.10, $2.75 and $3.50, respectively; manholes, $15; 6-in. slant, 34 cts.; iron inlet, $55.

To P. J. Farley, sewers in portions of two streets at the following prices: sewers, 16 x 24, $1.10 in one street, $1.05 and $1.45 in the other street; 20 x 30, $1.65; pipe, 12-in., 58 cts.; 10-in., 50 cts.; 8-in., 32 cts.; Ys, 6-in., 60 cts.; 8-in. 80 cts.; 10-in., $1.07; 12-in., $1.35; manholes, $19.50; 6-in. slant, 30 cts.; iron inlet, $54.

To Blowe & Mines, sewers in portions of four streets at the following prices: sewer, 16 x 24, $1.05, $1.01 and $1.08; 20 x 30, $1.45 and $1.40; pipe, 12-in., 63 cts.; 10-in., 55 cts.; 8-in., 42 cts.; Ys, 8-in., 70 cts.; 6-in., 50 cts.; 10-in., 98 cts.; 12-in., $1.26; 6-in. slant, 35 cts.; manholes, $15; iron inlet, $56.

BRIDGES.

Kingman, Kan.—Bids are wanted Oct. 8 for constructing 3 county bridges. W. R. Long, Co. Clk.

Rossville, Ind.—Bids are wanted Oct. 7 for repairing Masters bridge, located ½ mile south of Rossville. Wm. H. Jenkins, Chmn. Co. Commrs., Frankfort.

Michigan City, Ind.—Bids are wanted Oct. 22 for furnishing material and constructing a draw bridge across the harbor at Michigan City. F. H. Doran, Co. Aud., Laporte.

Liberty, Ind.—Bids will be received by the County Commissioners until Oct. 7 for constructing the superstructure of a 50-ft. iron bridge. Milton Maxwell, Co. Aud.

Chicago, Ill.—The Council's Track Elevation Committee is considering the preliminary plans for the elevation of 30 miles of track, with 34 subways. The companies involved are the Grand Trunk, Terminal Transfer, Panhandle, Chicago Junction and Michigan Central.

Blackfoot, Idaho.—Bids will be received by the County Commisioners until Oct. 14 for repairing the wagon bridge across Snake River near Blackfoot. Geo. F. Gagon, Clk.

Matanzas, Cuba.—See "Paving and Roadmaking."

Newberry, Pa.—The County Commissioners of Williamsport have approved the report of viewers for a bridge to cross Susquehanna River between Newberry and Duboistown. Estimated cost, $90,000.

Washington, D. C.—W. J. Douglas, Engr. of Bridges, D. C., writes that the contract for constructing a Melan arch bridge (steel ribs to be furnished by the District) has been awarded to Talty & Allen, of Washington, for $14,890. The contract for furnishing arched ribs (delivered in 30 days) has been awarded to the Penn Bridge Co., of Beaver Falls, Pa., for $987.

Phoenixville, Pa.—See "Electric Railways."

Oswego, N. Y.—The lower bridge has been reported unsafe and will require extensive repairing.

Derby, Conn.—See "Railroads."

Eau Claire, Wis.—Local press reports state that Mayor Howe has disapproved the appropriation of $2,000, made by the City Council for the repair of Water St. bridge, and it is possible that a new steel bridge will be constructed.

Batavia, N. Y.—The Owego Bridge Co., Owego, N. Y., is stated to have secured the contract for constructing a plate girder bridge at Walnut St., at $12,800.

Duluth, Minn.—It is stated that the Duluth, Missabe & Northern Ry. Co. will replace a number of bridges on its line. The contract for the masonry and pier work on said bridges has been let to MacLeod & Smith. The cost of the contemplated improvements is stated to be about $60,000.

Rexford Flats, N. Y.—The Canal Board has approved plans for a bridge across Erie Canal, at Rexford Flats.

Waterford, N. Y.—John Dunfree & Co., Syracuse, N. Y., are stated to have received the contract for constructing a bridge across the canal at Waterford, for $8,585.

Elizabeth, N. J.—The County Board of Freeholders has accepted plans prepared by County Engineer Hubbard for a bridge at Netherwood Ave.

Seneca Falls, N. Y.—The proposition to issue $11,000 bonds toward the construction of the Rumsay St. bridge, carried at the recent election.

Benton Harbor, Mich.—It is stated that the Secretary of War has notified the City Council and the officials of the Pere Marquette and the Cleveland, Cincinnati, Chicago & St. Louis railroads that 3 swing bridges must be constructed across Paw Paw River within the next 6 months.

Pittsburg, Pa.—Press reports state that the 7th St. bridge may be rebuilt, at a probable cost of $200,000.

Harrisburg, Pa.—A bridge is to be constructed across the subway approach at Market St. and the Pennsylvania R. R. tracks; contract for same to be awarded as soon as subway is completed.

Denver, Colo.—The construction of a viaduct at 19th St. is contemplated.

Northumberland, N. Y.—Permission has been granted to the Greenwich and Johnsonville R. R. Co. to construct a bridge across Champlain Canal, at Northumberland, and to operate a steam railroad over same.

Canajoharie, N. Y.—The Board of Trade has appointed a committee, James Arkell being chairman, to secure a lift bridge to replace present structure across the canal. A committee has also been appointed to secure better approaches to the Mohawk River bridge.

Richmond, Minn.—It is stated that a railroad bridge is to be constructed across Sauk River at Richmond.

Grand Forks, N. D.—Local press reports state that the Northern Pacific Ry. Co. will construct a steel draw bridge across Red River, in this city, during the coming winter.

Miles City, Mont.—W. S. Hewett & Co., Minneapolis, Minn., are stated to have secured the contract for the construction of the Yellowstone River bridge, on Ft. Keogh reservation, for $38,347. The bridge is to consist of 2 spans, each 310 ft. long, an approach on the south side, 50 ft. long, and a timber approach, at each end, 25 ft. long.

Rathbone, N. Y.—The construction of an iron bridge at a probable cost of $5,000 is being considered.

Kansas City, Mo.—Local press reports state that bids will be received by the Park Board until Oct. 23 for the steel work on the Benton Boulevard bridge. Probable cost, $12,000. Geo. E. Kessler, Sec'y.

St. Charles, Mo.—J. D. Houseman, Mgr. of the St. Louis, St. Charles & Western Ry., is said to be interested in the construction of a highway bridge across Missouri River, at St. Charles.

Shelbyville, Tenn.—The County Bridge Committee has decided to construct 3 steel bridges across Duck River, at a total cost of $11,000.

Harrisburg, O.—It is stated that a bridge will probably have to be built by the Columbus & Southern Ry. Co. near Harrisburg.

Auburn, Ind.—Bids are wanted Oct. 9 for constructing 3 steel bridges. Address, F. P. Seiler, Auburn.

Princeton, Ind.—Bids are wanted Nov. 5 for constructing 8 steel bridges. S. H. Adams, Co. Aud.

Manhattan, Kan.—Bids are wanted Oct. 8 for constructing a steel bridge across Kansas River. Address, J. D. Harshburger.

Kentland, Ind.—Bids are wanted Nov. 4 for constructing an iron bridge across Iroquois River, in Washington Township, to be known as the "State Line Bridge." Schuyler C. Jones, Co. Aud.

Dartmouth, Mass.—Bids are wanted Oct. 9 for reconstructing a highway bridge across Apponagansett River, Dartmouth. C. W. Howland, Chmn. Bldg. Com., S. Dartmouth, Mass.

Minneapolis, Minn.—The City Council on Sept. 27 sustained the Mayor's veto of the $215,000 bridge bond resolution.

Dewitt, Ill.—An iron bridge, having 3 spans, each 60 ft. long, is to be constructed across Salt Creek, east of Dewitt, at a probable cost of $4,500.

Absecon, N. J.—Bids are wanted Oct. 9 for constructing new abutments and bridge at Absecon; also, for new abutments and replacing old bridge. M. L. Jackson, Chmn. Bridge Com., Hamnouton, N. J.

Akron, O.—Bids are wanted Oct. 12 for constructing a bridge at Cherry St. Chas. H. Isbell, Clk. Bd. City Commrs.

Buffalo, N. Y.—Bids are wanted, separately, until Oct. 14, for constructing the substructure and superstructure of Van Rensselaer St. viaduct. Frank V. E. Bardol, Ch. Engr, Grade Crossing Commissioners, Bureau of Engineering.

Zanesville, O.—Bids are wanted Oct. 24 for furnishing the material and constructing the masonry for the lift bridge across the lateral canal of Muskingum River, at the easterly end of the "Y" bridge. Jas. L. Starkey, Co. Aud.

Cedar Rapids, Ia.—Bids are wanted Oct. 18 for constructing a viaduct and the necessary approaches thereto at A Ave., east, across 4th St. R. A. Wallace, Chmn. Pub. Improvement Com.

PAVING AND ROADMAKING.

Cohoes, N. Y.—Bids are wanted Oct. 7 (readvertised) for completing the contract of Martin Murray for the grading of Garner St. extension, as advertised in The Engineering Record.

St. Louis, Mo.—Local press reports state that bids are wanted Oct. 11 for reconstruction work on various streets, as follows: Asphalt on Garrison and Theresa Aves., and with brick on portions of 6 streets. Hiram Phillips, Pres. Bd. Pub. Improvements.

Huntington, Ind.—Bids are wanted Oct. 22 for 17,000 yds. of brick, asphalt or macadam paving, 10,000 ft. of curb, 6,000 ft. of sidewalks and 12,000 yds. of excavation. Work to begin April 1, 1902. Frank Guthrie, City Engr.

Philadelphia, Pa.—Bids are wanted Oct. 14 for the completion of the improvement of Mifflin Sq. Abraham L. English, Dir. Dept. of Pub. Safety, Bureau of City Property.

Buffalo, N. Y.—Bids are wanted Oct. 10 for paving Yale Place and repaving Krettner St. R. G. Parsons, Sec'y Bd. Pub. Wks.

Cleveland, O.—Bids are wanted Oct. 10 for grading, draining, curbing, paving with brick and improving Waverly Ave. Chas. P. Salen, Dir. Pub. Wks.

Erie, Pa.—Bids will be received until Oct. 7 (readvertisement) for repaving Peach St., 26th to 12th St., 14,500 yds., with brick or asphalt, also same street, same date, from 12th St. north to extent of appropriation (perhaps $22,000 worth). Benj. E. Briggs, City Engr.

Columbus, O.—Bids are wanted Oct. 7 (readvertisement) for resurfacing a portion of Town St. with asphalt; also for repairing the paved gutters with hard burned brick or block, where necessary. Clarence M. Addison, Clk. Bd. Pub. Wks.

Ft. Smith, Ark.—Bids are wanted Oct. 9 for furnishing and delivering 100,000 No. 1 vitrified paving brick. Tom Ben Garrett, Chmn. Bd. Pub. Wks.

Barberton, O.—Bids are wanted Oct. 14 for paving with brick and curbing with stone on Tuscarawas Ave. W. A. Witner, Village Clk.

Akron, O.—Bids are wanted Oct. 12 for paving with brick and curbing with stone on a portion of Brown Ave. Chas. H. Isbell, Clk. Bd. City Commrs.

Zanesville, O.—Bids are wanted Oct. 19 for furnishing material and paving with brick on a portion of Muskingum Ave. C. H. Bainter, City Clk.

Beaumont, Tex.—City Sec'y T. C. King writes that contracts will be let in a few weeks for vitrified brick paving on a 6-in. concrete foundation. Estimated cost, $80,000. M. A. Orlopp, of Beaumont, Engr. in Charge.

Winnipeg, Man.—The City Council has approved the petition for asphalt paving on Main St. Estimated cost of work to be, from Point Douglas Ave. to Aberdeen St., pavement full width of street, $131,000; from Aberdeen St. to city limits, 2 asphalt roadways, each 24 ft. wide, with boulevard in center, $98,000.

Madison, Wis.—The Common Council has voted in favor of constructing asphalt pavement on the streets surrounding the Capitol square.

Detroit, Mich.—Local press reports state that the following bids were opened Sept. 24 for repairing asphalt paving, using pitch lake asphalt: Western Paving & Supply Co., of Indianapolis, $1.49 a yd.; Bermudez Asphalt Paving Co., of Chicago, $1.44; American Contracting Co., $1.37; Trinidad-Bermudez Co., $1.49. Barber Asphalt Paving Co., $1.43.

La Crosse, Wis.—An ordinance is stated to have been passed providing for the issue of $15,000 street improvement bonds.

Lima, O.—A resolution has been adopted by the Council declaring it necessary to improve a portion of Scott St. by grading, draining, curbing and paving. C. E. Lynch, City Clk.

Freeport, Ill.—The contract for paving Stephenson St. has been awarded to G. Maffioli, of Rockford, for $28,286, using Clinton, Ind., block at $1.36 per sq. yd.

Oyster Bay (L. I.), N. Y.—The Board of Highway Commissioners on Sept. 28 is stated to have opened the following bids for graveling the Berryhill road: Theron Burden, Long Island City, $43,250; Andrews Bros., Mineola, $39,500; Eldert & Johanknecht, Jamaica, $36,820.

Washington, Ind.—County Clk. Thomas Harris writes that on Oct. 8 a vote will be taken in Washington Township and City on the proposition to construct gravel roads at an estimated cost of $79,000.

Taunton, Mass.—Both branches of the City Council have passed the orders appropriating $20,000 for general street improvements and $15,000 for the paving of Court St. and City Square.

Spokane, Wash.—The Alcatraz Asphalt Paving Co. is stated to have bid $7,254 for asphalt sidewalks on Boone Ave.

Independence, Mo.—The City Council has passed a resolution providing for the macadamizing of Crysler Ave.

Needham, Mass.—At a recent town meeting it was voted to purchase a steam road roller at a cost of $2,850.

Toronto, Ont.—The Board of Control has recommended the award of contracts as follows: Asphalt pavements—College St., $31,765, to Constructing & Paving Co.; another portion of College St., $8,920; Parliament St., $7,300; and Pearson Ave., $4,600, to Barber Asphalt Paving Co.

Davenport, Ia.—Estimates have been passed for the paving of a portion of 14th st., the total cost being $14,040.

Matanzas, Cuba.—Principal Asst. Engr. Miguel C. Palmer, Obras Publicas, writes that work will begin in December on 3 kilometers of road, from Matanzas to Canasi, estimated cost $35,000; including 2 steel bridges and several concrete-steel culverts. Surveys for the road from Cardenas to Camarioca are now being made.

Amsterdam, N. Y.—The Montgomery Board of Supervisors has voted to carry out the project of macadamizing Mohawk turnpike from Amsterdam to Mohawk. The improvement, which will be made with State aid, will cost $31,400.

Clinton, Conn.—Bids are wanted Oct. 9 for macadamizing 3 sections of roads, in all 7,575 ft. Wm. H. Kelsey, 1st Selectman.

Portsmouth, N. H.—The contract for constructing New Hampshire Ocean Boulevard is stated to have been awarded to A. J. Wellington of 237 Franklin St., Boston, of the Massachusetts Broken Stone Co., whose bid was $19,441.

Neenah, Wis.—Bids are wanted Oct. 9 for a macadam pavement on a portion of Church St. J. P. Keating, City Clk.

Youngstown, O.—Bids are wanted Oct. 12 for grading, draining and improving Quarry St. C. E. Cross, Clk. Bd. City Commrs.

Bloomfield, Ind.—Bids will be received by the County Commissioners until Nov. 4 for constructing a gravel road in Stockton Township. Harvey L. Doney, Co. Aud.

Williamsport, Ind.—Bids are wanted Oct. 18 for constructing a gravel road, 32,600 ft. long, in Mound Township. Wm. H. Stephens, Co. Aud.

Aurora, Ill.—See "Sewerage and Sewage Disposal."

Syracuse, N. Y.—Bids are wanted Oct. 7 for paving with sheet asphalt or vitrified brick on a portion of Wellington Place, also for paving with Trinidad sheet asphalt or vitrified brick on a portion of W. Castle St. Jos. H. Saunders, City Clk.

Milwaukee, Wis.—Bids are wanted Oct. 8 for paving with asphalt on Juneau Ave., from Jackson to Milwaukee Sts., on the same street with brick from Jackson to Van Buren Sts., also for curbing the sidewalks with stone on the above-named portions of Juneau St., and for constructing a cement sidewalk on a portion of 3d St. and a combination cement curb and gutter on S. Pierce St. Chas. J. Poetsch, Commr. of Pub. Wks.

Wilkinsburg, Pa.—Bids are wanted Oct. 10 for grading, paving and curbing of Todd St. Frease & Sperling, Boro. Engrs.

Reading, Pa.—Asst. Registry Clk. C. C. Weltmer writes that the contract for block paving on Perkiomer Ave. (bids opened Sept. 26) has been awarded to Jacob Mayer, of Reading, Pa., for $10,860.

Chester, N. Y.—Mowel & Daniels are stated to have secured the contract for building Telford roads in the village, for $14,113.

Monongahela, Pa.—Bids are wanted Oct. 7 for 1,800 cu. yds. excavation, 700 to 800 lin. ft. curbing, and 5,600 sq. yds. vitrified brick paving. Frank R. Colvin, Chmn. Street Com.

Alexandria, Va.—Bids are wanted at the City Engineer's Office until Oct. 10 for 100,000 vitrified paving brick or block, and 1,200 lin. ft. of straight and 120 lin. ft. of circular 6 x 18-in. granite curb, to be used in paving and curbing King St. E. S. Leadbeater, Chmn. Com. on Streets.

Columbus, O.—The Nelsonville Brick Co. has secured the contract for furnishing the city with 40,000 bricks at $13.50 per thousand.

The Mayor has approved the ordinance, passed by the Council, providing for the improving of Buckingham St., with asphalt or brick, at a probable cost of $15,000.

Atlantic City, N. J.—The contract for paving outlined for the winter months is stated to have been awarded to McAvoy, Murray & Cunningham, at $121,902.

Urbana, O.—The Improvement Board contemplates paving several streets this fall, at a cost of $22,403.

Chagrin Falls, O.—Consulting Engr. L. E. Chapin, of Canton, O., writes that on Sept. 23 the Council awarded paving contracts as follows: To Forsyth Bros., Chagrin Falls, for curbing, furnished and set, at the following prices: straight curb, 33 cts. per lin. ft.; circle curb, 40 cts.; abutment, 35 cts.; total, $905.80.; also for block paving and storm water drains laid complete, as follows: Perkins Block, $1.23 per sq. yd.; drain pipe, 12-in., 39 cts. per lin. ft.; 15-in., 60 cts.; 18-in., 66 cts.; for catch basins inlets furnished and set, each, $20; total contract, $13,280.91.

POWER PLANTS, GAS AND ELECTRICITY.

Frankfort, N. Y.—Bids are wanted by the Village Board of Trustees until Oct. 15 for erecting a brick electric power house, 40 x 75, with wood and tin roof. J. F. Tucker, Village Clk.

Wilkesbarre, Pa.—Bids are wanted Oct. 15 for lighting the streets and lanes for a period of 3, 5 or 7 years, with not less than 400 or more than 800 open or closed arc electric lamps of 2,000 actual c.p. each; said lamps to burn every night from dusk until daylight. T. I. Deitrich, Chmn. Joint Lighting Com.; Fred. H. Gates, City Clk.

Southampton (L. I.), N. Y.—It is stated that the Suffolk Light, Heat & Power Co. is about to be formed here, with a capital of $25,000, to construct an electric light plant. Edw. Bell and Thos. H. Barber are reported interested.

Parkersburg, W. Va.—The City Clerk writes that a committee of the City Council is investigating the cost and advisability of the city constructing an electric light plant.

Batesburg, S. C.—City Treas. M. B. Edwards writes that this town has just taken a new charter, with a view to making improvements; an electric plant will probably be built in a few months.

Bedford, Ind.—The Council is stated to have granted the Bedford Light, Heat & Power Co. permission to construct a gas plant.

Ipswich, Mass.—The citizens are stated to have voted Sept. 23 to establish an electric light plant.

Corry, Pa.—The Corry Electric Light & Power Co. has been incorporated, with a capital of $10,000.

Vancouver, B. C.—The Vancouver Power Co. is reported to have in contemplation the harnessing of a portion of the waters of the Coquitlam for power purposes.

Milwaukee, Wis.—Plans for a tunnel to extend across the river near the East Water St. Bridge, to be built by the Milwaukee Electric Ry. & Light Co., for carrying its feed wires, have been submitted to City Engineer Poetsch. John I. Beggs, Gen. Mgr., Milwaukee.

San Bernardino, Cal.—The Mendone Power Co. is stated to have petitioned the Supervisors for a franchise for a pole line from Redlands west across San Bernardino County.

Dickson, Tenn.—See "Water."

Italy, Tex.—It is stated that the Italy Water Co. contemplates constructing an electric light plant. J. V. Clark, Mgr.

Wilmington, Del.—The Consumers' Production & Supply Co,. of which John T. Dickey is Pres., has petitioned the Street and Sewer Department for permission to construct, lay and maintain under the streets of the city, conduits, ducts, and electrical wires for conveying electricity, gas, steam, air and oil.

Pottsville, Pa.—The Schuylkill County Electric Co., of Pottsville, has been incorporated, with a capital of $10,000.

Westmount, Que.—The Lachine Hydraulic & Land Co. is stated to have secured the contract for lighting the town for 5 years from Dec. 16, at $90 per lamp per yr.

Merrillan, Wis.—See "Water."

Atlantic City, N. J.—The Committee appointed to report on the construction of a municipal electric light plant estimates the cost of a plant sufficient to provide 500 lights at $179,300.

La Salle, Ill.—The Enterprise Heat, Light & Power Co. is stated to have been formed, with a capital of $25,000, to construct an electric light and gas plant.

St. Paul, Minn.—See "Public Buildings."

Niagara Falls, Ont.—A. C. Douglass is stated to have secured the contract for constructing the power tunnel for the Canadian Niagara Power Co., for about $500,000. It will be 2,200 ft. long, extending from a point near the head of Cedar Island, a short distance below the Horseshoe Falls.

Baldknob, Ark.—The Council is stated to have granted M. Jolly and W. K. Baker a franchise for an electric light plant.

Washington, D. C.—See "Public Buildings."

Chattanooga, Tenn.—Joseph H. Warner, Edwin Warner and others have received a charter for the People's Light & Power Co., which proposes manufacturing electricity for motive power, electrotyping, heating houses, etc.; capital, $200,000.

Circleville, O.—Clarence Curtam, C. A. Leist, and others are interested in the proposition to construct a heating plant. C. F. Abernethy, Engr. in Charge.

Holley, N. Y.—J. Mills Platt, of Rochester, is stated to have been selected to prepare plans for the proposed $15,000 electric light plant.

Dublin, Ga.—See "Water."

Roseburg, Ore.—The Douglas Electric Co. is reported incorporated, with a capital of $6,000, to construct an electric light plant in Roseburg. Incorporators: L. A. Walker and F. W. Benson.

Union, Ore.—It is reported that the power house and dynamos of the Union Electric Light Co., which were burned on Sept. 24, will be rebuilt at once.

Newberry, Mich.—Bids will be received by the Board of Trustees of the Upper Peninsula Hospital for Insane at Newberry, until Oct. 10, for the installation of dynamos and engines, with building connections and wiring, electrically driven service pumps with connections and for 2 water-tube boilers. M. E. Cooley, Consulting Engr., Ann Arbor, Mich.

Hazlehurst, Miss.—See "Water."

Ottawa, Ont.—It is stated that Rolland Miller, Montreal; Victor Vivian Rogers and Victor Harold Lyon, of Ottawa, are about to apply for a charter for the Canadian Power Co., the capital to be $25,000.

San Jose, Cal.—Stephen Kieffer, of Sacramention; C. W. Armstrong and G. G. Strickland, of San Francisco, with a party of assistants, are reported to have started from here Sept. 25 for Santa Ysabel Creek on Mount Hamilton Range, to commence preliminary surveys for an impounding dam and the conducting of water to Calaveras, where an electric generating plant will be erected.

Bay City, Mich.—The Council is stated to have granted the Hecla Cement & Coal Co. a franchise for a gas plant. The works to be finished within 18 months.

Columbus, O.—Clarence M. Addison, Clk of the Bd. of Pub. Wks., writes that contracts for street lighting for a period of one year, from Oct. 1, 1901, have been awarded as follows: To Columbus Electric Co., of Columbus, 600 electric lamps at $74.75 per lamp; to Columbus Street Light Co., of Columbus, 400 Welsach lamps at $26 per lamp.

Newport, R. I.—See "Government Work."

Jackson, Miss.—The Governor has approved the charter of the Jackson Electric Ry., Light & Power Co., of Jackson. Capital, $250,000. H. H. Carson, of Memphis, Tenn., is interested.

Buffalo, Minn.—See "Water."

Sandstone, Minn.—Recorder Geo. McNeil writes that on Sept. 28 it was voted to grant a franchise for an electric light plant to the Sandstone Land Co.

Marquette, Mich.—It is stated that the Marquette Gas Co. will expend about $50,000 in improvements. Peter White, of Marquette, is one of the directors.

Jackson, Ga.—See "Electric Railways."

Huntingdon, Tenn.—It is stated that bids are wanted Oct. 17 for improving the municipal electric plant. J. F. Walters, Supt.

Iroquois, Ont.—The citizens are stated to have voted Oct. 1 to issue $12,000 bonds for the construction of an electric light plant.

Waterloo, Ind.—See "Water."

Norwood, O.—The citizens are stated to have voted to issue bonds for improving the electric light plant.

Winnipeg, Man.—A press report states that the Winnipeg St. Ry. Co. and the Ogilvie Milling Co. will jointly construct a power plant for the transmission of electric power from the Winnipeg River to this city.

Norway, Mich.—The following bids for furnishing material and machinery and constructing an electric light plant were opened Sept. 19 by the Board of Public Works: Allan Black Co., St. Paul, Minn., $21,900 (awarded); Arthur Frantzen Co., Pittsburg, Pa., $26,923; Langstadt & Meyer, Appleton, Wis., $35,350; Stephens Engineering Co., Chicago, $26,390; Van Rensselaer Lansingh, Chicago, $28,490.

ELECTRIC RAILWAYS.

Fresno, Cal.—The Fresno City Ry. Co. has been incorporated, with a capital of $500,000, to construct an electric railway 43 miles long. Incorporators: S. N. Griffith and W. M. Wyatt, of Fresno, Claus Kroeger, of Oakland, and others.

Adams, Mass.—The Hoosac Valley St. Ry. Co. is stated to have petitioned the Council for franchise to extend its line. W. T. Nary, Mgr., North Adams.

Batavia, N. Y.—The Board of Aldermen is stated to have granted a franchise to the Buffalo & Williamsville Electric R. R. Co.

Kansas City, Kan.—The Wyandotte County Commissioners are stated to have granted a franchise to Wm. Lackman to construct and operate an electric railway from Rosedale to the Johnson County line, a distance of about 2 miles.

Indianapolis, Ind.—Townsend, Reed & Co., of Chicago, Ill., are stated to have secured the contract to construct an electric railway 25 miles long from Indianapolis to Shelbyville, for the Indianapolis, Shelbyville & Southeastern Traction Co., just incorporated, with a capital of $600,000.

Walla Walla, Wash.—E. S. Isaacs has petitioned the Council for a franchise to construct an electric railway on certain streets of this city.

Gloversville, N. Y.—The Mountain Lake Electric R. R. Co. is reported to have in contemplation the purchase of considerable new machinery for its power house. A. J. Keith, Mgr., Gloversville.

Evansville, Ind.—The Evansville & Princeton Traction Co. is stated to have petitioned the Board of Public Works for a franchise. Perry J. Freeman, Richmond, Ind., and Fred'k J. Van Orman, Evansville, are among the incorporators.

Phoenixville, Pa.—L. Knowles Perot, Pres. of the Schuylkill Illuminating Co., is stated to have purchased the Montgomery & Chester Electric R. R., running between Phoenixville and Spring City. It is stated that a bridge will be built over the Pickering Valley R. R. at Ironsides, and other improvements will be made, in all to cost about $50,000.

Canton, O.—W. W. Irwin, Wm. Wagner and associates have petitioned the Council for a franchise.

San Bernardino, Cal.—The City Trustees are stated to have granted the San Bernardino St. Ry. Co. a franchise from 3d and E Sts. to the northern city limits. W. S. Hooper, Secy.

Waukegan, Ill.—J. H. Van Vlissingen and Alex. Clarke, of Chicago, are reported interested in the construction of an electric railway from Winthrop Harbor to Waukegan, to connect with the Chicago and Milwaukee electric line.

Greenfield, Mass.—E. Herbert Sanderson, of Bernardston, F. Z. Allen, of Northfield, and Fred'k E. Pierce, of Greenfield, are incorporators of a company formed to construct an electric railway from Greenfield to Northfield, through Bernardston. Length of proposed line is about 15 miles.

Portsmouth, Va.—The Portsmouth & Newport News Ry. Co. is asking for additional streets in Portsmouth to extend its line. About one mile more track, with many special crossings, etc. M. P. Jones, Gen. Supt., Port Norfolk, Va.

Anniston, Ala.—The Woodstock Iron Co. is reported to have in contemplation the construction of a trolley line from the Louisville & Nashville R. R. tracks to its ore mines at Rocky Hollow.

Bethlehem, Pa.—Preliminary surveys have been made for a trolley line between South Bethlehem and Center Valley, Pa. Jno. J. Osterstock and W. F. Pascoe, of Easton, Pa., are interested.

Fishkill, N. Y.—The Citizens St. Ry. Co. and the Carroll Electric Co., of Fishkill and Matteawan, are stated to have effected a consolidation. About $20,000 will be expended to increase the facilities of the electric works.

Ossining, N. Y.—The Westchester Traction Co. has been incorporated, with a capital of $200,000, to operate an electric road from Ossining to Pleasantville, a distance of 5 miles. Directors: Thos. P. Barrett, of New York City; G. N. Bissell, of White Plains, and others.

Marysville, O.—Robt. Thompson, of Peoria, Ill., and Dr. T. A. Wright, of Toledo, are reported to be securing a right of way through Union County for the Toledo, Columbus, Springfield & Cincinnati Electric Ry.

Coraopolis, Pa.—The Coraopolis & McKee's Rocks St. Ry. Co. has been incorporated with a capital of $48,000, to construct an electric railway 8 miles long between Coraopolis and McKee's Rocks.

Deshler, O.—Application has been made by the Toledo & Lima Traction Co. for a franchise to construct, operate and maintain a single or double track street railway, to be operated by electricity or motive power except steam, and bids for said franchise will be received by the Village Council Oct. 18. J. B. Caddy, Village Clk.

Worcester, Mass.—Jas. W. Stockwell, of Sutton; Chas. H. Wilson, of Brookline, and others, are reported interested in the construction of an electric railway from Worcester to Providence, R. I., through Millbury, Sutton and Douglas.

Woonsocket, R. I.—The Council of the town of Burrillville is stated to have granted an franchise to the Columbus St. Ry. Co. Edgar K. Ray, Pres., Woonsocket.

Uhrichsville, O.—The Uhrichville, White City & Newcomerstown Ry. Co. has been incorporated with a capital of $10,000, to construct and operate an electric railway, connecting Uhrichsville and Newcomerstown. Incorporators: C. W. Walker, W. P. Sherron and others.

Cincinnati, O.—The Cincinnati, Georgetown & Portsmouth Ry. is stated to have been purchased by Comstock Bros., of Detroit, Mich. It will be changed to standard gauge and operated by electricity. The road now ends at Georgetown and it will be extended to Ripley at once, and later to Portsmouth, Ironton and other points. A. W. Comstock will remove to Cincinnati to be president of the road.

Milwaukee, Wis.—The Council Committee on Railroads on Sept. 26 decided to report to Common Council in favor of granting the Milwaukee Electric Ry. & Light Co. additional franchises asked for. John I. Beggs, Gen. Mgr.

Little Rock, Ark.—The Council is stated to have granted a 50-year franchise to the Little Rock Traction & Electric Co. It is reported that the company will expend about $500,000 in improving its present service. J. A. Woodson, Gen. Mgr.

Jackson, Ga.—The Council is stated to have granted the Jackson St. Ry. & Electric Light Co. franchises for an electric railway and an electric light plant.

Dunkirk, N. Y.—Wm. J. Conners, S. F. Drake and others are stated to have purchased the Dunkirk & Point Gratiot Ry. They propose constructing a line from Buffalo to Jamestown by way of Dunkirk.

RAILROADS

Derby, Conn.—O'Brien & Sheehan, 253 B'way, New York, N. Y., have secured the contract for railroad work on the Naugatuck division of the New York, New Haven & Hartford R. R., between Derby and Ansonia, including a steel bridge across the Naugatuck River; the entire work will amount to about $500,000.

Long Island City (L. I.), N. Y.—Wm. H. Baldwin, Jr., Pres. Long Island R. R., and Wm. J. Kelly, its counsel, have filed with the Rapid Transit Commission an application and plans for the proposed passenger and freight tunnel, from Thompson Ave., Long Island City, to 33d St. and B'way, Boro. of Manhattan; cost estimated at $5,000,000.

Tampico, Mex.—Henry Hile, Treas. Quaker City Gold Mining Co., Betz Bldg., Philadelphia, Pa., and Dr. Joseph Hancock, 1639 Columbia Ave., Philadelphia, are reported interested in the Mexican Continental Ry. & Steamship Co., which proposes to construct a railroad from both Tampico and Tuspan to Banderas Bay on the Pacific, a distance of about 500 miles.

Pittsburg, Pa.—Contracts for grading and masonry on 28 miles of the Pittsburgh, Carnegie & Western R. R., a branch of the Wabash R. R., are reported to have been awarded as follows, covering all but 2 sections of the work: Kennefick & Hunt, 5 sections; Moran & Co., 3 sections; Amos M. Hassett, 5 sections; Jas. G. Corcoran, 3 sections; T. A. Gillespie, 5 sections; J. Jacoby & Co., 3 sections; the Ferguson Co., 2 sections. This will carry the line from Bridgeville through Washington County and across the Panhandle of West Virginia almost to the Ohio River. Total amount of the contracts is said to be between $2,000,000 and $2,500,000. Joseph Ramsey, Jr., Pres., St. Louis, Mo.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Washington, D. C.—Bids are wanted Oct. 26 for constructing a power house and nurse's home, with stack and equipment, on Providence Hospital grounds, as advertised in The Engineering Record.

Greensburg, Pa.—Bids are wanted Oct. 19 for the excavation and foundation of the proposed Westmoreland County court house. John H. Brown, Co. Compt.

Wellesley Hills, Mass.—The Congregational Society is reported to be planning to erect a $35,000 church. J. Lake, Chmn.

New York, N. Y.—A permit has been issued for a 1-story brick church to be erected on Elizabeth and Broome Sts. for the Italian Mission P. E. Church, to cost $35,000. Architects, Hoppin & Koen, 244 5th Ave.

New Orleans, La.—Plans and specifications will soon be ready for a steel shed about 400 ft. long by 60 ft. wide, for the Board of Commissioners of the Port of New Orleans. Engrs., Coleman & Malochee, 319 Carondelet St.

Atlantic City, N. J.—F. A. Souder, 1018 Arctic Ave., is stated to have secured the contract for erecting a city fire station, at $25,587.

Jacksonville, Fla.—The County Commissioners have accepted the plans of Holmes & Lawton, of Jacksonville and Charleston, S. C., for the Duval County Court House, estimated to cost $70,000.

Brooklyn, N. Y.—The Board of Aldermen on Oct. 1 is stated to have voted to approve the bond issue of $300,000 to build an addition to the Brooklyn Institute of Arts and Sciences.

Jacksonville, Fla.—The plans of A. B. Carr & Co., of Birmingham, Ala., and Francis J. Norton, of Jacksonville, associate architects, are stated to have been accepted for an $18,000 edifice for Mt. Zion A. M. E. Church. Rev. E. J. Gregg, Pastor.

Dayton, O.—H. Rechsteiner and Steve Gosman are reported to be members of the committee for building a $20,000 Catholic Church in the South Park and Oakwood districts.

Matanzas, Cuba.—Principal Asst. Engr. Miguel C. Palmer, Obras Publicas, writes that contracts will soon be let for a $125,000 market place for this city.

Eatonton, Ga.—It is stated that the question of issuing $30,000 bonds for a court house will be submitted to a vote of the people.

Syracuse, N. Y.—Bids are wanted Oct. 7 for erecting hose house No. 2, in the 10th Ward. Robt. H. Jones, Clk. Bd. Contract and Supply.

Havre de Grace, Md.—Plans for the Seneca Memorial Church are stated to have been prepared by Wm. L. Plack, 1403 Filbert St., Philadelphia, Pa.; cost, $50,000.

Guthrie, Okla. Ter.—The plans of J. Foucart, of Guthrie, are stated to have been accepted for a $20,000 city hall.

Indianapolis, Ind.—Crapsey & Lamm, Groton Bldg., Cincinnati, are stated to have prepared plans for a $70,000 M. E. Church to be erected here.

Canandaigua, N. Y.—Fletcher Bros. & Co., 47 Wiggins Blk., Cincinnati, O., are stated to have secured the contract to erect the Methodist Church here for $33,963.

St. Paul, Minn.—The complete tabulated bids opened Sept. 24 by the Board of State Capitol Commissioners for the mechanical equipment of the Capitol are given below:

Bidders.	Complete. Total bid.	Complete. Alternate.	Boiler plant. Bid.	Boiler plant. Alternate.	Elec. gener'n plant.	Elec. wir'g.	Heating. A.	Heating. B.	Elevators.	Plumbing.	Power house and tunnel.
Allan Black, St. Paul	$370,000	$354,000	$64,000	......	$52,382	$29,486	$86,998	$79,198	$33,450	$34,790	$64,857
Geo. R. Morton, St. Paul	405,220	401,969	64,074	$59,492	41,627	35,640	101,803	....	35,123	52,464	74,459
T. M. McGuire, Minneapolis	....	....	69,361	62,661	48,894	......	131,600	119,500	......	......	62,598
W. I. Gray, Minneapolis	372,015	352,308	......	......	......	......	....	....	......	......	......
Davis Heating Co., St. Paul	....	....	79,790	73,500	......	......	112,900	100,600	......	......	......
H. Kelly & Co., Minneapolis	437,386	422,424	69,062	62,000	67,150	37,000	117,852	109,952	33,450	45,272	67,000
Chas. B. Kruse & Co., Milwaukee	493,000	487,400	66,553	60,910	47,189	130,834	107,350	99,494	18,400	50,000	67,000
Butler Ryan Co., St. Paul	430,977	359,302	83,577	77,920	25,922	42,800	117,515	....	38,000	52,250	70,913

Other bids received for portions of the work were as follows: *a*, boiler plant; *b*, electric generator plant; *c*, electric wiring; *d*, heating; *e*, elevators; *f*, plumbing; *g*, power house and tunnel: Dwyer H. & P. Co., St. Paul., *a* $106,270, *d* $124,265, *f* $42,197, *g* $78,000; M. J. O'Neil, St. Paul, *f* $44,800; Blake & Williams. N. Y., *d* $116,273 and $99,305; Moore Heating Co., Minneapolis, *a* $104,200, *d* $170,800; Evans Almirall Co., N. Y., *d* $118,900 and $101,200; Geo. J. Grant, St. Paul, *g* $68,460; Geo. A. Kees, St. Paul, *f* $46,890; Nimis & Nimis, St. Paul, *c* $61,427; Otis Elevator Co., N. Y., *e* $33,450; Chas. Kaestner & Co., Chicago, *e* $33,700; A. Frantzen & Co., Chicago, *c* $34,500; Geiger, Fiske & Koop, Louisville, *e* $34,665; Northern Elec. Mfg. Co., Minneapolis, *b* $48,951, *c* $45,350; Wm. Craig, Minneapolis, *e* $36,780; A. Kieckhefer Elevator Co., Milwaukee, *e* $16,750.

Scarsdale, N. Y.—It is stated that Adrian Iselin will add to the hospital here a home for convalescents, to cost $50,000, both institutions to be conducted by the Sisters of Charity.

Ortonville, Minn.—O. H. Olson, of Stillwater, is stated to have secured the contract for erecting the Bigstone County court house, for $29,999.

Reidsville, Ga.—It is stated that bids are wanted Nov. 11 for erecting a 2-story court house, to be 72 x 131 ft., and constructed of brick, stone, terra cotta, wood and iron. B. F. Alexander, Co. Ordinary; J. W. Gulucke & Co., Archts., Temple Court, Atlanta.

Lincoln, Neb.—Bids are wanted Oct. 14 for constructing 60 steel cells at the State Penitentiary, in Lincoln. Geo. D. Follmer, Pres. Bd. Pub. Bldgs.

Jacksonville, Ill.—It is stated that bids are wanted Oct. 21 for erecting a library. W. E. Veitch, Pres. Bd. Dir. Pub. Library.

York, Neb.—Bids are wanted Oct. 10 for erecting a public library. E. J. Wightman, Sec'y Bldg. Com.

Norfolk, Neb.—The Insane Asylum at this place is reported to have been destroyed by fire on Sept. 23.

Tallahassee, Fla.—Bids are wanted by the Capitol Commission until Nov. 14 for alterations and additions to the State Capitol buildings. W. S. Jennings, Governor & Chmn.; Frank P. Milburn, Archt., Columbia, S. C.

New York, N. Y.—The plans of York & Saunders, 156 5th Ave., are stated to have been accepted for the hall which the N. Y. Historical Society will erect on Central Park West and 76th St., to cost about $400,000.

Plans have been filed for the 69th Regiment Armory, to be erected on Lexington Ave. and 25th St., to cost $450,000. Architects, Horgan & Slattery, 1 Madison Ave.

The Directors of St. Luke's Hospital are stated to have under consideration the erection of a pavilion on the N. W. cor. of 113th St. and Morningside Ave., to cost about $300,000.

BUSINESS BUILDINGS.

Akron, O.—Bids will be received by the German-American Co. until Oct. 21 for erecting a music hall at Exchange and High Sts. P. E. Werner, Pres.; Fugman & Uhlrich, Archts., 89 Euclid Ave., Cleveland.

Birmingham, Ala.—Bids are wanted Oct. 12 for erecting a clubhouse for the Southern Club. T. U. Walters & Ullman, Archts, Chalifoux Bldg.

Youngstown, O.—Bids are wanted Oct. 10 for erecting an Odd Fellows' temple. M. J. Samuels, Chmn. Bldg. Com., 124 W. Federal St.

Fall River, Mass.—Chauncy H. Sears is stated to have received the contract for constructing the Stevens mill, for about $136,000.

Rutland, Vt.—It is stated that plans have been prepared for a depot for the Rutland R. R. Co., to cost about $100,000. Wm. S. Jones, Gen. Supt., Rutland.

Oconto Falls, Wis.—The Falls Mfg. Co. will erect 2 brick buildings, one 60 x 74 ft., the other 36 x 121 ft. E. A. Edmonds, Mgr.

Providence, R. I.—It is stated that a new station will be built on India St. by the N. Y., New Haven & Hartford R. R. Co. C. A. McAlpine, Supt. of Providence Div. It will be used as a union station by the Consolidated R. R. and the Union R. R.

Denver, Colo.—T. W. Boal, Equitable Bldg., has prepared plans for a $59,000 brick and stone office building, to be erected for Dr. Foster, at Tremont and 15th Sts.

Amesbury, Mass.—B. H. Seabury, of Springfield, has prepared plans for a $20,000 3-story brick building, to be used for store and offices. Owner, W. E. Fuller.

Philadelphia, Pa.—Hales & Ballinger, 1200 Chestnut St., are stated to have prepared plans for the proposed plant of the Crane Ice Cream Co., to be erected on Filbert and 18th Sts., to cost about $50,000.

Pensacola, Fla.—It is stated that the Louisville & Nashville R. R. Co. will erect a 2-story warehouse 50 x 1,200 ft. on Central wharf, to cost about $500,000. E. O. Saltmarsh, Div. Sup., Pensacola.

Logansport, Ind.—The printing establishment of Wilson, Humphreys & Co. is reported to have been destroyed by fire Sept. 29.

Grand Rapids, Mich.—Plans are reported as being prepared for a 6-story addition to the Kent Hotel.

It is stated that Nichols Bros. will erect a 6-story building on south side of Bridge St.

Trenton, N. J.—The plans of Brouse & Arend, First Natl. Bank Bldg., are stated to have been accepted for a 3-story brick and fireproof building, to be erected on South Stockton St., for the Inter-State Telephone Co.

Louisville, Ky.—Local press reports state that bids will be opened Oct. 8 in the office of Capt. H. B. Grant for the erection of a Masonic building on Chestnut St.

Columbus, Ga.—J. A. Williams, of Hamlet, N. C., is stated to have secured the contract for erecting the Seaboard freight depot, for $20,000.

Newaygo, Mich.—It is stated that the Newaygo Portland Cement Co. will erect a $20,000 brick warehouse.

Arcadia, Fla.—The A. T. Smith Hardware & Furniture Co. is stated to have been formed here with a capital of $50,000, and will erect a 3-story building on Polk Ave. E. T. Smith, Gen. Mgr.

New York, N. Y.—The contract for installing the heating and ventilating plant in the N. Y. Stock Exchange Building, has been awarded to Baker, Smith & Co., 83 W. Houston St.

Boston, Mass.—Plans have been filed for a 7-story block granite warehouse to be erected on Marginal St., East Boston, for the National Dock & Warehouse Co., 109 Lewis St., East Boston; cost, $40,000. Architects, Peabody & Stearns, 53 State St. Builders, W. H. Keyes & Co., 95 Milk St.

West Baden, Ind.—Caldwell & Drake, of Columbus, Ind., are stated to have received the contract for erecting the new West Baden Springs Hotel, to be erected on the site of the buildings destroyed by fire in June. The new building will be 6 stories high, with 600 rooms.

New York, N. Y.—The City Club is reported to have in contemplation the erection of a new club house, to cost about $350,000.

Truro, N. S.—The business block of E. Gunn and the town's opera house are reported to have been destroyed by fire Oct. 1.

Omaha, Neb.—It is stated that Crane Co., wholesale dealers in plumbers' supplies, will erect a $60,000 business building on 10th and Harney Sts.

Seattle, Wash.—W. E. Stevens, proprietor of Hotel Stevens, is reported interested in the erection of a hotel on 3d Ave. and James Sts., to cost about $400,000.

Brooklyn, N. Y.—A permit has been taken out by S. E. & M. Vernon, 57 Duane St., N. Y. City, for erecting a 6-story brick storage building at North 10th and Berry Sts., at a cost of $32,000. Archt., L. Berger & Co., 300 St. Nicholas Ave., N. Y. City.

Pittsburg, Pa.—Local press reports state that the contract for the new stock yards at Herrs Island, on the Allegheny River, is about to be let. The question of whether the buildings will be of brick or iron is about to be decided, and as soon as a choice is made the work of excavating will be begun. Most of the surveying has already been done.

Chicago, Ill.—Treat & Adler are stated to have prepared plans for a new plant for the American Hide & Leather Co. There will be several buildings, from 1 to 4 stories high, and the cost is estimated at $70,000. The same architects have also prepared plans for remodeling the wholesale building at Van Buren and Franklin Sts., owned by the Meyer estate, the work to cost about $40,000.

Henry P. Harned, 218 La Salle St., is stated to be preparing plans for a 6-story store and warehouse 50 x 103 ft., to be erected at 302-304 Clark St. for C. B. King, Pres. Commercial Safety Deposit Co., to cost $50,000.

Plans have been prepared by E. R. Krause, 100 Washington St., for a 4-story factory to be erected at 150-154 E. Ohio St. for C. F. Wolff, to cost $32,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

445 & 447 W 30th St, br factory; c, $45,000; o, Louis and Herman Runkel; a, G F Pelham.

12th Ave & 56th St, br repair shop; c, $200,000; o, City of New York; a, Horgan & Slattery.

55th St and 5th Ave, br stable; c, $25,000; o, Col Daniel S Lamont; a, Little & O'Connor.

DWELLINGS.

Waukesha, Wis.—Field & Medary, 1414 S. Penn Sq., Philadelphia, Pa., are stated to be preparing plans for a $15,000 dwelling for Frank H. Putney.

Omaha, Neb.—John C. Barnard will erect a $50,000 apartment house on Leavenworth St. and Park Ave.

Wilmington, Del.—A steel frame construction, 8-story apartment, 100 x 125, is to be built on Jefferson St., between 10th St. and Delaware Ave. W. Frank Tatnall, 1004 Jefferson St., represents the estate.

Chicago, Ill.—Andrew Sandegren, 185 Dearborn St., is stated to have prepared plans for a 3-story flat for John A. Strand, to be erected at 92 to 100 Hazel Ave., in Buena Park, to cost $56,000.

James Gamble Rogers, 1314 Ashland Blk., is preparing plans for a 2-story residence of pressed brick, to be erected at Lake Forest, at a cost of $30,000.

Henry K. Holsman, 153 La Salle St., is preparing plans for an apartment building to be erected at 69th St. and Jefferson Ave., for Edw. Harterth, to cost about $20,000.

Chas. A. Stonehill, of the Chicago Mercantile Co., will erect a 3-story residence on Drexel Boulevard, near 49th St., to cost about $60,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

40th St & Park Ave, br and marble dwellg; c, $23,000; o, Wm H Patterson; a, Geo E Wood.

129th St & 10th Ave. br tenem't; c, $70,000; o, Leon A Liebeskind; a, Geo F Pelham.

SCHOOLS.

Waco, Tex.—Bids will be received by Messer & Smith, Archts., Waco, until Oct. 10 for the erection of the George W. Carroll Science Hall, a 3-story and basement stone and brick building, for the Baylor University at Waco. E. R. Nash, Chmn. Bldg. Com.

McKeesport, Pa.—Bids are wanted Oct. 7 for erecting a school in the 10th Ward. D. P. Smith, Sec'y Bd. of School Controllers.

Brooklyn, N. Y.—Bids are wanted Oct. 14 for erecting school No. 141. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Milwaukee, Wis.—Bids are wanted Oct. 11 for erecting a school on 20th St. in the 10th Ward, including plumbing, ventilating and heating, etc. John R. Wold, Comptroller.

Guttenburg, Ia.—Bids are wanted Oct. 15 for a steam heating plant in the public school. Wm. Nolte, Sec'y.

Columbia, Mo.—Bids are wanted Oct. 23 for erecting building on the grounds of the University at Columbia. J. G. Babb, Sec'y Bd. Curators; Cope & Stewardson, Archts., 800 Security Bldg., St. Louis.

Leavenworth, Kan.—Bids are wanted Nov. 4 for the erection of 3 schools for the city. Cost, $12,000 each. Wm. P. Feth, Archt., Leavenworth.

Denver, Colo.—Thos. Walsh, 506 McPhee Bldg., has prepared plans for a $30,000 brick and stone 8-room school, to be erected for District No. 2.

East Cleveland, O.—The Board of Education is stated to have decided to erect a $20,000 school on the Mayfield road near Superior St.

Ft. Smith, Ark.—Architect Klingensmith is stated to have prepared plans for a 3-story brick building for St. Ann's Academy. Milton P. Boyd, Chmn. Bldg. Com.

Philadelphia, Pa.—Henry D. Dagit, 435 Chestnut St., is stated to have prepared plans for a school and hall for St. Elizabeth's R. C. Church, to be erected on 23d St. and Montgomery Ave., to cost $60,000.

Wheeling, W. Va.—Bids are wanted Oct. 14 for erecting an 8-room annex to Ritchie Main School. Walter H. Hall, Clk. Bd. Educ.

Madison, Wis.—Local press reports state that bids are wanted Oct. 11 for erecting a building for the College of Agriculture of the State University. Probable cost, $150,000. Address, Board of University Regents.

Dublin, Ga.—See "Water."

Philadelphia, Pa.—Horace Trumbauer, Land Title Bldg., is stated to have submitted plans for the main building of the Widener Memorial Industrial Training School for Crippled Children, to be erected at Logan Station. The school, which will occupy a plot of 36 acres, fronting on Old York Road, between Thorp's lane and Somerville Ave., will cost about $2,000,000.

Niagara Falls, N. Y.—Contracts for erecting the high school are reported to have been awarded as follows: Masonry, W. A. Shepard, Niagara Falls, $52,166; carpenter work, Schumacher & Mayer, Niagara Falls, $37,054; heating, Fuller, Warren Htg. Co., of Boston, Mass., $8,344, and plumbing and wiring, F. W. Oliver & Co., Niagara Falls, $7,780.

Trenton, Mich.—Edw. C. Van Leyen, 40 Fort St. n., Detroit, is stated to have completed plans for an $18,000 high school.

Lake City, Fla.—Burwell & Freeman, of Jacksonville, are stated to have secured the contract for erecting 3 buildings at Lake City, for the Florida State Agricultural College.

STREET CLEANING AND GARBAGE DISPOSAL.

South Bend, Ind.—City Engr. A. J. Hammond writes the Board of Public Works will receive bids Nov. 1 for the establishment of a crematory; bids have been asked with a view to securing information, and a contract is not promised.

East Liverpool, O.—The construction of a garbage crematory is said to be under consideration. Dr. C. B. Ogden, Health Officer.

Great Falls, Mont.—The contract for removing city garbage from Oct. 1, 1901, to Oct. 1, 1903, has been awarded to Robert Bissett, for $4,989.

Huntsville, Ala.—Local press reports state that it is proposed to construct a garbage crematory. Alfred Moore, Mayor.

Philadelphia, Pa.—Bids are wanted Oct. 26 for a garbage crematory at the Navy Yard, League Island, Pa. Appropriation, $7,200. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

GOVERNMENT WORK.

Fort Terry, N. Y.—Bids are wanted Oct. 31 for constructing, plumbing and electric wiring, double, frame non-commissioned officers' quarters and ordnance storehouse, as advertised in The Engineering Record.

Fitchburg, Mass.—Bids are wanted at the Treasury Dept., Washington, D. C., until Nov. 6, for the construction, including heating and electric wiring, of the U. S. Post-Office at Fitchburg, as advertised in The Engineering Record.

Ft. Leavenworth, Kan.—Bids are wanted Oct. 26 for constructing certain buildings, as advertised in The Engineering Record.

Governor's Island, N. Y.—Bids are wanted at the U. S. Engineer Office, New York, until Nov. 2, for furnishing materials and building riprap bulkhead at Governor's Island, as advertised in The Engineering Record.

Indian Head, Md.—Bids are wanted Oct. 15 for erecting one chronograph and record office and one surgeon's office and dispensary at the Naval Proving Ground, Indian Head. Chas. O'Neil, Ch. Bureau of Ordnance, Navy Dept., Washington, D. C.

Ft. Mansfield, R. I.—Bids are wanted by the Constructing Quartermaster, New London, Conn., until Oct. 7, for sinking a tubular well at Ft. Mansfield.

New York, N. Y.—Contracts for work at Marine Barracks, the New York Navy Yard (bids opened Aug. 30), have been awarded as follows: General work, to George Hildebrand, 1368 Broadway, for $14,802; heating work, to Blake & Williams, 211 W. 20th St., for $10,607.

Boston, Mass.—The following bids were opened Sept. 28 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing an extension of a rolling mill at the Boston Navy Yard: Penn Bridge Co., Beaver Falls, Pa., $97,870, $106,770; F. G. Coburn, Melrose, Mass., $97,550, $92,550;; J. H. Colson & Son, Boston, Mass., $108,000.

Governor's Island, N. Y.—Bids are wanted Oct. 24 for installing steam heating plant in quartermaster's storehouse, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Oct. 9 for the construction of a conduit for heating connection with F St. wing, Patent Office Building, Washington. E. A. Hitchcock, Sec'y Dept. of the Interior.

Ft. Morgan, Ala.—Bids are wanted Oct. 12 for erecting one single set officers' quarters at Ft. Morgan. Address, J. T. French, Q. M., Mobile, Ala.

Newport, R. I.—Bids are wanted at the Treasury Dept., Washington, D. C., until Oct. 23, for furnishing heating apparatus for the U. S. Custom House, etc., at Newport, as advertised in The Engineering Record.

Newport, R. I.—Bids are wanted Oct. 24 for the installation of a conduit and wiring system for the extension of the U. S. Port Office and Custom House at Newport, as advertised in The Engineering Record.

Ft. De Soto, Fla.—Bids are wanted Oct. 14 for constructing 13 water tanks at Ft. De Soto. C. L. J. Frohwitter, A. Q. M., Ft. Dade, Fla.

Chicago, Ill.—Bids are wanted Oct. 7 for smoke-preventing devices, attached to the steam boilers at the U. S. Temporary Post Office, Chicago. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Norfolk, Va.—Bids will be received at the Engineer's Office, 166 Granby St., Norfolk, until Nov. 4, for constructing a wharf at Ft. Wool, Va.

Governor's Island, N. Y. Harbor.—Bids are wanted Oct. 8 for making repairs to ordnance storehouse No. 4, and for constructing a tramway between said storehouse and wharf, at Governor's Island. F. Von Schrader, Acting Depot Q.-M., Army Bldg., N. Y. City.

Boston, Mass.—Bids are wanted Oct. 26 for constructing a fireproof store and brick entrance building at the Navy Yard, Boston. Appropriation, $23,500. Bids will also be received Nov. 2 for erecting 2 brick and steel buildings at the Navy Yard, Boston. Estimated cost, $121,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Philadelphia, Pa.—See "Street Cleaning and Garbage Disposal."

New York, N. Y.—The following bids were opened Sept. 28 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of a storehouse at the N. Y. Navy Yard.: Geo. Hildebrand, $174,500; Cramp & Co., Bridgeton, N. J., $168,850; Merrill Fireproofing Co., Jersey City, $145,750; R. H. Hood & Co., $142,400; Tidewater Building Co., $159,000; Lewison & Just, $176,800; P. J. Carlin & Co., $173,000; H. Probst, $173,000; J. Stevenson, $171,689, $167,941, $145,920. Address of bidders, New York, unless otherwise stated.

Governor's Island, N. Y.—Bids were opened Sept. 30 by Maj. W. L. Marshall, Corps of Engrs., U. S. A., as follows: Building pile dock, H. L. Spearin, $27,586; Jas. D. Leary, $27,207; Degnon-McLean Const. Co., $25,590; Geo. W. Rogers, $25,954; W. H. Jenks, $25,931; B. F. Jones, $25,569; John Monks & Son, $29,046; Geo. Humphreys, $27,582; Rosevelt & Sullivan, $25,403. For dredging, the bids were as follows *a*, stone of 2 cu. yds. and over; *b*, smaller material; *c*, additional cost of depositing at sea: Morris & Cumings Dredging Co., *a* $3.50, *b* 90 cts., *c* 15 cts.; International Contracting Co., *a* $5, *b* 62 cts., *c* 14 cts.; W. H. Beard Drdg. Co., *a* $2, *b* 78 cts., *c* 12 cts.; R. G. Packard Co., *a* 78 cts., *b* 78 cts. Bidders all of New York.

MISCELLANEOUS.

Akron, O.—Bids are wanted Oct. 12 for building a retaining wall on the south side of Cherry St. Chas. H. Isbell, Clk. Bd. City Commrs.

Boston, Mass.—The following bids were opened Oct. 1 by Supt. of Streets Wheeler for building a sea wall, extending the wharf, building a boat house and steps and other work, including 12,000 cu. yds. of excavation for grading and 300 cu. yds. earth and rip rap excavation for the sea wall: George H. Foss, $29,730; Patrick McGovern, $23,942; Miller & Ellis, $17,698; John Cashman, $19,655.

Auburn, N. Y.—Bids are wanted Oct. 21 for the construction of a steel tower 60 ft. high, with fire-alarm bell, as advertised in The Engineering Record.

Kansas City, Mo.—Bids are wanted Oct. 15 for constructing a 48-in. concrete tunnel, 400 ft. long, for supplying the power station of the Consolidated Electric Light & Power Co. with water from the Kaw River. Daniel Bontecou, Engr.

New York, N. Y.—Under a mandamus granted by the Supreme Court the Board of Aldermen on Oct. 1 voted to approve a bond issue for $1,318,332 for land for the new park at 52d St. and the North River.

Sydney, N. S.—It is stated that bids are wanted Oct. 20 for quarrying and crushing 300,000 tons of stone from quarries at Marble Mountain and George River, to be delivered f. o. b. cars or vessels. David Baker, Gen. Supt., Dominion Steel & Iron Co.

Ventura, Cal.—It is stated that bids are wanted Oct. 14 for constructing a concrete retaining wall in Santa Paula road district. Geo. E. Farrand, Clk. Bd. Supervisors.

Baltimore, Md.—Bids will be received by the Board of Awards until Oct. 9 for constructing a stone and timber bulkhead at South St. N. H. Hutton, Harbor Engr.

NEW INDUSTRIAL PLANTS.

The Virginia Portland Cement Co., Craigsville, Va., will double the capacity of its plant, adding about 800 H.-P. to the power plant. This addition will make the total capacity 1,200 bbls. daily.

The Elkin, N. C., Mfg. Co. will probably build a small hosiery mill.

The Andrew Lohr Bottling Co., Cairo, Ill., is erecting a 3-story, 60 x 100-ft. factory, and, while there will be no immediate change in the power plant, it proposes, later, to add boilers, engine and electric generators.

The Abbeville, S. C., Mfg. Co. will install a 150-H.-P. boiler, 100-H.-P. Corliss engine, wood-working machinery, etc., in its furniture factory. C. P. Hammond, Sec'y & Treas.

The Northwest Thresher Co.. Stillwater, Minn., is building a new foundry, to cost $10,000.

An ice company has been organized in Nevada, Mo., to install a 15-ton plant. Q. T. Moore, Pres.; F. L. Lacaff, Sec'y.

The Minnesota Malting Co., Red Wing, Minn., expects to double its plant next spring.

The Mangold Stave & Lumber Co., Harviell, Mo., is in the market for an exhaust system for removing shavings.

The Love Bros. Architectural Iron Works, Aurora, Ill., are putting in the foundations for a 42 x 200 ft. pattern and machine shop, and will need hoists and metal-working machinery by Jan. 1, and pneumatic tools next spring.

Charles Bruns, Seguin, Tex., will build a 10-ton ice plant.

Thomas B. Lee, Greenwood, S. C., is interested in the erection of a cotton batting and quilt mill having a daily capacity of 2,000 lbs.

Smith & McCoy, Norfolk, Va., are erecting a 80 x 40-ft. machine shop, a 60 x 40-ft. boiler shop and a saw-mill.

BUSINESS NOTES.

The Valley Sugar Co., Saginaw, Mich., has been organized, with a capital stock of $600,000, and has let a contract to the Kilby Mfg. Co., Cleveland, O., for a 600-ton beet-sugar plant at Carrollton, Mich., to be completed by Aug. 15, 1902.

The E. Keeler Co., Williamsport, Pa., is building an 80 x 150-ft. addition to its erecting works. The machinery has been contracted for.

The Pittsburg, Pa., Filter Mfg. Co. is building a large plant for the Indianapolis, Ind., Water Co., and has recently been awarded a contract for a million-gal. plant for the Waynesburg, Pa., Water Co.

The well-known firm of T. C. Alcott & Son, of Mount Holly, N. J., manufacturers of the high duty turbine, have acquired by purchase the entire plant, including all patterns and patents of the John W. Taylor Mfg. Co., formerly and better known as the T. H. Risdon & Co., manufacturers of the celebrated Risdon turbine and the Taylor sleeve gate turbine. The combined plants of this company will hereafter be operated by the incorporators, Thomas J. Alcott and his two sons, Edgar A. and Howard E. Alcott, under the name of the Risdon-Alcott Turbine Company. Their product will be turbines and appurtenances almost exclusively, and the wide range of power and speed covered by the different sizes and patterns of turbines controlled by this company makes it possible for them to fulfill the requirements of almost any situation. Their greatly increased facilities in the way of new buildings, new tools and appliances enables them to handle work of large magnitude with considerable dispatch.

The Union Steam Pump Co. held a convention of representatives at Battle Creek, Mich., Sept. 24-26, at which the following firms were represented: Advance Packing & Supply Co., Chicago; Strong, Carlisle & Hammond, Cleveland; Elmer E. Dale Supply Co., Toledo; Erie, Pa., Mfg. & Supply Co.; Smith Courtney Co., Richmond, Va.; Champion Milk Cooler Co., Cortland, N. Y.; Wray-Austin Machinery Co., Detroit; Cameron Barkley Co., Charleston, S. C.; Pacific Coast Mfg. Co.; C. H. Dutton Co., Kalamazoo, Mich.; Darling Bros., Montreal, Can. The following delegates were also present: Jos. W. Beck and Chas. Nuhring, representing Cincinnati; E. E. Martin, Philadelphia, representing Pennsylvania; E. L. Cole, Mobile, Ala.; Kay Dyhr, Copenhagen, Denmark; C. B. Epes, Tyler, representing Texas.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Oct. 9.	Weatherford, Okla. Ter.	Sept. 28
	Adv., Eng. Record, Sept. 28.	
Oct. 10.	Traveling crane, Cleveland, O.	Oct. 5
Oct. 10.	Wells, Guthrie, Okla. Ter	Oct. 5
Oct. 11	Lexington, Mass	Oct. 5
	Adv. Eng. Record, Oct. 5.	
Oct. 16.	Springfield, O.	Oct. 5
Oct. 17.	Tunnel, Newark, N. J.	Oct. 5
	Adv., Eng. Record, Oct. 5.	
Oct. 22.	Merrillan, Wis.	Oct. 5
Oct. 24.	Chimney, Cleveland, O	Oct. 5
Oct. 26.	Pumps, Washington, D. C.	Oct. 5
	Adv., Eng Record, Oct. 5.	
Nov. 1	Hazlehurst, Miss.	Oct. 5
Nov. 1.	Greenwood, Miss	Sept. 21
	Adv., Eng. Record, Sept. 21 to Oct. 5.	
Nov. 11.	Water-works franchise, Yazoo, Miss.	Sept. 14
——	Well, Mt. Pleasant, S. C.	Oct. 5
	SEWERAGE AND SEWAGE DISPOSAL.	
Oct. 7.	Cement and bricks, Portland, Me.	Oct. 5
Oct. 7.	Syracuse, N. Y.	Oct. 5
Oct. 7.	Aurora, Ill	Oct. 5
Oct. 7.	Lockport, N. Y	Oct. 5
Oct. 8.	Jersey City, N. J.	Oct. 5
Oct. 8.	Columbus, O	Oct. 5
Oct. 8.	Conneaut, O.	Sept 14
Oct. 8.	Cleveland, O.	Sept. 14
Oct. 8.	Boston, Mass	Sept. 21
	Adv., Eng. Record, Sept. 21, 28.	
Oct. 8.	Cincinnati, O.	Sept. 28
Oct. 9.	New York, N. Y	Sept. 28
Oct. 9.	Kansas City, Mo	Oct. 5
Oct. 10.	Construction, Portland, Me.	Oct. 5
	Adv., Eng. Record, Oct. 5.	
Oct. 10.	St. Paul, Minn	Oct. 5
Oct. 10.	Wilkinsburg, Pa	Oct. 5
Oct. 10.	Buffalo, N. Y	Oct. 5
Oct. 11.	St. Louis, Mo	Oct. 5
Oct. 14.	Toledo, O.	Oct. 5
Oct. 15.	Cincinnati, O	Oct. 5
Oct. 16.	Logansport, Ind	Sept 14
Oct. 16.	Ridgefield, Conn	Oct. 5
	Adv., Eng. Record, Oct. 5.	
Oct. 16.	New York, N. Y.	Oct. 5
Oct. 17.	Xenia, O	Sept. 21
Oct. 21.	Santiago, Cuba	Sept. 14
	Adv., Eng. Record, Sept. 14 to 28.	
Oct. 22.	Merrillan, Wis	Oct. 5
Oct. 23.	Havana, Cuba	June 29
	Adv., Eng. Record, June 29 to July 20, Oct. 5.	
Nov. 1.	Greenwood, Miss	Sept. 21
	Adv., Eng. Record, Sept. 21 to Oct. 5.	
Nov. 4.	Burlington, Ia.	Oct. 5
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
——	Canon City, Colo.	Sept. 28
	Adv., Eng. Record, Sept. 28, Oct 5.	
	BRIDGES.	
Oct. 7.	Rossville, Ind.	Oct. 5
Oct. 7.	Liberty, Ind.	Oct. 5
Oct. 8.	Kingman, Kan	Oct. 5
Oct. 8.	Manhattan, Kan	Oct 5
Oct. 9.	Dartmouth, Mass	Oct. 5
Oct. 9.	Absecom, N. J	Oct. 5
Oct. 9.	Vicksburg, Miss	Sept. 14
Oct. 9.	Auburn, Ind.	Oct. 5
Oct. 12.	Akron, O.	Oct. 5
Oct. 12.	Washington, D C	Sept. 28
	Adv., Eng. Record, Sept 28	
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Truth about the Brooklyn Bridge.

The publication elsewhere in this issue of the first half of an important unprejudiced report on the Brooklyn suspension bridge and the publication later of its mathematical supplement are unpleasant duties The Engineering Record owes to its readers. It is painful to place on record a statement so damning when read with care and criticized in the light of engineering knowledge. This bridge occupies a unique position among engineering works, not only on account of its great length of span, but still more on account of the enormous passenger traffic which it accommodates. On its capacity to perform its functions depend, in a large measure, the comfort and safety of a million people. It is the most important single structure owned by the city. There is every reason for expecting great care in its maintenance, complete records of its original details and of every change made in them, and the immediate use of every new advance of science which permits the strains in the members to be estimated with a nearer approach to accuracy than was previously possible. The management of the bridge should, in short, be a model of practical and scientific efficiency. It is because this is such a self-evident truth, that the report is so startling and so disquieting to the engineer, who reads in the moderate language of the document warnings that the general public cannot appreciate at their full significance. There is nothing in the numerous details of the bridge to baffle well-directed efforts toward effective inspection and maintenance. The method of keeping such a structure at the highest degree of efficiency is perfectly well understood. Engineers are now familiar with methods of mathematical analysis by which the stresses due to the actual loads on the bridge can be computed with a fair degree of accuracy for all the members. And, finally, the causes of the deterioration which the bridge has been suffering have been clearly recognized for a long time, and the remedies, and even the preventatives of such deterioration, are well known.

It will be remembered that on July 24 nine of the short suspender rods were found broken near the center of the span under the northernmost cable. The reporting engineers take the ground that the failure of two of those suspenders, which had evidently been broken for a long time, would have been discovered promptly had there existed a reasonable system of inspection; and no experienced engineer will controvert that position. Indeed, the detection of an unsound or failed connection or a loose member of any kind by the sound of a hammer blow is one of the commonest of all inspection experiences. The nature of the trunnion connection at the lower ends of the suspender rods was sufficiently described immediately after the accident to show its unfitness for the duties it has to perform, even if cared for with the most scrupulous attention. The report indicates that this detail, the crucial one, almost, of the entire structure, has received neither inspection nor care. It was intended to be lubricated, in what would probably be an unsuccessful effort to make it work properly, but apparently it has been left to the deteriorating effects of moist sea air, dirt and rain, with the inevitable result of its acting like a solid piece. The investigating engineers state that the failure of the desired action results in a dangerous cross-bending, but that other cross-bending, due to the transference of wind loads from the floor to the cables through the same short suspender rods, may have been even a more important agent in the July failures. There may be some question whether they have not overestimated the effect of this wind transference, but there is no doubt that the influences they describe were active agents in the failure, as stated in this journal on August 17. This detail should be displaced by one whose action will be certain and efficient.

Those parts of the bridge found to be most overstressed are the intermediate floorbeams of both railroad and roadway and the channels supporting the intermediate floorbeams. The stresses produced in these members by the loads they now carry are from two to two and a half times as much as they should be. This is a most serious condition of affairs, although it is possible that the resulting stresses might be carried without rupturing the metal for many years and perhaps for all time. It occurs, however, in a portion of the structure subjected to comparatively rapid repetitions of loading, which carry with them the gravest dangers. The detection of these overstresses involves only computations of the simplest character, which are made without difficulty even by under-graduate students in our engineering schools. The question inevitably arises why those computations were not made by the engineering staff in charge of the bridge. How have they been caring for this great structure on the safety of which so much depends? Is it possible that they have taken no steps to acquaint themselves even with the simplest features of their duties? Or if they have known of the existence of these dangerous overstresses, have they supposed them to be reasonable and safe for such a structure? The revelation of these highly overstressed floorbeams, the simplest members in all the structure and those experiencing the most fatiguing duty, is most remarkable. The other overstresses, running from perhaps 10 to 20 per cent. above permissible working values, are not serious, although they are certainly not desirable. Indeed, metal in a structure designed twenty years ago, carrying stresses no more than 10 or 15 per cent. greater than originally intended, is not uncommon in much excellent work.

The gravest aspect of the case, however, is not so much the condition of the bridge as the gross lack of efficient inspection and maintenance, which seems to be without a mitigating feature. Apparently there has been complete ignorance of existing conditions in the structure from the plank of the highway floor to the cables and the towers. The saddles at the tops of the towers and the suspender trunnions were both found stuck fast by dirt and rust, flexible members were mutually rubbing away their sectional areas, mal-adjustments were crudely made, welds in steel rods were employed and dangerous overstresses were not recognized. The criticisms in The Engineering Record on August 17 may well be applied to the situation in the light of this report.

The bridge is certainly able to carry the loads now coming upon it, if well maintained, although by no means so strong as the officials in charge have asserted. The engineers making the investigation particularly disclaim any minute thoroughness in the analysis of the stresses in the bridge. The careful determination of its actual strength requires accurate measurements of all parts of the structure, the official data being evidently of trifling value, and a mathematical analysis of a searching nature. This thoroughness was impossible owing to lack of time. A criticism of a few of the papers appended to the report, if made just now, might seem to detract from the grave revelations referred to above. It has therefore seemed best to reserve certain of the appendices and the criticisms on them for a later number.

The Presentation of a Gold Medal to Abram S. Hewitt a few days ago by the Chamber of Commerce of New York was a public mark of appreciation of valuable unrewarded services to the city, which is gratifying to all who are pleased to see honor bestowed upon those who merit it. The medal was given in recognition of his services in obtaining better transportation facilities in New York, for to Mr. Hewitt more than to any other one man is due the success of the long educational movement which will shortly reach fruition in the Rapid Transit Railway. In the course of a long and active life he has accomplished many undertakings of wide-reaching importance and has served the city in many public and private ways, for which he has received various honors, but this medal, to use his own words, he holds as the crowning honor of his long career. Years ago he decided that an underground railway was the most practicable means of improving passenger transportation on Manhattan Island, and that the tunnel should be owned by the city and leased to an operating company. The idea was bitterly opposed by men in public life and by influential newspapers, but a few other men recognized its merits and forestalled the slow progress of public opinion by obtaining a franchise for such a railway. Fortunately this finally lapsed on account of financial troubles. Some years later the unceasing advocacy of the project by Mr. Hewitt resulted in the organization of the work on the present substantial non-political basis, which has inspired the taxpayers with full confidence in the results of their enormous expenditures for the purpose.

A Good Deal of Wasted Energy would be saved, Mr. James Mansergh, President of the Institution of Civil Engineers, recently said, if those who engage in every kind of engineering work would remember to use the money standard, as well as the foot-rule and higher mathematics. All other things being equal—adaptability, soundness, efficiency—the engineering work which costs the least money is the best.

The Luxemburg Stone Arch Viaduct.

The viaduct from the city of Luxemburg to its new railway station is a cut-stone structure 60½ feet wide between parapets, crossing the Petrusse River with a single span of 275½ feet, which will carry the roadway 145 feet above the bottom of the valley. The roadway is supported over the spandrels by four 17½-foot semicircular arches at each end, beyond which there is one 70½-foot semicircular side arch and a solid-fill approach between curved masonry wing walls on each side of the valley. The viaduct is symmetrical about the center of the main span, except for the difference in wing walls due to the varying slopes of the ground. The lower parts of the skewback piers and the arch rings above ground are faced with coursed quarry stone with deeply cut arrises. The four main vertical piers are faced with dressed stone with very deep rounded arrises. All the other face masonry is of smooth-dressed stone. The intrados voussoirs of the main arches are of cut stone, the upper arch-ring courses are of hammered ashlar and the hearts of the main piers are of solid uncoursed rubble.

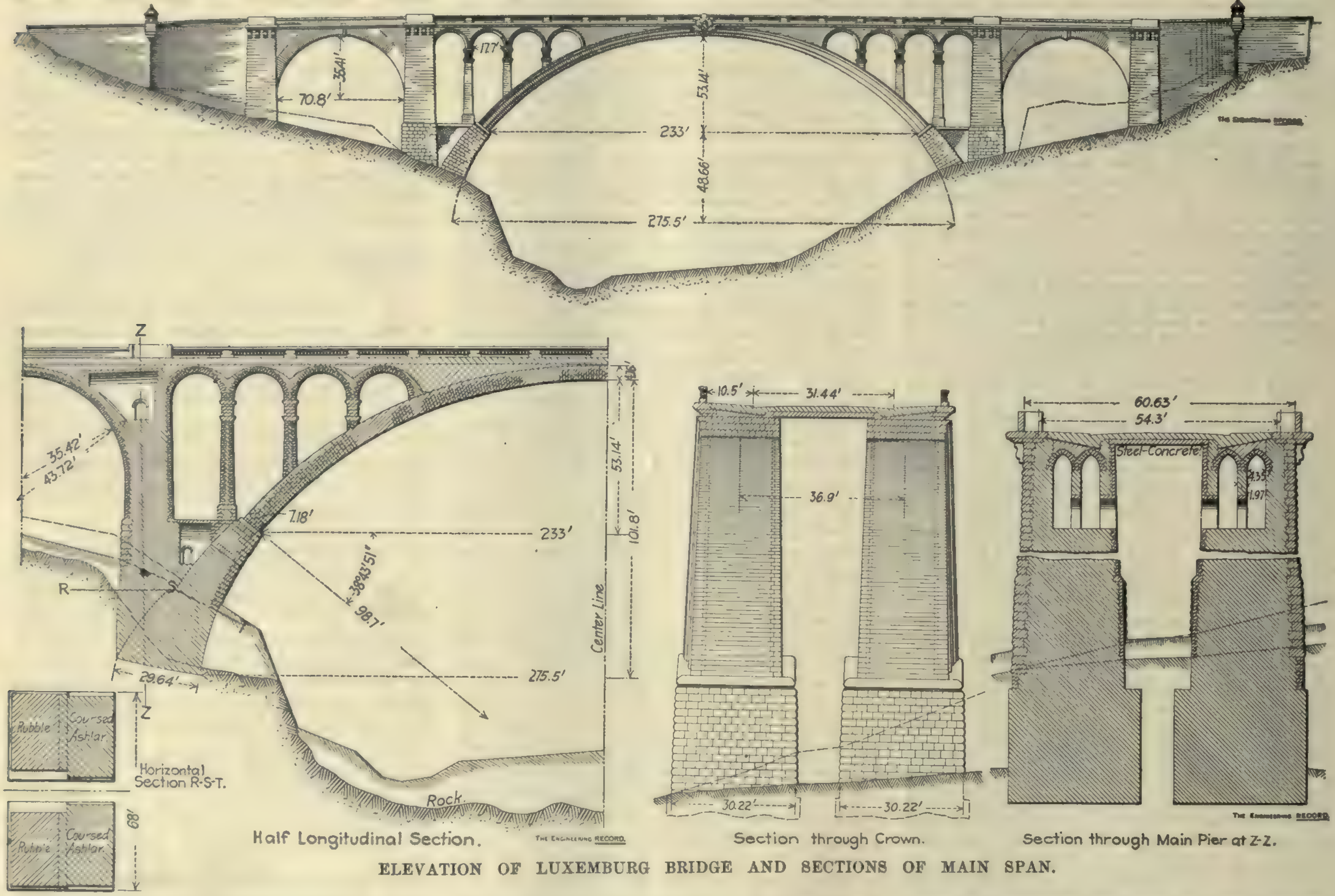
Each of the three spans is remarkable for having in reality two separate arches 17½ feet wide and 19½ feet apart in the clear at the crown. The twin abutment piers at the ends of the double curved wing walls are united by semicircular retaining arches with vertical axes, and the tops of the parallel main arches are united by a horizontal flat platform supported on their inner spandrel walls. This platform consists of a continuous slab of steel-concrete about 22½ feet wide and 1.15 feet thick. The upper part of each great arch consists of a circular segment with a chord of 233 feet. It is composed of three ring-courses and is 4¾ feet deep at the crown and 7.18 feet thick, radially, at the ends, where it is seated on offset segments of a much greater thickness. These end segments have their upper eight radial courses five stones thick, and below that are laid with larger numbers of thinner cut stones in each radial plane, having a length of 29½ feet on the skewback line, where they are bedded with concrete on the solid rock nearly 40 feet below the surface of the ground.

The ends of the arch are carried below the surface of the ground so as to reduce the apparent span to about 250 feet, and this appears even less on account of the massive character and rough finish of the end segments, which gives them a resemblance to inclined abutments. The voussoirs in the extrados are offset to give horizontal seats for the spandrel walls, which are made lighter by pairs of transverse pointed arches dividing each of them into three sections, as shown in the cross-section. The true rise of the main span is 101.8 feet above the lower edge of the skewbacks; the rise of the center section is 53.1 feet above the offsets in the arch ring, and the clear height above the water is 138 feet. The arch faces batter about 1:33 and the voussoirs vary from about 12 to 18 inches in thickness. The facing stones in the lower part of the arch rings are 20 inches thick where the interior courses are 10 inches thick.

The 31½-foot roadway is chiefly carried on the platform between the main arches, and the two 10½-foot sidewalks are carried directly above them. Under each sidewalk there is a waterproof course of asphalt protecting the arch masonry, and covered with a bed of broken stone laid dry, on which there is a cushion of sand and the stone pavement. The two lower courses of face-stones in the main arch have vertical faces, and the upper one overhangs the lower one by 1/12 of the depth of the arch ring. The upper-course face-stones have moulded faces and overhang the second course by one one-sixth of the depth of the arch ring. The spandrel arches have a single course of voussoirs and the face ring is moulded to correspond with the main arch. In front elevation the transverse spandrel walls resemble coursed columns, with square bases, battered shafts, and double projecting belt courses with fluted panels between them at the top. Over the main span the sidewalks have heavy turned stone balusters and massive hand rails; over the side spans and approaches there are solid parapet walls instead.

The bridge will contain nearly 29,000 cubic yards of masonry and 45 tons of metal. Preliminary work was commenced in 1889, and it is expected that the bridge will be opened for traffic in the spring of 1903. M. Sejourné is the chief engineer, and the work is being executed by the government of the Grand Duchy of Luxemburg. These notes have been prepared from a set of plans for which The Engineering Record is indebted to Vice Consul-General Murphy at Frankfort.

The Luxemburg bridge will be distinguished as the longest stone-arch span ever built. The next longest now in existence is the famous Cabin John arch, which was built in 1857-8 to carry the Washington aqueduct over the Cabin John Creek. It has a clear span of 220 feet, with a segmental curve of 110 degrees, with a soffit radius and rise of about 134¼ and 57¼ feet respectively. The soffit voussoirs are of granite, 4 feet deep at the crown and 6 feet deep at the skewback. Outside of the granite arch is a heavy rubble arch faced with rock-faced ashlar ring stones, with the extrados stepped to support the spandrel walls on horizontal beds. The bridge was not originally intended for travel, but a roadway has been built above its masonry aqueduct. This bridge was suggested and designed by Mr. A. L. Rives, and its construction



Half Longitudinal Section. Section through Crown. Section through Main Pier at Z-Z.

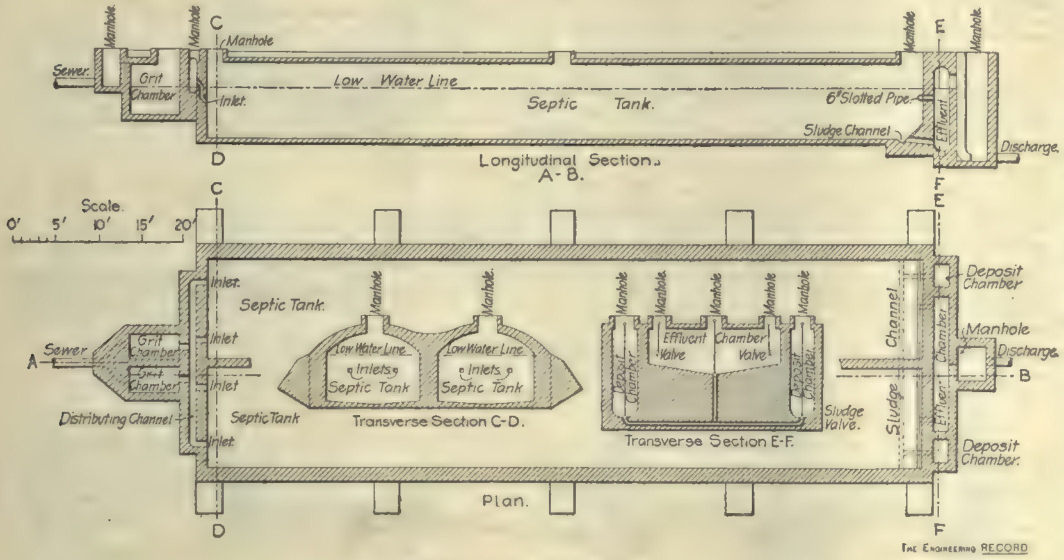
ELEVATION OF LUXEMBURG BRIDGE AND SECTIONS OF MAIN SPAN.

was interrupted by the civil war and was in charge of several army and civil engineers, as stated by Mr. W. R. Hutton, in The Engineering Record of July 29, 1899.

The Vancouver, B. C., Septic Tanks.

The Vancouver septic tanks are three in number, and were designed to treat the sewage from districts having populations of 5,000, 3,000 and 2,000 respectively. They were constructed in 1900 from plans furnished by the Septic Tank Syndicate, and the first was put in operation about the beginning of the current year, the others being started a week or two later. The effluent is discharged into salt water without further treatment. The city scavengers have been dumping nightly into one of the tanks five or six loads of night soil, and although this was the last tank to be put in service, its effluent is the clearest.

The general type of the tanks is shown in the accompanying sketches. Some changes were made in the original plans to avoid the use of wood covering for the inlet and effluent channels, the walls being carried up and arched over, leaving only the necessary manholes appearing on the surface. The masonry is a concrete of two parts of Portland cement, three of sand, two of fine gravel and four of broken stone. After the concrete was well rammed, it was finished with a half-inch coat of 1 : 2 Portland cement mortar. The finish was put on both sides of all walls and arches, and also on the floors of the tanks and other compartments. Earth has been filled over the tanks, graded and seeded, so that there is nothing offensive or unsightly about them on the surface of the ground.



VANCOUVER SEPTIC TANK.

No analyses of the sewage or effluent have yet been made, but the practical results of the septic action are apparent. In a recent letter Col. Thos. H. Tracy, city engineer, stated that the tanks had then (September) been in use about eight months, and their operation was quite satisfactory. The scum on the surface increased rapidly during the warm weather, and the bacterial action became more decided. Only one complaint had been made of any odor, which, on investigation, was traced to the odor from an outlet manhole of one of the tanks, due to the backing up of the tide. There was not the slightest odor from the tank itself when the manhole covers were taken off. "Our experience here would go to prove," Colonel Tracy writes, "what might naturally be expected, that the best results will not be obtained until the tanks are in operation at least six months, including part of the summer season."

Sewer Ventilation Experiments at Leicester, England.

The results of nearly 3,000 experiments relating to sewer ventilation were described in an address recently made to the municipal engineering and surveying section of the Royal Institute of Public Health, by Mr. E. G. Mawbey, city engineer of Leicester. Under the direction of his predecessor many miles of sewers were constructed with an average of 37 lampholes and manholes, with open covers, to the mile. Complaints were frequent against these surface ventilators, and many were ordered closed, 3 x 4-inch ventilating pipes being fixed to buildings when permission could be obtained and many connections being made to factory chimneys. After a time only closed covers were used on all new manholes and lampholes.

When Mr. Mawbey assumed charge of the engineering work he found that the small ventilating shafts frequently became choked with dust at the base, and he employed 4 x 6-inch or larger shafts, and provided them with rust chambers and access holes. Numerous experiments convinced him they were better than surface ventilators, and an inquiry among other cities showed that the same view was generally held. In 30 towns surface ventilators were closed, and, with few exceptions, shafts were substituted when there were well-founded complaints of offensive odors. In five towns between half and three-fourths of the street ventilators had been closed, and in seven towns practically all of them had been abolished in favor of shafts. It was accordingly decided to adopt shaft ventilation at Leicester, and in 1895-99, 134 open covers on sewers and 18 on storm-water drains were closed, and 144 ventilating shafts substituted for them.

It should be noted that the surface-grid system of ventilation was well tried in Leicester under all conditions, including those most favorable to it, but the offensive emanations were a fruitful source of nuisance, and strenuous complaints were constantly being made by the public. This condition of things could not be attributed to the existence of old and defective sewers, for in the case of wide streets on new building estates, where excellent sewers of the best type had been laid down, with open grids at short distances apart and regular flushing, there was the same nuisance. Even where pipe shafts were erected quite close to the surface grids complained of, the latter still frequently acted as offensive outlets, as was proved by many anemometer tests as well as by the stench arising from them. Nor was this due to any defects in the pipe shafts, for numerous anemometer tests showed that they acted most efficiently as extractors. The idea that with a combination of open grids and tall shafts the former might be relied on to act as inlets only was proved to be fallacious. In one case, where a stench arose from an open grid, a large ventilating shaft was erected on an adjacent property. A double shaft was constructed, with two stacks of 9-inch stoneware pipes side by side, and surmounted by two patent earthenware chimney pots. The grid was left open to ascertain whether the emanation from it would be overcome by this large double ventilating shaft. Anemometers were placed in each of the shafts and in the manhole under the grid, which remained in position for thirteen consecutive days, with the result that through the double shaft there was an outward or up current averaging no less than 252,650 cubic feet per diem, or a velocity of about 181 lineal feet per minute, in No. 1 of these pipes, and of about 216 lineal feet per minute in No. 2 pipe. Yet, although this shaft was placed only 31½ yards distant from the grid, there was, during this same period, an outward current from the grid averaging 40,538 cubic feet per diem, or a velocity of 76 lineal feet per minute, while the inward current at this grid averaged only 18,003 cubic feet per diem, or less than half as much as the outward current, and only about one-fourteenth part as much as that extracted by the shaft. In fact, the grid continued to be a nuisance and had to be closed.

This is one of the very great number of tests made, the anemometers being read and other observations taken in many instances every hour. The chief object of these tests was to make observations of the velocities of the air currents in the various shafts over extended periods, but in many cases some or all of the following observations were also taken: Temperatures of air outside the ventilating pipes, temperatures of air inside ditto at street level, temperatures of air in the sewers, temperatures of sewage, humidity outside the ventilating pipes, humidity inside the ventilating shafts at street level, barometrical pressure, the velocity and direction of the wind during part of the time, and the rainfall. These are all factors more or less affecting ventilation; but so variable and complicated are the conditions of these forces and the local circumstances, that it is hardly possible to lay down any reliable rules as to the actual extent to which any particular one of them has contributed to the excellent aggregate results obtained. It is clear, however, that the factor requiring the greatest consideration in determining the arrangements and positions of ventilating shafts is the wind, which is an extremely powerful agent in causing inward and outward currents.

It has been shown over and over again in the course of the tests that, even when the temperature of the external air was considerably higher than that of the air in the sewers, there were excellent currents up the tall ventilating shafts, the tops of which were above the ridges of the roofs and exposed to the extracting action of the wind blowing across them. It very rarely happens, and then only for short intervals, that the atmosphere above the house tops does not travel at a rate of least 1 mile per hour, or 88 feet per minute, and a movement which is only just perceptible is actually one of 2 miles an hour.

An interesting point in connection with the experiments was the question of the air supply to the sewers having closed manhole and lamphole covers. The tests proved that the private ventilating pipes on drains, not disconnected from the sewers, acted as air inlets. The number of these private ventilating pipes was about 4 per 100 feet of sewer. Mr. Mawbey does not believe in main traps on house drains except where the drains pass under buildings, and their omission is held to improve the ventilation by affording more opportunities for air to be drawn into the sewers. In all cases where a main trap is used, he advises carrying a 4-inch ventilating pipe from the sewer side of the trap up the building and terminating well above it.

There were 1,042 fifteen-minute tests made on thirty 6 x 4-inch ventilating shafts. The average velocity of the up currents was 162 feet per minute, while the average velocity of the down currents was only 35 feet. The minimum up current in any shaft was 79 feet and the next lowest 92 feet. The maximum up current was 242 feet. The minimum down current in any shaft was 30 feet and the maximum 79 feet, the next highest being 39 feet. Up currents were registered on 1,002 tests and down currents on 619. Both up and down currents frequently occurred during the same fifteen-minute test.

In 24 tests of two 12 x 5.5-inch shafts the average up velocity was 139 feet, and the average down velocity was 31 feet. Similar results were obtained with other tests on 6 and 9-inch round shafts. Some of these round shafts are used for telegraph, telephone and lamp posts. As a rule the shafts are 150 to 600 feet apart, according to the size of the sewers and the facilities for erecting them. Each is fitted with an anemometer and access hole near the street level, and a chamber to collect any falling rust.

At the present time the regulations governing sewer ventilation include the following:

"(1) That closed manhole and lamphole covers be used in the construction of foul and storm-water sewers in all public and private streets and roads, and that all such foul-water sewers be ventilated by high shafts fixed, with the consent of the respective owners, wherever necessary and practicable on houses or other buildings, and where not practicable by means of standard ventilating shafts on footways or other suitable places.

"(2) That every public ventilating shaft be fixed clear of any windows or chimneys, and arranged to terminate at a height above the level of the ridge of the building on which it is fixed or nearest to which it is erected."

The third regulation refers to a report on types of ventilating shafts and to their location by the committee on the recommendation of the engineer.

"(4) That the borough surveyor be authorized to enter into negotiations with builders and others depositing plans from time to time in future for permission to erect ventilating shafts of the requisite sizes and distances apart on houses and other buildings in all public and private streets for the effectual ventilation of the sewers, the corporation offering as an inducement to make at their expense the connection of the private drain with the sewer after the necessary excavation has been done by and at the expense of the owner, and, in addition, to erect the shaft on his property, and to pay to the owner for such permission a sum not exceeding £2. These considerations to cover the right of the corporation, when required, to utilize the private drain trench, when opened by the owner, for the laying of a separate branch pipe to the shaft. The period for which the above permission shall be granted shall, except in very special circumstances, be not less than two years, after which period the corporation may be called upon by three months' notice to remove the shaft.

"(5) Where a disconnecting trap is fixed on a private drain, which does not pass under a building (such trap not being required by the corporation), the owner shall provide a 4-inch circular ventilating pipe, or pipe of equal sectional area, to be carried up the building from a 4-inch stoneware branch, laid from the drain on the sewer side of the disconnecting trap, the ventilating pipe to terminate not less than 3 feet above the eaves of the roof and to be clear of all windows.

"(6) That the borough surveyor be authorized and directed to substitute shaft ventilation for any sewer grid which has, to the satisfaction of the Highway and Sewerage Committee, been proved to be a nuisance, and also to close such grid when the arrangements for the erection of the shaft have been made."

The Power Plant of the Colonial Hotel, Nassau, Bahama Islands.

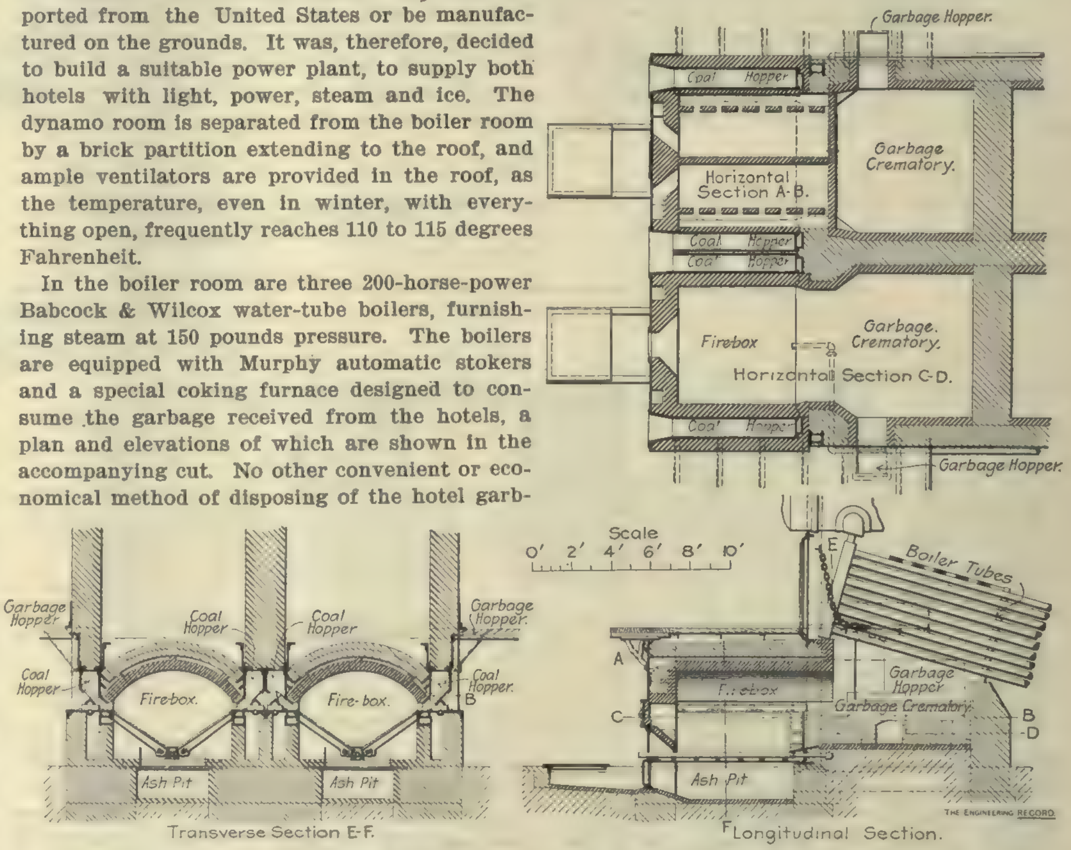
The Royal Victoria Hotel at Nassau was purchased and remodeled about two years ago by Mr. Henry M. Flagler. It proved so attractive that it was found desirable to erect a new, large hotel, the Colonial, equipped with all the modern improvements usually found in similar hostelries, which was opened about eighteen months ago.

Nassau is not well adapted to provide for the wants of the winter tourists, and consequently everything which a hotel requires must be imported from the United States or be manufactured on the grounds. It was, therefore, decided to build a suitable power plant, to supply both hotels with light, power, steam and ice. The dynamo room is separated from the boiler room by a brick partition extending to the roof, and ample ventilators are provided in the roof, as the temperature, even in winter, with everything open, frequently reaches 110 to 115 degrees Fahrenheit.

In the boiler room are three 200-horse-power Babcock & Wilcox water-tube boilers, furnishing steam at 150 pounds pressure. The boilers are equipped with Murphy automatic stokers and a special coking furnace designed to consume the garbage received from the hotels, a plan and elevations of which are shown in the accompanying cut. No other convenient or economical method of disposing of the hotel garbage was available, as it could not be buried, owing to the coral formation of the islands. A raised platform is built on each side of the boilers and the garbage is wheeled to these platforms and dumped into hoppers which lead to the garbage receptacle, directly beneath the front of the boiler tubes and back of the fire box, which is built out in front of the boilers. The flames and gases from the fire impinge upon the top of the garbage thus placed and consume it. The refuse contains a large quantity of moisture, and several months' operation has demonstrated that the combustion of the garbage does not decrease the coal consumption, although there is no increase in the fuel account when the crematories are in use. It is probable that the heat of combustion of the refuse is about sufficient to vaporize the moisture contained in it, and therefore the process of cremation is conducted without expense. The amount of ash or residue left is insignificant, and the plant may be operated for several weeks without cleaning.

The stack, which is built of brick, is 125 feet in height and 5 feet square inside. The boilers are connected with the stack by an oval brick underground flue.

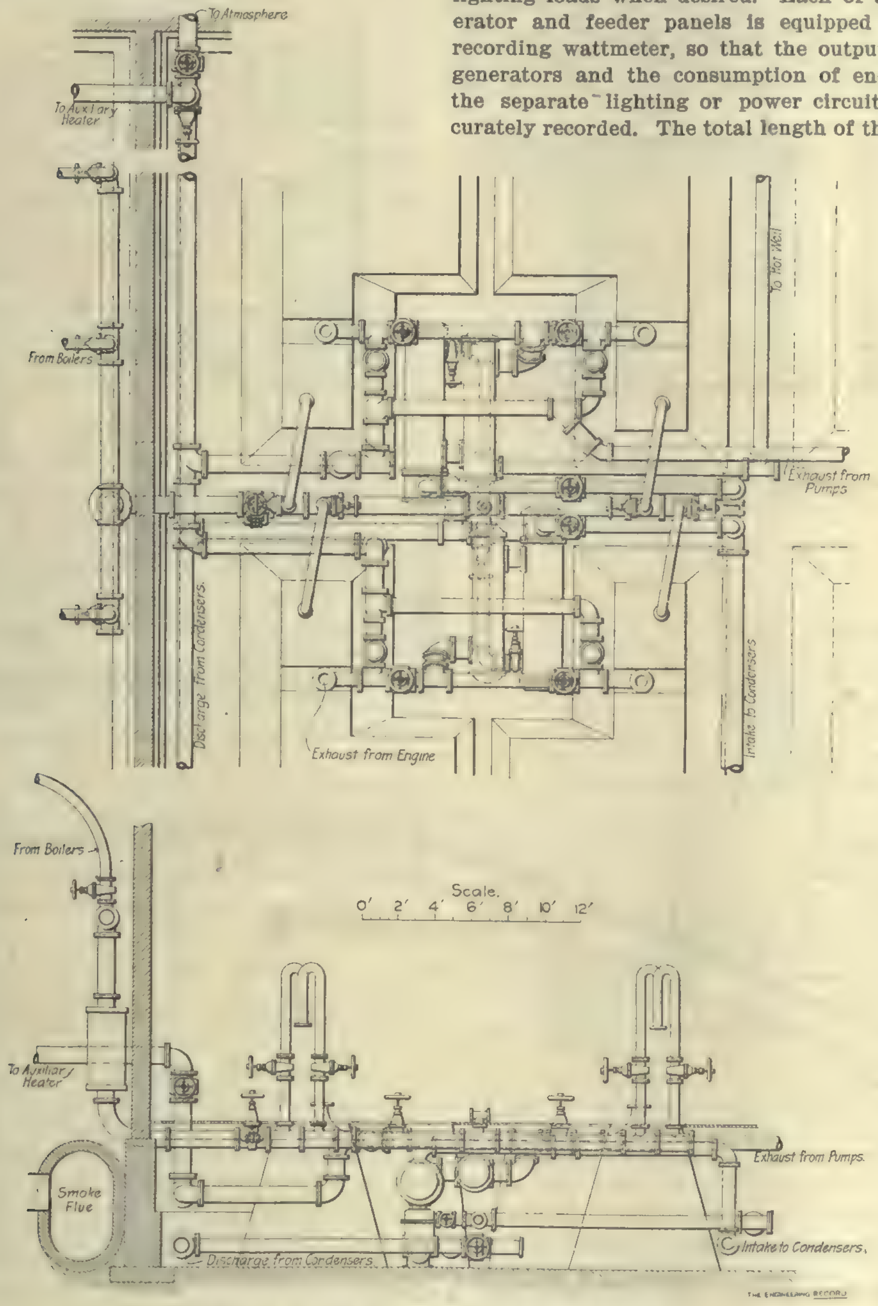
In the dynamo room are four Ball & Wood 10 and 20-inch by 16-inch tandem compound condensing engines, each direct-connected to a 100-kilowatt General Electric two-phase, 60-cycle, 2,100-volt alternator, running at 225 revolutions per minute. The generators are of the revolving field type, with direct-current compounding devices. There are two surface condensers of the Wainwright type, each capable of taking care of two engines. Salt water for condensing is taken directly from the harbor. There are two special horizontal 300-horse-power heaters for feed water, of the even-flow corrugated seamless tube Wainwright type; also one Webster 800-horse-boiler combined heater and filter. The condenser pumps, boiler feed pumps and all the pumps for house supply and fire use are of the Deane manufacture. Those used in connection with the ice plant were furnished by the Stilwell-Bierce & Smith-Vaile Company. The high-pressure steam piping is all of extra heavy pattern, and was completely laid out, cut and fitted in New York before shipment. All drips are returned to a partitioned hot-well, where the oil is separated and the water again used in the boilers.



Garbage Crematory at the Colonial Hotel.

On account of the formation of the island, all water for drinking and ice-making at Nassau must be stored in cisterns during the rainy season, which is over about the time the hotels open for winter tourists in December. Ocean water is used for condensing and fire purposes. Wells dug on the island yield a brackish water, which, after treatment in purifying apparatus furnished by the We-Fu-Go Company, is suitable for flushing in the hotels and supplementing the rainwater used in the boilers.

As coal of very ordinary quality costs in the neighborhood of $7 per ton delivered at the power house in Nassau, the question of steam economy was a very important one, and led the engineer to decide that not only a condensing plant was necessary, but also all small power units should be driven by motors rather than by small steam engines. It was found that with the economy guaranteed for the 150-horse-power direct-connected units, less steam per horse-power would be required in operating motor-driven pumps and an ammonia compressor, located even directly alongside of the generators in the dynamo room, taking into consideration the various losses in transformation through the generators, switchboard, transformers and motors, than would be consumed by small steam pumps or a direct-acting compressor of moderate cost. The pumps installed are used for taking the rainwater from the cisterns and distributing it for the various uses throughout the hotel, for supplying water to the ice-making plant and brine to the refrigerating boxes in the hotel, and like purposes.



Piping of the Colonial Hotel Power Plant.

Because of the poor economy of a small engine, a direct-connected polyphase motor-exciter set was installed, and is used for supplying the field currents to the alternators under the usual conditions of operation. A duplicate exciter, direct-connected to a 7 x 6-inch Forbes vertical engine, is used for furnishing direct current when first starting or whenever, for any reason, the plant has been completely shut down. The exciters and all the motors used in the installation were furnished by the General Electric Company.

On account of the distance of the hotels, particularly the Royal Victoria, from the power house, and because of the comparatively large amounts of energy distributed and the further possibility of municipal lighting being undertaken, it was found desirable to use polyphase currents, and the two-phase system was adopted, using 60 cycles and 2,100 volts.

The switchboard is built of Italian marble mounted in an ornamental bronze frame, and consists in all of 20 panels, of which seven are used for single-phase lighting, six for two-phase motor circuits, four for the two-phase generators, one for the exciters and one for power-house lighting, leaving one blank panel for an additional generator. The feeders are all equipped with circuit-breakers instead of fuses. The board throughout is provided with two sets of bus-bars, each consisting of four conductors, permitting the separation of the motor and lighting loads when desired. Each of the generator and feeder panels is equipped with a recording wattmeter, so that the output of the generators and the consumption of energy on the separate lighting or power circuits is accurately recorded. The total length of the board is 54 feet. The board complete was built by the H. Krantz Manufacturing Company.

The underground system of distribution is used exclusively. Iron pipes connect the power house with the Colonial Hotel, but from the latter to the Hotel Royal Victoria are installed four-duct conduits, manufactured by the American Vitrified Conduit Company, with McGregor manholes.

Oil transformers of large size, 2,100 to 112 and 224 volts, manufactured by the Pittsburg Transformer Company, are used throughout the installation for both motor and lighting work.

The refrigerating plant was furnished by Messrs. Westinghouse, Church, Kerr & Company. It has a total capacity of 25 tons of refrigeration, of which 20 are for ice-making and 5 tons used in refrigerating boxes in the kitchen and bar-room of the Colonial Hotel. The plate system, with brine circulation in both ice-making and refrigerating, is employed. The ammonia compressor, which is of the quadruplex single-acting type, running at 80 revolutions per minute, has cylinders 10½ inches in diameter, with 10½ inches stroke. The compressor is provided with a heavy band-wheel and is belt-driven from a 50-horse-power induction motor. On account of the high temperature of the ocean condensing water, the compressor is rather larger than might be necessary under other conditions, but it is so arranged that two of the cylinders may at any time be disconnected and thus operated under half capacity. In the ice-plant building are located the necessary motor-driven pumps for continuously supplying and circulating the water during the freezing process; also for forcing it through a circulating filter, which is used to eliminate impurities in the water rejected in the plate system of freezing. The ice-tank is built of and lined with selected yellow pine dressed all over. The ammonia condenser is of the vertical atmospheric type, made up of extra heavy pipe with special cast-steel headers. For separating the ice from the coils steam cutters are used. A geared traversing hand hoist, with overhead ball-bearing trolley and rail supported from the roof, permits the easy lifting of the ice from the tanks and transporting it to the cutting-up platform. In one end of the ice-plant building is an ice-storage, having a capacity of 75 tons. The ice plant is run continuously 24 hours a day during the hotel season, any excess of ice being offered to the townspeople, by whom it is eagerly sought, as there is no other ice-making plant in the Bahama Islands.

Adjoining the power house is a complete machine shop, equipped with a lathe, drill-press, planer, etc., all power being furnished by a 10-horse-power polyphase motor.

The electric elevators in the Hotel Colonial are one passenger, one combined passenger and baggage, and one laundry elevator; in the Hotel Royal Victoria, one combined passenger and baggage and one laundry elevator, all furnished by the Otis Elevator Company and operated from two-phase motors. The passenger and baggage elevators have a speed of 150 feet per minute, and the laundry elevator 100 feet per minute. The elevator engines are of the drum-gear type, with a phosphor bronze worm-wheel engaging a solid steel forged screw. The elevators are provided with automatic safety stops for the upper and lower landings, and automatic electric controllers which regulate, independently of the operator, the rapidity with which the cars accelerate. Each car is counterbalanced and equipped with the most approved form of safety appliance. The passenger cars are of ornamental wrought iron and mahogany, equipped with electric lights and annunciators.

Mr. Henry Floy, New York, had charge of both the design and installation of the entire equipment.

The Advantages of a Combined Curb and Gutter of Concrete are well known, but on streets with heavy traffic the scraping of the wheels of large drays against the curb is liable to wear the latter away very rapidly. Among the preventative measures against this chipping are various types of steel facing, among which is the Wainwright system, introduced in a number of cities where the teaming is too heavy to be withstood by either natural or artificial stone. It has steel bars bedded in the concrete in such a way that the metal takes up most of the wear. The Steel Protected Concrete Co., Real Estate Building, Philadelphia, issues licenses for employing this construction.

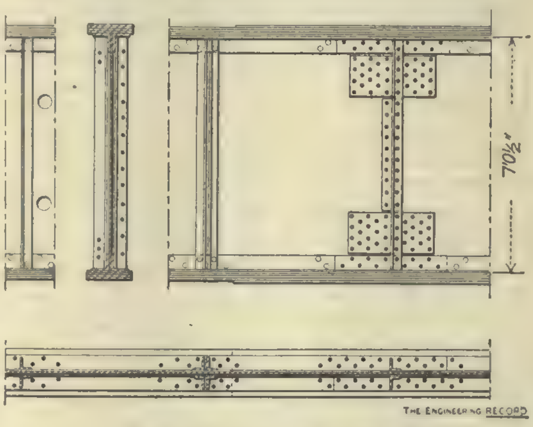
Girders in the Colonial Building, Boston.

The Colonial Building, on Boylston Street, Boston, recently completed for the F. L. Ames estate, is a ten-story steel-cage structure about 125 feet high, which occupies all of a lot about 200 feet deep with a 125-foot front. In the first story there are two stores, and the rest of that and part of the second, third and fourth stories are occupied by the auditorium, halls and offices of a theater. The basement and cellar are used for mechanical plant, storage, etc., and the remainder of the building is devoted to offices. The auditorium, about 72 x 80 feet in plan, is in the central part of the building, and has on one side an outer wall, and on the other sides the stage, halls, corridors and foyers.

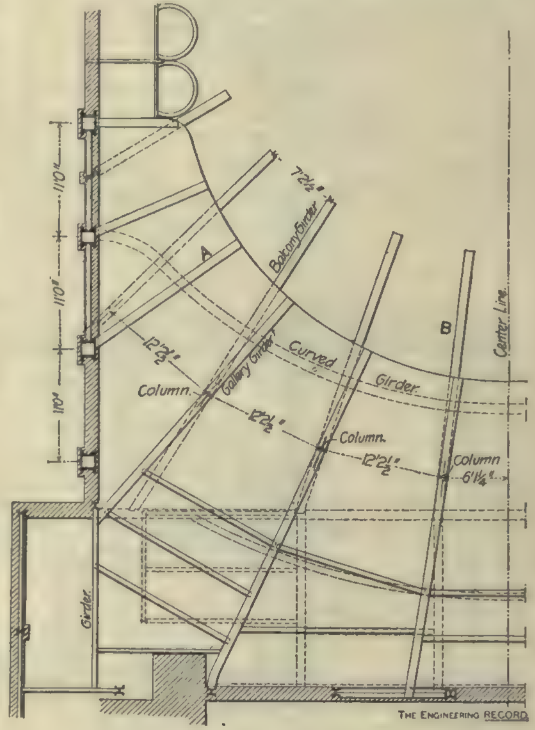
The auditorium ceiling and the six office stories above it are carried by seven double plate girders 82½ feet long, seated on top of the wall columns. They are 7 feet deep, weigh about 82 tons each, and were only partly riveted together at the shops, so that they could be handled, shipped and erected more easily. Each 84 x ¾-inch web plate was made in four sections from 18½ to 22½ feet long, two of which were shop-spliced together and the 6 x 6 x ¾-inch flange angles were shop-riveted to them, so as to lap 20 inches past the end of the web and stagger on opposite sides, as shown in the detail of the middle joint, which was field-riveted. Both shop and field web-splices were alike and were made with top and bottom pairs of 15 x ¾-inch cover-splice plates, 31 inches long, with 36 rivets in ten vertical rows, and with two 7 x ¾-inch cover-splice plate 29½ inches long between them, with 20 rivets in two vertical rows. Single 5 x 3½ x ½-inch vertical web-stiffener angles were riveted over the splice plates and over filler plates on both sides of the girder at alternate panel points, and at the intermediate panel points there were double sets under the column seats, with their outstanding vertical flanges 1 inch apart in the clear. All the stiffener angles have their ends cut to a driving fit between the girder flange angles, and the intermediate ones on the insides of the girders had their outstanding flanges punched for the bolts of the vertical transverse connection diaphragm plates, which unite the twin girders and were bolted up through 5-inch hand-holes left in the middle of the girder webs.

The two sections of each longitudinal half of the double girder were hoisted separately to a working platform at the level of the column tops and there fitted together, on blocking, in a vertical plane, and the 16 x ¾-inch top and bottom flange cover plates were assembled and riveted with pneumatic hammers. The center splice was made and the two girders were connected together and jacked to place on the column caps, where the connection was reinforced by heavy gusset plates. The girders were braced together by sway-brace frames of angles, and deflected 1½ inches under dead load. The field riveting on a girder required about a week.

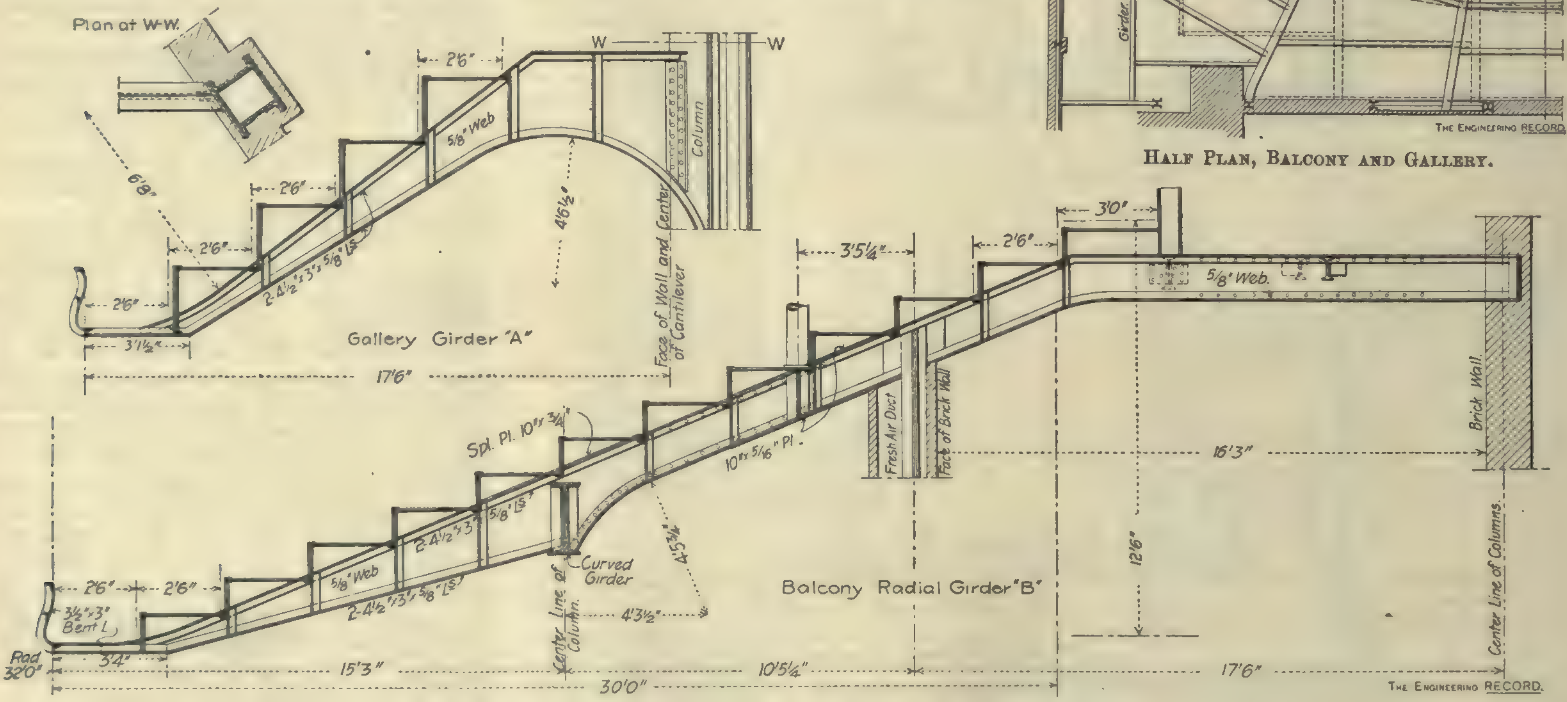
The auditorium is unobstructed except by four columns, one on each side of each center aisle, which carry the balcony girders, and six 4-inch solid steel columns between the girders of the balcony and gallery, which carry the latter girders. Both balcony and gallery floors are inclined about 30 degrees from the horizontal and have the usual concave outline in front, the balcony extending much nearer the stage than the gallery. Both are finished with a curved ceiling underneath, and have rectangular offsets for the rows of seats above. In the balcony floor there are ten inclined plate girders, radial toward the center of the stage. At the ends of the balcony, next the boxes, these girders are cantilever brackets attached with long vertical connections to the extended webs of special oblique wall columns with I-shape cross-sections. The second girders from the ends of the balcony are connected at their upper ends to regular wall columns, are supported intermediately on a curved transverse girder, and project beyond it as cantilevers about 15 feet long in horizontal plan. The third girders are riveted at their upper ends to steel columns in the brick wall between the auditorium lobby and the foyer; are connected there to horizontal longitudinal 15-inch I-beams in the floor of the upper part of the gallery, and are supported near the lower end by the curved girder, which they overhang about 15 feet. The fourth girders are similar, except that they make smaller angles with the horizontal plate girders, with which they are connected at the upper ends, and are web connected to them so as to form essentially continuous bent girders reaching to the main transverse floor girder in the framework of the office part of the building, which is supported by the wall and interior columns. The fifth, or center girders, are also similar, and have the upper horizontal portion made integral with the lower inclined part, as shown in the detail elevation.



Ceiling Girder in Auditorium.



Half Plan, Balcony and Gallery.



RADIAL CANTILEVER GIRDERS FOR GALLERY AND BALCONY.

The horizontal upper parts of the radial balcony girders were first erected. The two sections of the inclined part were then erected and the upper end of the cantilever portion was connected to the curved girder by a horizontal transverse pin through the lower part of its web, which is not shown in the accompanying drawing. The end of the girder was guyed and adjusted to bring the pitch right, and the holes were drilled in place for the top splice plate connecting the girder sections over the top flange of the curved girder. The assumed total load of 200 pounds per square foot of balcony floor brought about 15 tons on the cantilever projections of the girders. The circular girder was dimensioned for strains as if it had been straight, and then an arbitrary flange excess was added by increasing the size of the angles to prevent danger of buckling.

The horizontal girder which supports the cantilever ends of the inclined girders is supported on two regular wall columns and on four intermediate short columns to the auditorium main floor. It is curved so as to be, in plan, normal to the radial girders; is 2 feet deep with 6 x 6-inch flange angles, and is made in separate sections, web-connected with field-riveted joints.

The gallery girders are similar to the balcony girders, but are smaller and are in vertical planes slightly divergent from those of the balcony girders and intersecting them about midway between the curved girder and the transverse foyer wall. At these intersections the small solid columns are seated on the top flanges of the balcony girders to carry the gallery girders, which have no curved girder and have cantilever projections of from 10 to 12 feet. The inclined surfaces of the gallery and balcony floors are made with concrete and wood and are proportioned for a live load of about 150 pounds per square foot. The upper limit is defined by a curved 12-inch I-beam at the intersection with the horizontal floor of the foyer, which is built with end-construction hollow tile terra-cotta arches.

The terraces for the seat platforms on top of the radial girders are made with frames of light horizontal angles latticed together and covered with wire cloth plastered solid on risers and treads. The wooden treads are nailed to wooden risers bolted through the plaster to the steel framework. The spaces between the balcony floor and the curved ceiling below, between the radial girders, are used as hot-air ducts from which fresh air is discharged through openings in the risers. All girders, beams and columns are fireproofed with hollow tile, brick or plaster on metallic lath.

Mr. C. H. Blackall was the architect of the building, and Messrs. Purdy & Henderson were the consulting engineers for structural work.

Standardization of Extra Heavy Flanges.

The accompanying table is a schedule of dimensions of flanges for extra heavy fittings which 28 large valve and fitting manufacturers in the United States have agreed to adopt. In response to an invitation, issued by Mr. J. C. Meloon, mechanical superintendent of the General Fire Extinguisher Company, of Providence, representatives of several of these manufacturers met in New York on April 24 of the present year and a committee was chosen to formulate a standard for extra heavy work, consisting of the following members: Mr. Meloon, who was elected chairman; Mr. J. F. O'Brien, secretary of The Pratt & Cady Company, of Hartford, who was elected secretary; and Messrs. L. R. Greene, of the Walworth Manufacturing Company, of Boston; H. D. Gordon, of Jenkins Brothers, of New York; F. A. Strong, of the Eaton, Cole & Burnham Company, of Bridgeport, Conn., and F. A. Connet, of the Builders' Iron Foundry, of Providence. Finally, on June 28, the recommendations and schedule given in the succeeding paragraphs were submitted to manufacturers interested, and all were adopted at that time, January 1, 1902, being set as the date at which the schedule should take effect.

As may be seen from the table, the numbers of bolts for flanges for different pipe sizes are arranged in multiples of four, this recommendation being similar in this respect to the schedule of standard pipe flanges adopted July 18, 1894, at a conference of committees of the American Society of Mechanical Engineers and the Master Steam and Hot-Water Fitters' Association, with representatives of leading manufacturers and users of pipe. The second recommendation, which also is provided in the schedule of standard flanges referred to, is that drilling should straddle the vertical axis, that is, that the bolt holes should be arranged symmetrically with respect to the vertical axis of the flange. The distance from center to center of bolts does not exceed 3⅝ inches, except on flanges of 2½-inch pipe. In this case the committee at first proposed eight ⅝-inch bolts, but sample elbows and flanges were drilled and bolted together, and it was found that the use of eight bolts interfered with their insertion. The distance from the center of bolt to the edge of the flange, it is recommended, should always be equal to or exceed the diameter of the bolt plus ⅛ inch for 9-inch valves and under, and the diameter of the bolt plus not less than ¼ inch for sizes larger. The bolt circle diameters allow the use of a calking recess on pipe flanges, provided such device is specified. A copy of the schedule can probably be obtained of the secretary, Mr. J. F. O'Brien, P. O. drawer 66, Station A, Hartford.

Flange Dimensions for Extra Heavy Pipe Work.

Size of pipe. ins.	Dia. of flange. ins.	Flange thickness. ins.	Dia. bolt circle. ins.	Number of bolts.	Dia. of bolts. ins.
2	6½	⅞	5	4	⅝
2½	7½	1	5⅞	4	¾
3	8¼	1⅛	6⅝	8	⅝
3½	9	1 3/16	7¼	8	⅝
4	10	1¼	7⅞	8	¾
4½	10½	1 5/16	8½	8	¾
5	11	1⅜	9¼	8	¾
6	12½	1 7/16	10⅝	12	¾
7	14	1½	11⅞	12	⅞
8	15	1⅝	13	12	⅞
9	16	1¾	14	12	⅞
10	17½	1⅞	15¼	16	⅞
12	20	2	17¾	16	⅞
14	22½	2⅛	20	20	⅞
15	23½	2 3/16	21	20	1
16	25	2¼	22½	20	1
18	27	2⅜	24½	24	1
20	29½	2½	26¾	24	1⅛
22	31½	2⅝	28¾	28	1⅛
24	34	2¾	31¼	28	1⅛

Test of an Industrial Power Plant.

The power required to drive shafting and the relative economy of burning different fuels in a boiler are two of the interesting subjects discussed in a paper presented to the International Engineering Congress at Glasgow by Messrs. James Crighton and W. G. Riddell. The paper is a description of improvements made in the power plant of a marine-engine works and of tests made on the completion of the plant to ascertain the degree of economy realized by the change. Tests of boiler evaporation with different coals were made, and a comparison was drawn between the new and the old system, both in the cost, based on operating expenses, of an indicated horse-power per working year and in the amount of work done and unit cost of output for the same period.

A cylindrical marine boiler was selected to replace a marine type of boiler working at a pressure of 80 pounds, and a single steam engine capable of driving and lighting the entire works was introduced in place of four compound noncondensing engines, indicating collectively 215.8 horse-power, the desirability of the former plant in divided units, which allowed of driving any machines over-time from a small engine, being met by an installation of electric motors connected with a public electric service. The main details of the boiler are as follows: It is 13.5 feet in diameter and 12.5 feet long, and fitted with three Morrison suspension furnaces 3 feet 1 inch in diameter and 8 feet long. The grate area is 46.2 square feet; the heating surface 2,040 square feet, being 44.2 times the grate area. The working pressure is 200 pounds; a fan is provided for forced draft; and feed water is received at 205 degrees Fahr. The engine is of the vertical type, with 12.5 and 23-inch cylinders and 21-inch stroke.

The boiler trials were carried on for four successive weeks, with a different kind of coal each week. The coal was tested daily with a Thomson oxygen calorimeter. During the first week coal called washed singles, having a calorific value of about 10,000 British thermal units per pound, and costing $2.14 per ton, was used; during the second week, washed doubles, or nut having a slightly higher calorific value, and costing $2.39 per ton, was used; during the third week, steam coal triping, costing about $2.55 per ton, was used; and during the fourth week, steam coal having a calorific value of 14,320 British thermal units per pound, and costing $2.79 per ton, was used. The coal of the third test contained a large proportion of dust, and a pressure of ⅝ inch had to be maintained in the ashpits in order to burn it quickly enough; this carried the dust away without burning.

The results of the four weeks' tests are given in an accompanying table. In the determination of the rate of combustion per square foot of grate a deduction of 2 tons was made in each case from the weekly coal consumption, this amount being used to keep up steam at night and to light the fires at the beginning of the week. For the other figures the total weekly consumption was taken. The authors state that an equivalent evaporation of 11.5 pounds from and at 212 degrees Fahrenheit was frequently attained for several hours at a time, but the losses due to stoppages for meal hours and for cleaning fires reduced this to the figures given in the table.

Comparative Boiler Tests Using Different Coals.

Number of Test	1	2	3	4
Coal per sq. ft. of grate per hr., lbs.	40.5	39.7	34.5	31.4
Per cent. of ash in coal	15	12	16	8
Water evaporated per lb. coal, lbs.	6.76	6.88	7.9	8.62
Water evap. per lb. coal from and at 212 deg. Fahr., lbs.	7.16	7.29	8.36	9.13
Water evap. per sq. ft. htg. surf., lbs.	6.55	6.47	6.58	6.55
Temp. uptake, deg. Fahr.	630	635	650	617
Ashpit air pressure, in.	½	½	⅝	½
Fuel per 1,000 lbs. evap., cts.	14	15.3	14.2	14.3
Total cost per 1,000 lbs. evap., including cost of water, coal and ash cartage, cts.	14.8	16.1	15.	15.2

The power absorbed by the line shafting was determined by a series of three trials: In the first, the line shafting and loose pulleys only were run; in the second, the machines and countershafts; in the third, the machines cutting at their normal rate. The average diameter of the line shafting is 3¼ inches, and its speed is from 140 to 150 revolutions per minute. It runs in white metal self-oiling pedestal bearings, spaced about 12 feet apart. The total length of the shafting in the works is about 2,300 feet, and the weight is 83,830 pounds. The engine indicated 61.75 horse-power at the first trial, 141 horse-power at the second, and 210 at the third. From these figures it will be seen that the line shafting absorbs 29.3 per cent. of the total power, and only 33 per cent. is actually applied to the cutting tools.

The cost of an indicated horse-power in the old plant, on the basis of 165.2 average indicated horse-power, was $41.30 per year, and the cost of an indicated horse-power in the new plant, on the basis of an average of 271.3 horse-power, is $21.10 per annum. According to the authors' figures, 66.2 per cent. are chargeable to coal account, 1,300 tons being used, at $2.79 per ton; 7.8 per cent. to wages for steam raising, and 17 per cent. to wages for engine tending; 2.1 per cent. for maintenance of engine and boiler; 2.5 per cent. for oil, waste and sundries; 3.5 per cent. for water, and 0.9 per cent. for cartage of ashes. In the old system 1.61 tons of turnings were removed per indicated horse-power per annum, at a cost of $25.30 per ton; and in the new plant, 1.74 tons per horse-power per year, at a cost of $12.05 per ton.

The Demolition of Dry-Dock Walls.

The reconstruction of dry-dock No. 2 in the Brooklyn Navy Yard has been lately carried on inside the old caisson, which was retained temporarily in place to serve as a cofferdam to exclude sea water from the excavation. After the completion of the dry-dock and its new converging entrance walls, outside of those of the old structure, it was necessary to remove the latter, a task which has proved difficult and interesting. The wall consisted of calked 3-inch creosoted pine sheathing and a 6-inch solid course of planks on inclined oak and pine timbers, attached to the tops of several rows of piles, and was similar to the original main wall of the dry dock, which was illustrated in The Engineering Record of January 20, 1900. Originally the excavation had been made and the piles driven through 10 feet of fill and underlying clay, peat, sand, silt, etc., and when successive cavities had formed behind the wall they had been filled with concrete. It was feared that if the piles were pulled out or the wall violently removed, holes and cracks would be caused in the bottom which might start a flow of ground water sufficient to cause undermining or scouring, and it was required to cut off all the timber work and remove the concrete down to the sill of the new docks, so as to widen and clear the entrance without materially disturbing the old bottom.

Owing to the angle which the wall made with the vertical, the thickness of the cut, the large number of spikes encountered and the concrete filling, it was not considered desirable to cut off the timber with a circular saw, and it was cut by boring through it horizontal lines of auger holes as close together as possible, and then stripping off sections of the solid timber lining with a derrick tackle. The holes were bored through the wall and approximately normal to it, in a direction making as small an angle as possible with the horizontal, and on a line just above and parallel to, the intersection of the wall with the timber floor, 28 feet below water level.

A 12 x 24-inch T-shaped wooden girder about 60 feet long was used, with two 6 x 12-inch planks in the web and one in the flange. It was run down through the water on as flat a slope as possible to the point where a hole was to be bored, the upper end being supported on a raft or float. The girder was lifted by a derrick-boom, and two sharp steel points in the lower end entered the sheathing planks and held the girder against slipping while the hole was being driven. In the angle between the web and the flange of the girder, wooden journal blocks were set a few feet apart and received a 1-inch iron shaft nearly as long as the girder and made of 16-foot lengths of rod, connected together by a pair of welded loop eyes at each joint, so as to give it flexibility and prevent binding. The lower end of the shaft was connected to the 7-foot shank of an ordinary auger bit, and the upper end was fitted to engage the socket of a standard Little Giant pneumatic borer.

The boring machine was handled, operated and fed by three men, who advanced it on the girder with its handles engaging a pair of guides on the upper end of the 24-inch web. When the bit was withdrawn from the hole it entered a 3-foot protecting sleeve of gas pipe, which was secured to the lower end of the girder. Air at about 80 pounds pressure was obtained from an adjacent pressure main of the regular distribution system installed throughout the Navy Yard, and from 50 to 60 holes, averaging 3 feet in length, were bored in an 8-hour day. Each hole encountered from one to three calked joints at which the bit was often stopped on account of the oakum clogging the gimlet point and destroying the feed. Whenever a bolt or spike was struck, which was very frequently the case, the hole had to be abandoned and considerable time was required to file up the auger. As it was easier to repair the 2-inch bits than the 3-inch bits, and as the smaller holes were bored somewhat faster, they were chiefly used during the latter part of the work.

As fast as the planking was removed the concrete backing was broken up with a pointed 8-inch shaft, 32 feet long, which was used as a battering ram in the pile driver leads. The broken concrete was washed out with a hydraulic jet and removed by a dredge mud-bucket. When the piles were thus cleared they were cut off by a diver, who directly operated a pneumatic boring machine at the required point. He used a 1½-inch bit and could cut off a 12-inch pile in 10 minutes, but experienced difficulty in boring parallel holes, as they had a tendency to drift into each other and make a wedge-shaped or irregular cut.

Dry-dock No. 3 was constructed behind an ordinary puddled coffer dam with three sheet pile walls which, after the work was completed, were cut off at the bottom by ten 5-foot submerged circular saws, with detachable teeth. These cut through 75 lineal feet of cofferdam in 40 days and used up about 9,000 teeth, a whole new set of teeth being frequently used up in cutting off one pile.

The work was done under the direction of Captain P. C. Asserson, of the Bureau of Yards and Docks, and was executed by the R. G. Packard Company, Mr. C. P. Bleecker, engineer in charge.

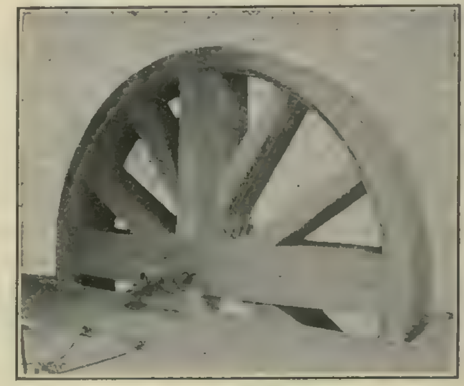
Notes.

A Plant for Fire-Proofing Wood has recently been erected by Messrs. G. Lebioda & Company, of Boulogne, France. The process, of which they hold the patents, consists essentially of forcing the fire-proofing compound into the wood, this being done by a direct high pressure connection to one end of a log, the other end of which is under atmospheric pressure only. The connection being made into the end wood, the fluid is forced into the wood cells and displaces the sap. The apparatus consists of an iron vessel, into which the wood to be impregnated is placed, provided with the necessary devices for making the connections and mounted over a trough in which the impregnating fluid that is forced through the wood is caught, a high-pressure pump and accumulator, and a centrifugal pump for raising the effluent to an overhead tank. The impregnating vessel is capable of treating 14 railroad ties at a time, or 500 in 10 hours. The fire-resisting qualities of the prepared wood were tested recently by erecting a small house, of about 70 square feet floor area, and building a fire inside it with light wood and shavings sprinkled with petroleum. The house of prepared wood was only slightly scorched and charred, while a similar structure of untreated wood was entirely destroyed in a quarter of an hour.

Cast Iron for Superheater Tubes was advocated by Mr. F. Kintzle, superintendent of the Aachen Furnace Company, in a discussion before the local branch of the Society of German Engineers. The majority of superheaters in use, he thought, were provided with this form of tube. When superheaters were first introduced in their works, in 1897, those having cast-iron tubes were tried on two boilers, careful inquiries being made among those using apparatus of this construction. The results of the investigation were most assuring. Since then 56 boilers in all had been equipped with superheaters of this form, and their work had been entirely satisfactory. During this time but one break had occurred, the pipe breaking squarely across. The boilers are all of the fire-tube type, the superheaters lying immediately beyond the tubes, out of reach of the flame. In separately fired superheaters the cast-iron tubes did not do so well; in them a break occurred four times, in each case the crack running parallel with the length of the tube. In none of these instances, however, was there anything of the nature of an explosion. In this form of superheater their use was open to question. The iron should be of the best quality, and he strongly advised strengthening the pipes with internal and external ribs.

The Separation of Oxygen from the air by a process of fractional distillation has been worked out by M. Raoul Pictet, the Geneva physicist, with the aid of apparatus described in detail in "Engineering" of September 13. If liquid air is allowed to evaporate, the gas which first comes off is almost pure nitrogen, while after nine-tenths of the liquid have evaporated, the remaining tenth is nearly pure oxygen, which can be collected and stored. The first cost of liquid air is somewhat high, but by a system of heat interchanges, M. Pictet utilizes the evaporating gases to lower to the point of liquefaction the fresh supplies of air passed into his apparatus. The energy supplied to the stills must be sufficient to compensate for the loss of liquid air evaporated by heat flowing in by conduction or generated by the friction of the fluids. This supply of energy is afforded by keeping the air in the inlets to the stills under 30 to 40 pounds pressure, while the exhaust takes place at atmospheric pressure. There are ten stills, of which three yield a distillate containing 55 per cent. of oxygen, of great value in metallurgical operations where high temperatures rather than many heat units are needed. With a plant treating some 500 tons of air per day, it is estimated that 110 tons of distillate containing 50 per cent. of oxygen can be obtained at a cost, including interest, depreciation and like charges, of about 3 cents per 1,000 cubic feet, which might be largely reduced by the sale of carbon dioxide, a by-product of the operations.

A Large All-Wood Belt Transmission Wheel has recently been installed in the mills of the Peters Lumber & Shingle Company, of Benton Harbor, Mich. The diameter of the pulley is 16 feet, the face 31 inches, and the bore 8¼ inches. It is built in quarters, of southern Indiana oak throughout and weighs 13,440 pounds. Its general construction is indicated in the accompanying reproduction of a photograph, which is inaccurate only in that it does not show the full number of compression bolts used at the hub. In the illustration, resting on the bearing of the pulley shaft, is a 4-inch pulley. The wheel was made by the Reeves Pulley Company, of Columbus, Ind., which entered the order August 3 and shipped the wheel September 17.



Pavement Guarantees.

A paper presented to the American Society of Municipal Improvements by Mr. Geo. W. Tillson, Prin. Asst. Engr., Dept. of Highways, Brooklyn, N. Y.

Previous to the introduction of asphalt as a paving material, the question of pavement guarantees did not demand much attention. Wood being practically the only perishable material in use, and that to no great extent, a pavement was supposed to last until it was worn out. But when coal tar was used, in the sixties, this supposition was found to be incorrect, and when, later, asphalt, a new and similar material, was proposed, it was necessary to do something to make city officials sure that they were at least getting something definite for their money. To accomplish this the idea of guaranteeing to keep the pavement in good condition and repair for a term of years, at the regular contract price, arose. This scheme soon became very popular, and to its effectiveness can be credited in a great degree the rapid progress of asphalt pavements. While public officers and property owners might be in some doubt as to the durability of the material, they were at least sure of a good pavement for a specified time. Later, when granite blocks with tar and gravel joints, and bricks, came into general use, making, with the asphalt, what are now called improved pavements, this same principle was applied, and at once became of great importance in paving contracts.

The subject naturally divides itself into three heads: First, length of guarantee. Second, requirements of guarantee clause. Third, payment of the guarantee. The accompanying table shows the practice in these particulars in twelve of the principal cities in this country.

Practice Concerning Pavement Guarantees in Twelve Cities.

	Period of Guarantee. Years. Asphalt.	Brick.	Stone.	Wood.	How Enforced.	Retained Money, if any, when paid.	Requirements of Guarantee.
Boston	10	..	10	10	Bond.	....	Satisfactory to Superintendent of Streets.
Buffalo	10	10	10	10	Bond.	....	Satisfactory to Chief Eng'r.
Chicago	10	10	10	2	Bond.	....	Good condition, ordinary wear excepted.
Cincinnati	5	2	5	..	10% of contract retained.	At end of guarantee period.	Good condition and repair.
Cleveland	10	3	5	..	Brick and stone 2¼ cts. per sq. ft. Asphalt 10% of contract retained.	At end of guarantee period.	Good condition and repair.
Columbus	10	5	5	..	10% of contract retained.	At end of guarantee period. City pays 6% on money retained.	As recommended by American Society Municipal Improvements.
Detroit	5	0	0	0	Bond.	....	Satisfactory to Board of Public Works.
Indianapolis	9	9	..	9	20 cts. per yd. retained.[a]	At end of guarantee period.	Specific.[c]
Milwaukee	5	5	5	0	10% of contract retained.	At end of guarantee period.	Specific.[c]
Brooklyn	5[b] 10	.. 5	.. 1	.. ..	5 years, bond; 10 years, 20% of cost of asphalt.	5 years. 10 yrs., 4% at end of 6th year then 4% annually.	Specific.[c] Specific.[c]
Philadelphia	5[b] 10	5 10	5 10	.. ..	Bond.	....	Satisfactory condition and city grade.
Toronto	10	10	10	1	Asphalt 15% of contract retained.	At end of guarantee period.	Satisfactory to Engineer.

a. The deposit is generally made in street improvement bonds bearing 6% interest, the contractor drawing the interest if repairs are made.

b. On original improvements, 5 years; on streets repaved with improved pavements, 10 years.

c. Given in detail in text.

The object of this paper is to consider the practice in detail, with a view of giving the writer's opinion of the proper requirements and the principles governing in each case.

Length of Guarantee.—Before deciding on this point it will be necessary to consider just what is expected of the guarantee. Is it simply to protect the city from the decay of a perishable material, or against poor workmanship and material whose exact nature could not be discovered in a short-time test, or is it to provide the municipality with a pavement absolutely free from cost for the entire guarantee period? It will readily be seen that these different conditions will modify the requirements.

In the case of asphalt it was undoubtedly originally intended to indemnify the city from any loss on account of poor material, poor workmanship, action of traffic, or deterioration of material for any reason whatever. No one knew what the condition of the early asphalt pavements would, or should, be at the end of five years, but the intention was to give a good pavement for that length of time. Even now it is doubtful if any engineer or chemist would be ready to accept finally any asphalt pavement when it was first laid. It is a perishable and complex material, and the guarantee period should be long enough to demonstrate fully that the crude material was up to the proper standard. It may be said that this can be ascertained by chemicals. This is doubtful. It would be extremely difficult to have every load of material so inspected as to be absolutely sure it was all right. The asphaltic cement might be unknowingly burned, or, if known, the knowledge kept from the superintendent. There are many ways in which an asphalt can be injured while the pavement mixture is being prepared, and all these chances should be taken by the contractor, as he agrees to lay a good pavement, and the guarantee period should be extended long enough to determine this fact.

One of the common ways of an asphalt pavement becoming defective is by cracking. In some sections of the country this is not important, but in the West, where extremes of temperature are great, it is often the first sign of failure. This cracking sometimes takes place the first winter, but generally not until the second or third. The writer remembers distinctly some asphalt streets that for three years after being laid were in almost perfect condition, but began to crack and disintegrate during the fourth season, and in the fifth had to be very generally relaid. In this connection it should be said that another street paved with the same mixture as those mentioned above, but which sustained a much heavier traffic, proved much more satisfactory in the end, although at the close of the third year it looked as if it would require repaving when the guarantee expired. The heavy traffic was a benefit to the pavement.

It would seem, then, that the early promoters of asphalt pavements builded more wisely than they knew, and that five years is the proper period for determination of the character of the pavements. In several cities where the law requires the property owners to pay for the original pavement, but that all repairs must be made by the city at large, it has been declared illegal for the city to receive bids for a longer period than five years, when it was proposed to assess the cost against the abutting property. If it be desired to make the period longer, that is simply a business proposition, and the increased price will be a measure of the contractor's estimate of the cost of repairs for the additional time.

In the case of brick, however, the conditions are somewhat different. It is only within the past few years that brick has been generally accepted as a paving material. A good paving brick is imperishable as far as the elements are considered. But there is a great variation in so-called paving brick. Because one kind will make a good pavement it does not follow that another will, unless alike in its important properties. This fact it is not easy to determine. If brick of a certain make have been tested by use, it is comparatively easy to select good brick manufactured by the same firm.

With brick it is only necessary to provide against poor workmanship and improper material. The former can be ascertained in a few months, the latter not so soon; so as five years have generally been decided upon as the unit of an asphalt guarantee, and as brick must compete directly with asphalt, it would seem to be doing no wrong to the former material to require that it should be guaranteed for the same length of time, and also that it would be just to the property owner. For it must be clearly understood in this discussion that any unjust requirement, while complied with by the contractor, must be paid for by the general public.

With stone the case is still different. Here it is known just about what the material will stand and what its nature is when laid. Intelligent inspection will easily determine that, so with a stone pavement bad construction is the only thing, as a rule, that should be protected by the clause. If the blocks are laid on concrete, with tar and gravel joints, the defects will generally be an uneven surface produced by traffic, on account of deficient ramming, some poor blocks that may have escaped the inspector's eye, and open joints between the blocks because the interstices of the gravel were not filled with tar. All of these deficiencies can be discovered during the first eight or nine months, but, as it is always safe to allow winter to elapse before the retained amount is paid, the conservative period for a stone block pavement would be one year.

Requirements of the guarantee clause.—This is an important matter, and the clause should be so worded as to make clear just what the contract requires. The early contracts were very remiss in this respect. They guaranteed the pavement for a term of years, but said nothing as to its exact condition. It will be noticed by reference to the table that of the twelve cities given there, only four make any attempt to be specific. The others require that the condition shall be satisfactory to the city officials. This is not very definite, and when, as in many instances, the officials under whom the pavement was laid are not in office when it is finally accepted, the way is open for many complications. That more misunderstandings and lawsuits have not arisen under this clause can be attributed to the fairness and good sense of public officials generally, and the willingness of paving contractors to do what is just, and sometimes even more, in order to avoid a suit. But there should be no occasion for these misunderstandings, and with a properly worded clause they need not arise. This Society has officially recognized this fact, and in 1897 adopted a report of the Committee on Street Paving, which recommended specific requirements for the guarantee clause. Very few cities, however, have attempted to follow out these recommendations.

One point of difference that has often arisen in the interpretation of the maintenance part of the clause is whether the contractor should make good settlements occurring over sewers or other trenches. The writer has always held that he should, provided the sewer has been constructed previous to the bidding; otherwise he should not, on the principle that he must be governed by the condition of the street when he bid. If the city change, or allow the conditions to be changed, it, and not the contractor, is responsible.

In recent years much damage has been caused to asphalt pavements by illuminating gas, and the question has arisen who shall pay for the repairs. While there does not seem any doubt that eventually this cost can, and will be, paid by the gas companies, it is quite important to know whether this is to be enforced by the city or the contractor. As these companies are supposed to be under the control of the municipality, and as any damage from gas would be something wholly outside the power of the contractor to prevent, it seems no more than right and just that this risk should be assumed by the city. It must be understood at all times that the contractor must be paid for all chances that he assumes, and that this amount will be included in his bid. Any damage from fire would unquestionably be paid for by the city, why not, then, damage from gas, when it can recoup itself from the gas companies? The above assumes, of course, that it can be definitely proved that the damage is caused by the gas.

At the present time it is known about how long a good asphalt pavement will last, under ordinary conditions, and it would seem that a guarantee against workmanship and material would be sufficient for maintenance during the guarantee period, with definite directions as to its condition at the close.

Of the four cities in the table specifying conditions at end of guarantee, Columbus says it shall be as recommended by this Society.

Indianapolis: "This guarantee shall cover all repairs growing out of the imperfection or unsuitability of material or composition, too great or too little moisture, all defects of workmanship, extreme heat or cold, and all other defects of climate, and covers all other deteriorations more specifically described as follows: In case of asphalt, brick, or wooden block, any holes or cracks in said pavements, and any defect resulting from the decomposition of the wearing surface or foundation. The pavement, at the end of the guarantee period, shall be in good condition, present surface so true and even that it shall in no way be an obstruction to travel, and have drainage so perfect that water shall collect in no place to a depth of more than one-quarter of an inch. . . . The determination of the necessity for repairs rests entirely with the Board of Public Works, whose decision on the matter shall be final and obligatory upon the contractor."

Milwaukee; asphalt: "The contractor must do all the work required by this contract, in such a good and substantial manner that at the end of 5 years from and after the completion of the contract the pavement shall be free from any cracks, rolls or other defects caused by the workmanship or material, detrimental to travel, and that neither the weather nor the legal travel of the street shall have caused the surface coat to be reduced more than 25 per cent. of its original thickness. In the event of the failure of the pavement to conform to the above requirements the contractor is, during such period of 5 years, to make at his expense such repairs from time to time as in the judgment of the board shall be necessary to make the pavement comply with such requirement." For brick the clause is the same, except as to condition at end of period, which reads: "The pavement shall be free from any broken brick or settlement or other defect detrimental to travel caused by the use of improper material."

New York; asphalt: "That just previous to the expiration of the guarantee period the entire work shall be inspected, and if any surface cracks or disintegrations shall exist, or any bunches, depressions or unevenness in the surface of the pavement shall show a variation of ⅜ inch under a 4-foot straight-edge or template, or any portion of the pavement shall have a thickness of less than 1½ inches, such portion or portions shall be immediately repaved by the contractor upon the order of the commissioner, by the heater process, or, when required, by removing the pavement from the foundation and replacing it in the same manner as when originally laid; provided, that when more than 50 per cent. of the surface of any one block requires repairing according to the above conditions the entire block shall be taken up and relaid. Whenever any defects are caused by the failure of the foundation, the pavement, including such foundation, shall be taken up and relaid in accordance with the specifications. That the period of maintenance shall be in force through the term of years aforesaid, irrespective of any changes that may occur in traffic conditions, on or across said street, whether due to the widening of said roadway or to the construction, reconstruction or rearrangement of new or existing surface or sub-surface construction thereon, or to any other cause."

The difference between the Indianapolis clause and those from Milwaukee and New York will be noticed. The first is for protection against improper material and workmanship, while the others provide for a new pavement if more than one-fourth of the wearing surface in Milwaukee, and pavement in New York, has been worn out. The one is for repairs during the guarantee period, and the others protect against the action of travel, no matter how well the pavement may have been laid. The New York clause is taken from a ten-year contract, and it is quite probable that a large portion of the pavement will be reduced to less than the limit at the end of that time. If any city wishes to insert such a provision in its contract it is eminently proper to do so, but it should be understood that it is a provision for general maintenance rather than repairs. The one seeks to keep the pavement in a certain condition for a term of years, the other to make good defects of material and original construction. It is taken for granted in this connection that the material selected will last naturally the guarantee period, if properly laid. Otherwise, the choice is forced. This, of course, is perfectly allowable in special cases. Then the contract becomes one for construction and practically another for maintenance.

For an asphalt pavement under a 5-year guarantee, the writer believes the Indianapolis clause to be a good one. Its provisions, if carrried out, would produce a good pavement, and they are sufficiently specific to permit a simple and equitable adjustment at the end of the guarantee period. By adding a condition as to the thickness of the wearing surface at the end of any term of years would properly extend it for any time. The New York clause determines the roughness of the surface by measuring from a straight-edge, and the clause from the Indianapolis specifications by the depth of water in depressions, the only reference to bunches being where it is said it shall not obstruct travel. The exact depth of the depression to be allowed and the minimum thickness of the pavement are purely arbitrary, and must be determined by local conditions; but these decisions will make a material difference in the price bid for an asphalt pavement, especially for a long period of guaranty.

For a block pavement, whether of stone or brick, the clause should require the pavement to present a true and even surface, that any individual block, or blocks, that shows any indication of abnormal wear should be taken out and replaced with new, and that all imperfect joints should be made good with the same material as originally required. In the case of a new and untried brick, it would be well to require that if the thickness during the guarantee period should be reduced below a certain amount, estimated to be the same as a well-known standard brick, the reduced portion should be taken up and relaid.

Payment of guarantee.—This has an important bearing upon the amount of the bid. It is recognized that whenever a guarantee is required, the contractor must obligate himself in some way to fulfill the requirement. In five of the twelve cities referred to in the table, a bond only is given for this. In the other seven a certain amount of cash is retained when the work is completed. In some cities this is a specified sum per square yard, and in others a percentage of the cost of the pavement. This amount should, of course, vary with the length of the guarantee. Cincinnati and Milwaukee retain 10 per cent. of the contract when this period is five years; Indianapolis 20 cents per square yard for nine years; and Columbus 10 per cent., New York 20 per cent. of cost of asphalt, and Toronto 15 per cent. for a ten-year period. Whether a bond and a certain amount of retained cash should both be required, has often been discussed. Theoretically it should make no difference, as the bids should be governed by conditions. But with a price once established, small changes do not raise or lower this very materially. No unnecessary conditions should be imposed. It does seem, however, that where a specific condition of the pavement is guaranteed for a term of years, a sufficient sum should be retained to make the pavement good at the end of that time. If actual cash is due the contractor, he will be much more anxious to have the work in satisfactory shape than if a bond is to be released only. If the money is in the city treasury, small repairs can be made much more simply than by proceeding against the bond. Any general resurfacing would probably require that method in the event of a refusal of the contractor to make the repairs called for.

It will be noticed that Columbus pays 6 per cent. on the retained money, and that Indianapolis allows the security to be in the form of street improvement bonds, the contractor receiving the interest.

The money withheld is for the purpose of making repairs, and, until the guarantee period has expired and the repairs made, the contractor has not earned the money, and certainly is not entitled to any interest. The theory of the New York clause is that the unit of asphalt pavement life is five years, and that no special payment shall be made for repairs for that period. During the past two season the cost of asphalt (wearing surface and binder) in Brooklyn has averaged $2 and $2.35 per square yard for five and ten-year guarantees respectively. That is, the additional five years have cost 35 cents, or 7 cents per yard per year. There is retained, when the work is completed, 20 per cent. of the cost, which would amount to 47 cents per yard, somewhat in excess of the bid. This is paid to the contractor as he earns it, beginning at the end of the sixth year, 4 per cent. annually till the guarantee has expired. Can anyone claim that he is entitled to interest on these sums?

It having been decided to retain a certain amount of money for repairs upon the completion of the contract, the question arises as to when it shall be paid. All of the cities retaining money, except New York, hold it until the end of the guarantee period. This does not seem nec-

sary, as the pavement is supposed to be kept
good condition, and it seems perfectly just
d proper that an annual amount to correspond
this work should be paid, making the con-
ct, as has been suggested, practically one for
e years without extra cost, with a specified
n for repairs for the remainder of the term.
e writer would suggest, then, that if the
arantee period for asphalt and brick be taken
five years, a bond be given for its mainten-
ce and repairs during, as well as the con-
tion of the pavement at the end of, this period,
d that the sum of 10 cents per yard be withheld during the same time for incidental repairs in case they should be not made by the contractor when required. The bond to be released and retained money paid at the end of the period, if the pavement be in accordance with the contract requirements. For a ten-year guarantee it is believed that the New York practice, already described, is satisfactory. Its only objection is the amount of bookkeeping involved, and in most cities this would not be very much.

For a one-year guarantee on stone, 10 cents per yard should be retained, and the bond maintained in force until the work is finally accepted.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXVII, DRESDEN, AUGUSTUS BRIDGE.
A view giving more detail than shown in the preceding example. On the left is the Bruehl terrace, of which other views have been given.

Modern Boiler Problems.

An interesting paper on the modern problems of boiler design was presented to the New England Cotton Manufacturers' Association at Niagara Falls by Col. E. D. Meier, M. Am. Soc. M. E. Formerly, he said, very little attention was paid to details of design and to the interrelation of various parts in the boiler, but it was just as necessary to have a clear understanding of the various functions and their dependence on one another in a boiler as in a steam engine. Many rules and ratios which were fixed by certain old authorities on steam, he continued, may no longer be applied without hesitation.

One designation, which he asserted had become an absurdity, had remained with the boiler, from the old practice of considering the boiler as part of the engine, and that was the term horse-power as applied to a boiler. The only rational thing to be done in this regard he thought was to abolish the term and to state instead how many units of evaporation (that is, the number of pounds of water evaporated from and at 212 degrees Fahr.) the boiler is to furnish as its normal work with the one-third margin recommended in the Code for Boiler Tests of the American Society of Mechanical Engineers. This would, he believed, provide a fair and precise basis for purchaser and builder alike. "The principal difference between fair trade and gambling," he continued, "is that in the one the conditions are known and frankly stated, while in the other they are uncertain and hidden. This plan throws the burden of establishing the facts on your consulting engineer, and that is what you pay him for."

On the design of the boiler plant, he had in substance the following to say: As all the important boiler works now employ specialist engineers either permanently or as needed, there no longer exists a necessity for the consulting engineer of a mill to prescribe details of design in a boiler or furnace. His business is primarily to state the requirements in plain words and exact figures, and secondarily to exclude designs or apparatus which, in his best judgment, are unsuited to the conditions. There is no more reason for him to indulge in boiler or furnace design than in engine design. A structural engineer states what physical and chemical qualities his material must have and leaves the manufacture to the steel maker. In like manner, when capacity, economy and quality of steam have been specified to the boiler maker, his judgment and experience should have free scope to design the plant to surely fulfill these requirements. The man who designs must be held responsible for the results. Hence, when special furnaces, automatic stokers, or artificial draft are required, a further division of responsibility must follow, both to avoid mistakes and injustice.

A wise old saw is to always insist on the largest possible heating surface. Yet there are many examples of increased steaming capacity resulting from removal of an entire vertical row of tubes in a horizontal tubular boiler, the increased circulation more than making up for the surplus heating surface which clogged it before. In the old days we used to hear much talk of effective heating surface, and there were empirical guesses stated as facts as to the relative effectiveness of vertical, horizontal, upper and lower segments of heating surface. We have learned that circulation both of the water and the gases increased the effectiveness of heating surface, and is hence as important a consideration as the quantity of the latter.

Every builder of water-tube boilers recognizes circulation as a necessity and provides for it in details of design. The relation of areas for circulation to amount and location of heating surface, and to grate area and draft, must be found by every builder for his own type before he can confidently design his boiler to meet given requirements.

To impose the ratios found by one on any and all others by specification is not engineering, but ill considered tyranny. The greater the difference between the temperatures of water and gases, the more rapid the transfer of heat, and hence the greater the effectiveness of heating surface. When this difference drops to less than 200 degrees Fahrenheit the value of additional heating surface in the boiler becomes nil and the economizer finds its proper place, to become useless in turn when this difference again sinks below 200 degrees. A well designed furnace with enough, not too much or too little air, a firebrick combustion chamber in which air and gases can mingle at high temperatures favoring complete combustion before cooling both by contact with heating surface, become then necessities.

From the foregoing considerations it is plain that the ratio of heating surface to grate surface must be variable, according to fuel and draft. As volumes of gases vary only about 11 per cent. between anthracite and low grade bituminous, and less than 5 per cent. between New River coal and the latter, the areas for circulation of gases are practically independent of the grate area or the kind of coal; and as we can maintain nearly equal furnace temperatures, neither will the heating surface require rearrangement.

This conclusion may be plainly stated thus: We must provide grate and draft enough to burn a sufficient quantity of the coal which is to be used. If we do this the flue area and heating surface need not differ materially from our previous best standards.

Therefore, to state that for a poorer coal you must have a larger boiler argues a confused view of the problem. There are hundreds of tests available to guide us in estimating the quantity of coal necessary to produce the required amount of steam. From them we learn also how much we can burn per square foot grate. After full consideration the American Society of Mechanical Engineers recommended as a basis for a fair rating of boilers, their capacity at good economy without forcing fires with the best coal ordinarily sold in the local market, and with a margin of one-third over this rating when forcing fires, with draft at least one-half inch water column.

When slack coal, screenings, run of mine, pea, buckwheat and rice coal are the fuels selected, a boiler rated as above would fall far below this rating in actual service, and the erroneous statement referred to is heard. The boiler, however, is of same capacity as before. We find that with best bituminous coal we can count on 10¼ units of evaporation per pound; with anthracite egg on 9½; with pea coal on 8½; with buckwheat, 7½; with rice coal, 7; all for good coal of these kinds running less than 20 per cent. ash.

We know that in practice we burn, per square foot grate, 24 pounds of good bituminous coals, 20 of anthracite egg, 18½ of pea and 16½ of buckwheat and 15 of rice coals. For these latter we must count on at least seven-tenths inch draft and may not go much over one inch for fear of blowing much unburnt coal off with the ashes. Putting these quantities together, and retaining for the nonce the unfortunate designation of horse-power, we find that we can count per square foot grate on 7.1 horse-power for best bituminous; 5.8 for egg; 4.4 for pea; 3.6 for buckwheat, and 3 horse-power per square foot grate for rice coal. Hence, if you have a 300-horse-power boiler every day giving its rating on bituminous coal and you change to buckwheat coal, you must not exact more than half rating unless you double your grate area. But the boiler remains as before, a 300-horse-power boiler.

As there is a practical limit to the length of grate which a fireman can manage, it finally becomes a question of width of furnace. And in placing the proper amount of heating surface over it, we come to a low, broad boiler for the low-grade anthracites and high narrow boiler for the high-grade bituminous coals. To change then from bituminous coal to buckwheat or rice coal involves much more than a mere consideration of relative prices per ton. It becomes a question of kind and length of grate bars, width of furnace and amount of draft, and means, therefore, a permanent change in the boiler plant.

Much ingenuity and experiment has been devoted to the development of automatic stokers for these low-grade anthracite coals and as lengths of grate two or three feet more than for hand firing have been successfully handled and combustion up to 22 pounds accomplished, they present the possibility for permanent adoption of the cheaper fuels without increase or complete change in the boiler plant.

The construction of boilers the author treated as follows: The materials and methods of construction have been steadily improved and made fit to meet the most exacting modern demands. Boiler iron is a thing of the past. Tensile strengths of 48,000-50,000 pounds in charcoal iron have risen in best homogeneous steel to from 60,000-65,000 pounds with ductilities even greater than those formerly attained. With such plate and small drums almost any pressure can be met. Since 1889 the American Boiler Manufacturers' Association has been active in the work of improvement of boiler materials, keeping in close touch with the steel makers. From the start cast iron was condemned as an unfit metal for any part of a boiler subject to tensile stress. Flange steel has taken the place of all parts formerly made of cast metal, the only excuse for the use of which was the ease and cheapness with which it could be formed into more or less intricate shapes without skilled labor. But with hydraulic presses and drop forging even this excuse falls, and the better material should be insisted upon.

The conclusions of Col. Meier's paper are as follows: The exigencies of modern steam practice demand concentration of the power producing plant in minimum space.

The grate area being limited in length by practical conditions, we must utilize every inch of width. With low-grade fuels this width becomes the measure of the power which can be produced. Heating surface must be disposed with reference to this width. For this the water-tube boiler is most adaptable. Internally fired or underfired shell boilers have not this flexibility of arrangement.

For high pressures, the best, most tenacious and most ductile materials must be used. There are defined in A. B. M. A. specifications which cover also the best practice as to constructive details.

Small and mainly cylindrical parts, with all pressures internal, best withstand the high tension of steam now demanded. Large shells present greater structural difficulties and collapsing stresses must be avoided. This again militates against fire tube boilers, where external pressure subjects the tubes to deformation and collapse and where larger units require great diameter of parts, while the water-tube boiler meets all these requirments.

Greatest economy requires high furnace temperatures, attainable only where the cooling of the gases by the heating surfaces can be deferred till the combustion is completed. This excludes internally fired and underfired shell boilers and gives preference to the water-tube type.

Rapid steaming requires large and effective liberating surface presented in almost ideal conditions by the unobstructed and rapidly moving water level of the sub-horizontal water-tub boiler; vertical boilers of any type are precluded by this consideration.

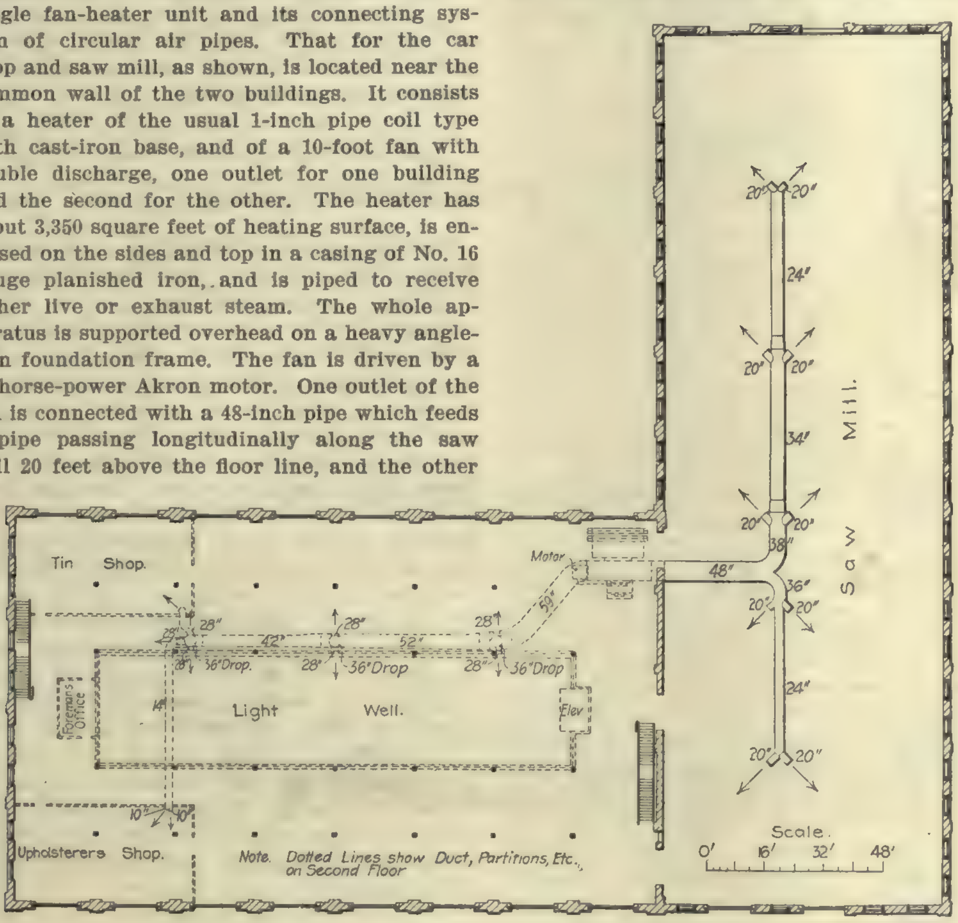
For cleaning the tube heating surface, both inside and outside, i. e., removing both scale and ashes, the water-tube boiler with straight tubes is immeasurably superior to all fire-tube types.

Ventilation and Heating in the Denver Shops of the Colorado Road.

The Colorado & Southern Railway erected a short time ago a number of shops in Denver. A fan system of heating was decided on, warming altogether by the air circulated. The plant is interesting in its general proportions, a comparatively small number of outlets sufficing for buildings of somewhat large volume. Otherwise the installation is typical of hot-air systems for mill buildings using fans for positive circulation, the apparatus comprising fans, heater coils and overhead circular air ducts provided with short branches directing the air toward the breathing line and the portions of the building subject to the greatest cooling action. The fan-heater units are of the type in which the heater coil is on the suction side of the fan, and the air drawn through the heater is taken from the interior space of the shop, this resort to what might be considered the use of partially vitiated air being advised on the grounds that the apparatus is much less expensive in steam consumption, receiving the air at a much higher initial temperature than if taken directly from out of doors, and because a large proportion of the heated air on issuing from the distributing air pipes eventually reaches the outside walls and partitions of the shop, whereby it makes its escape into the outside atmosphere through the numerous openings and unseen points of egress which a building of this type of construction possesses. The air thus escaping is, of course, replaced by cold and fresh air that makes its way in largely through open doors. The apparatus was installed by the B. F. Sturtevant Company, of Boston, Mass.

The buildings heated by the system briefly outlined comprise a machine shop and an erecting shop, these two buildings continuous with each other along one side, and a car shop and a wood-working machine room, the latter two adjoining each other at one end. The machine shop and the erecting shop are each 265 feet long, and the former is about 57 feet wide, while the latter is 68 feet wide. The two together occupy about 33,100 square feet of ground area. Each has a monitor roof, and the average height of the machine shop is 25 feet and of the erecting shop 41 feet. The plan of the car shop and wood-working building is shown in an accompanying drawing. The wood-working building, or saw mill, is 80 x 240 feet in plan and 27 feet in average height, and the car shop is 178 x 110 feet in plan and 43½ feet in average height, comprised in two stories. Each of these buildings also has a monitor roof. The second floor of the car shop is indicated in dotted line in the drawing.

Each pair of buildings is supplied from a single fan-heater unit and its connecting system of circular air pipes. That for the car shop and saw mill, as shown, is located near the common wall of the two buildings. It consists of a heater of the usual 1-inch pipe coil type with cast-iron base, and of a 10-foot fan with double discharge, one outlet for one building and the second for the other. The heater has about 3,350 square feet of heating surface, is enclosed on the sides and top in a casing of No. 16 gauge planished iron, and is piped to receive either live or exhaust steam. The whole apparatus is supported overhead on a heavy angle-iron foundation frame. The fan is driven by a 40-horse-power Akron motor. One outlet of the fan is connected with a 48-inch pipe which feeds a pipe passing longitudinally along the saw mill 20 feet above the floor line, and the other outlet is connected with a 59-inch pipe which is carried along near one side of the car shop about 14 feet above the second floor, feeding two rooms at the end of the building on this floor and three drop pipes each 3 feet in diameter, for the supply of the first story. The building is provided with a light well in the center, which leaves a clear space from the center of the first floor to the roof. The drop pipes are located at one side of the light well. In every case the discharge of air into the shops is effected through a short connection which curves from the main in the direction of air flow and both toward the outside wall and the floor line.



Car Shop and Saw Mill, Colorado Road, Denver.

The method of air distribution in the other pair of shops, the machine and erecting shops, is similar to that described. The fan-heater unit is located near one end of the two buildings and discharges through a large circular duct passing alongside the row of columns of the common interior wall of the two shops. From one side of the duct the air is discharged through short outlets into the machine shop and similarly from the other side into the erecting shop. The fan is a 9-foot centrifugal blower, enclosed in a three-quarter housing with a single upward discharge. The heater consists of an equivalent of about 9,675 linear feet of 1-inch pipe, that is, about 3,225 square feet of surface. The fan is driven from a 35-horse-power electric motor. Throughout the systems, air pipes 55 inches and upward are made of No. 18 sheet iron, pipes 35 to 54 inches in diameter, inclusive, of No. 20 iron, pipes 25 to 34 inches, inclusive, of No. 22 iron, and all pipes under 25 inches in diameter of No. 24 iron.

Assuming that the 10-foot fan, that supplying the car shop and saw mill, runs under certain conditions at 165 revolutions per minute, the discharge may be taken at 72,500 cubic feet per minute. If again it is assumed that the velocity of discharge through all outlets is approximately the same, it will be found that through the 49.2 square feet of outlet area in the car shop and saw mill the average velocity is 1,475 feet per minute. On this assumption also of a perfectly equable flow at all points, the saw mill receives 25,700 cubic feet of air per minute and the car shop 46,800 cubic feet per minute. The volume of the saw mill being 520,000 cubic feet, the apparatus has a capacity for delivering 2.97 times the total volume of the space heated per hour, that is, as ordinarily spoken of, especially where the supply is one taken from out of doors, the fan has a capacity of effecting 2.97 changes per hour. The capacity of the car shop is 850,000 cubic feet, so that there is a change of air in this case 3.3 times per hour. If the air is received by the heater at about 55 or 60 degrees and raised in temperature about 70 degrees, that is, to about 130 degrees, the total amount of heat absorbed from the heater coils is as follows, remembering that the air is expanded by heating, so that the average amount heated is for the range of temperature in question about 5 per cent. less than the discharge of the fan: 69,000 × 70 ÷ 55 = 87,800 British thermal units, 55 being the number of cubic feet of air which raised one degree Fahrenheit is roughly equivalent to one British thermal unit. The heating surface of the heater coils being about 3,350 square feet, it will be seen that 1,570 thermal units are absorbed from the heater per square foot of surface per hour.

In the same way it may be found in the case of the fan for the machine and erecting shops that at a speed of 180 revolutions per minute about 60,000 cubic feet are discharged per minute. Connected to this system there are altogether 45.6 square feet of outlet area, through which the air issues accordingly at about 1,320 feet per minute. In this connection it may be noted that the velocity through the long main duct is 1,700, 2,260 and 2,700 feet per minute as one approaches the fan. On the basis of outlet area the machine shop receives about 25,800 cubic feet of air per minute and the erecting shop 31,300 cubic feet. The former thus has a total amount of hot air discharged per hour into the space to be warmed of 4.1 times its total volume; this figure in the erecting shop is 2.54 times the total volume. An average of about 57,000 cubic feet of air is passed through the heater coils, remembering the fact that there is an increase in volume, due to the warming, so that 57,000 × 70 ÷ 55 = 72,500 British thermal units are required from the heater per minute, or for the 3,225 square feet of heating surface, 1,350 thermal units per square foot per hour. The two heaters under these conditions thus give off 160,300 thermal units per minute, requiring therefore in that time about 150 pounds of steam.

In conclusion, reference may be made to the location of outlets. In the saw mill, for example, it will be noticed that the 20-inch outlets are as much as 46 feet apart, and the larger outlets in the car shops are 40 to 45 feet apart. In the machine and erecting shops the distance between outlets, which are 30 and 34 inches in diameter, is as high as 58 feet. In the case of the erecting shop there are three 34-inch openings and one 30-inch opening, the four spaced along one side, which is 265 feet long, and discharging at an angle, like those in the saw mill, toward the opposite side of the shop 68 feet across. The machine shop outlets, of which there are four, 30 inches in diameter, are located directly opposite the openings into the erecting shop. Here the distance from outlets to the opposite wall is 57 feet.

Electrical Installation and Decorative Work in Connection with Exposition Buildings.

A paper read before the American Institute of Architects by Luther Stieringer, A. I. E. E.

In planning the electrical installation for an exposition, the first thing to be taken into consideration is the source of energy, and it must be decided whether it is to be from steam plants on the grounds or, as at the Pan-American Exposition, partly from a water-power plant and partly from steam plants on the grounds. A large exposition requires an immense amount of energy, and the various ways in which it is called upon to give service raise the question whether or no it would be wisdom for such an exposition to depend entirely upon any outside source of power, no matter how reliable it might be.

The electrical installation in an exposition calls for a number of classes of lighting service. First, there is the patrol lighting of the grounds, which is for the strictly utilitarian purpose of enabling employees and the public to see their way about the exposition grounds at such times and places as the illumination or display lighting is not available. Second, there is the general illumination of the grounds and buildings, which forms so important a part in all modern expositions, and, as press reports show, is by far the most important drawing feature of any of the attractions. Third, there is the display lighting, which may form an adjunct to the general illumination, or may seriously interfere with it, all depending upon the skill with which the general scheme of illumination is carried out. In this class may be included fountain lighting or other features of embellishment. Fourth, there is the lighting required on the interior of the buildings by exhibitors for general and special purposes. Fifth, there is the lighting of concessions, a point where an exceptional service is always demanded. In addition to these features it is necessary to take into consideration the fact that an electric-power service has to be considered both for concessionaires and exhibitors. The Pan-American Exposition is evidence of the fact that the use of electricity in exposition work and attractions has developed surprising popularity, and it is reasonable to suppose that the probabilities are that each succeeding exposition will be more exacting in its demand upon electricity and the electrical department than the one before it.

The great exposition of to-day calls for something besides splendor and beauty, and the general utility of the various services to which electricity has been applied is not forgotten. For this reason an exposition calls for complete police, fire alarm and signal systems, as well as the most perfect telephone and telegraph service. An ordinary exposition requires several hundred alarm boxes. Work in all departments is greatly expedited by the telephone, and its early installation is a great aid to progress.

The custom now is to place the mechanical and electrical work of an exposition service under one head, in order that this department may be responsible for all the energy generated or distributed, the greater part being distributed by electrical means. The electrical necessities have become so extended that the placing underground of conductors at expositions has become an established rule. To place such a mass of conductors overhead would obtrude on the main vistas to such an extent as to entirely spoil the architectural effect aimed at.

Naturally, the greater part of the electrical energy of the modern exposition is expended on lighting, and the major part of this is applied to the general and decorative illumination. In arranging the illumination of an exposition, it is far easier to supply too much light than it is to properly diffuse the light at one's command. In other words, the engineer is more likely to err in providing too much light at points than by failing to supply enough. The illumination itself should never be the primary object, but should always be considered the means of obtaining artistic results. Judicious distribution of the light is far more desirable than great brilliancy and glare. In fact, the latter effects are what ruin the beauty of any illumination. An exposition that seeks or aims to be called "beautiful" has little or no use for an intensely brilliant light. It is generally recognized that the interpolation of a brilliant light between the object to be viewed and the spectator destroys the effect and injures the eyes of the spectators.

In this paper it is not the intention of the writer to more than briefly outline the general principles underlying all truly successful decorative work accomplished by the aid of electricity with especial reference to expositions, which at the present day offer the most extended fields for this class of work. Many creations of man in this day are repetitions, combinations or modifications of something that has been handed down by the ancients. From generation to generation they have been passed until the originator is forgotten in history, and then the modern creation is passed off as something new. A busy world accepts the result and glories in the apparent progress of the age. However, when we enter the field of embellishment for night effects by the aid of the electric light, to the credit of the electrical fraternity be it truthfully said that we are dealing with a strictly modern affair and thoroughly modern creation. This is one of the things not transmitted down through generations from the ancients. We build on modern thought, modern intellect, modern knowledge; not on the way-behind conditions of centuries ago. As one popular and learned writer, just before the opening of the Pan-American Exposition, put it, "A Greek or a Roman could no more have imagined the splendors of the nocturnal scene we shall behold at the Court of Fountains at Buffalo than a cave-dweller or a man of the stone age could have imagined the daytime aspect of classic Athens or imperial Rome."

No matter what beauty the architecture may possess, the night aspect and beauty of a structure is dependent on the skill of the expert in decorative illumination, and this expert must at the same time bear in mind the practical requirements of installation. It seems almost needless to point out the fact that electric lighting has made possible effects undreamed of a few years ago, and that its installation and distribution at expositions calls for a kind of special knowledge only acquired by experience in this line of work.

Unfortunately, it is the constant experience of those who have made a specialty of this subject, that their part of an undertaking is considered of minor and secondary importance, something that may be supervised by non-specialists, by those having little or no knowledge of the fundamental principles of practical, decorative and useful illumination.

In planning the general illumination and display lighting, it is the province of the engineer and expert in this line to produce the most beautiful and pronounced effects possible with the energy at his command, and here is where a thorough knowledge of the principles and long experience in similar work count.

The incandescent lamp permits of a more artistic and enjoyable scene of illumination, because of the freedom with which it may be placed in any position the fancy may suggest. In all artificial illumination it is essential to secure uniform diffusion of light, if the best results are to be obtained. This can never be done by having the light concentrated in a few extremely brilliant centers about the space to be lighted. Such attempts to rival the sun are failures. While the centers are brilliant enough, this very brilliancy makes the outlying space seem dark. No artificial method of illumination is perfect, and must be always open to some objections arising from many limitations. Very often it is necessary to place the light in the line of sight. This is a difficulty which is met by the simple expedient of subdividing the light into small units and distributing these units uniformly. A lamp of over 16 or 20 candle power should never be used. What has just been said about diffusion and distribution of light holds true not only in regard to illumination for useful purposes, but applies as well to decoration and embellishment. There is another method of obtaining the same effects, namely, by using high candle-power lamps and diffusing by means of globes, shades and reflectors. This system, however, is seldom used.

The expert in illumination has constantly to urge the fundamental fact that in artificial illumination we can secure but relative effects, the harmony of which will accomplish indefinitely more than costly and laborious sensationalism. In the case of exposition buildings, the principle which experience has shown to give the best results is to outline and accentuate the lines of architecture with relatively small incandescent lamps. The night furnishes a background, and the imagination has free play to fill in the gaps. The effect produced in the illumination of an exposition is so largely a matter of artifice that the actual number of lamps used to accomplish certain results would be surprisingly small if known. The same amount of energy spent in illumination, if not skillfully distributed, might give very insignificant results, and when removed leaves no trace of its imperfections.

Expositions are such a popular attraction, and of such general interest usually, especially in industrial fields, that they justify and demand illuminations that are exceptional and only fitted for just such occasions. An illumination such as might be presented at an exposition, if repeated night after night in a city for a period that expositions hold their sway, would be charged with having gone glory mad. The moral of this is that an exposition and its illumination cannot be judged as being in the category of one-night stand events, but should be looked upon as being thoroughly unique and of special requirements and character.

The Condition of the Brooklyn Bridge.

A Report to E. A. Philbin, District Attorney, New York, by Edwin Duryea, Jr., and Joseph Mayer.

In reprinting the following report on the condition of the New York and Brooklyn bridge, it should be stated that soon after the recent breakage of some of the suspenders District Attorney Philbin requested Mr. Edwin Duryea, Jr., to examine the structure personally in a thorough manner. In order to save time and secure the advantage of friendly advice and criticism, Mr. Duryea later obtained the appointment of Mr. Joseph Mayer as his associate. They had been associated for two years on designs for the proposed Hudson River suspension bridge at 59th Street, New York, Mr. Duryea representing the financial backers of the work and Mr. Mayer the contractors. The field inspection of the investigation of the Brooklyn Bridge was done almost entirely by Mr. Duryea; Appendix D, containing all the mathematical computations, was practically all done by Mr. Mayer and the ideas of Appendix F are also mainly his. The report proper and the other appendices are mostly by Mr. Duryea, but everything he wrote was closely criticized by his associate, and nothing appears in the report or the appendices which is not approved by both engineers.

The Report.

On July 31st last we were retained by you by formal letter "to make an examination of the bridge now in operation between the Boroughs of Manhattan and Brooklyn, with a view of ascertaining whether or not the capacity of the bridge is overtaxed at the present time, and as to whether or not the bridge has been allowed to deteriorate because of improper supervision, inspection and repair"; and to "report as to all facts bearing upon the question as to whether or not there was neglect on the part of the persons who had charge of the bridge." It was also stipulated by you that the report covering the above points be delivered to you not later than the 15th of the following September.

While not specifically stated by you, we construed your intention to be that we should examine and report on the main bridge only, not including the approaches, though the latter contain several metal spans. The very short time at our disposal also prevented absolutely the consideration of more than the main bridge. Our examination and report, therefore, deal with the main structure only, from anchorage to anchorage inclusive.

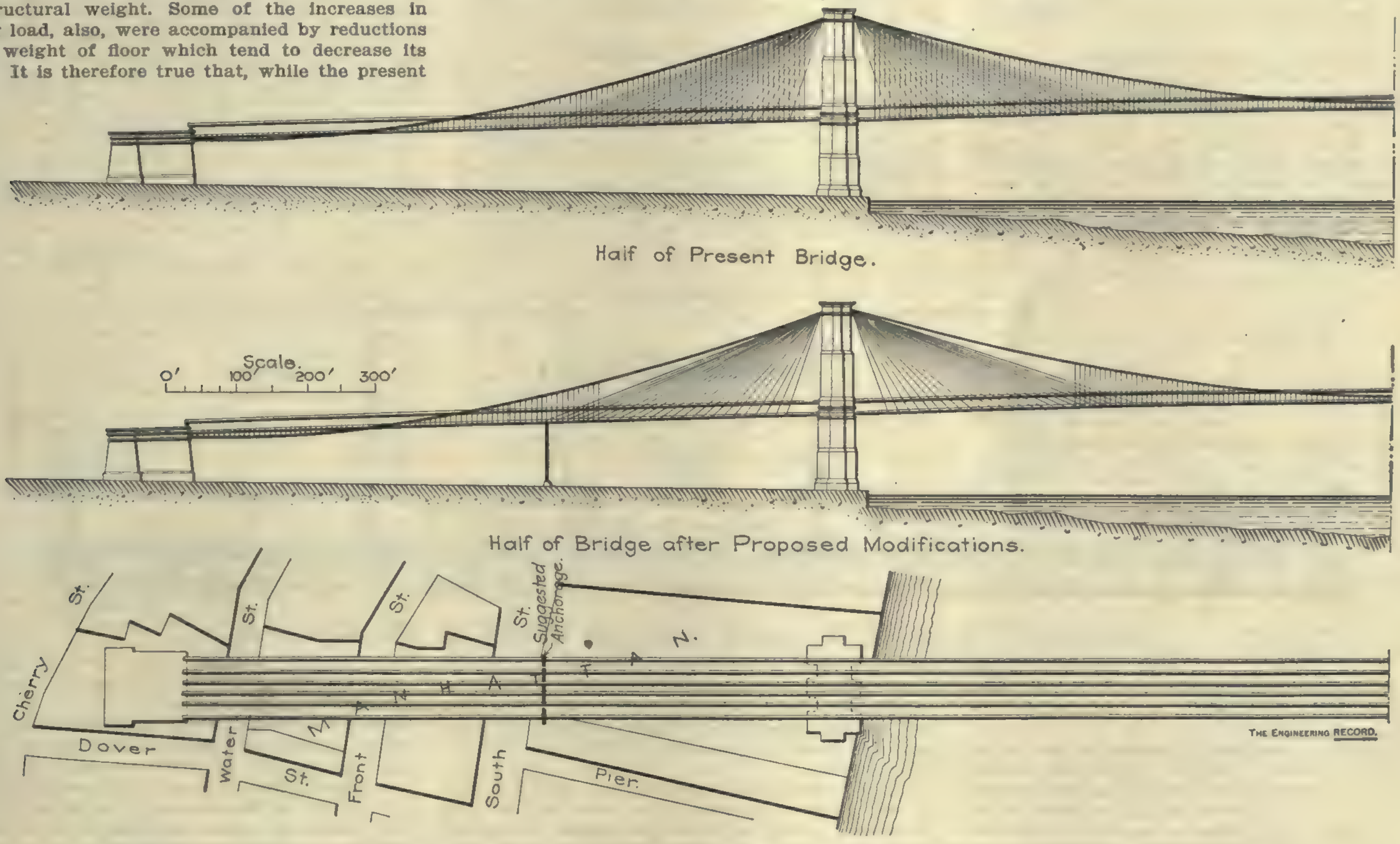
Under verbal instructions from your office, the inspection of the structure had already been begun on July 27th, and the computations to ascertain its strength were begun on July 29th. The work has been carried forward continuously since these dates, and we have the honor to present to you our conclusions in the following Report, and the facts and arguments leading to them in the attached Appendices.

Our examination of the New York and Brooklyn Bridge shows us that while no serious deterioration of the structure now exists, the supervision, inspection and maintenance are at fault in not removing various influences which tend to cause deterioration. The accident of July 24th last, when the breakage of two suspenders remained undiscovered until seven more failed entirely, shows the methods of supervision and inspection to be very faulty.

The supervision has also been faulty in a more general and important sense. Statements as to the safety of the bridge have been issued without obtaining, by the use of all available knowledge, the real stresses in the structure. Without a knowledge of these stresses all such statements are unwarranted.

Our investigation of the strength of the bridge shows that it is now practically as strong as when completed. It also shows that, while the moving loads now on the bridge are about 40% in excess of those proposed by the designer, his preliminary estimate of the probable weight of the structure itself was so much larger than its present actual weight that the combined weight of the structure and moving load is now less than 3% in excess of that assumed by him in 1882.

An increase in moving load, however, exerts a much greater effect on certain parts of the structure than would be caused by an equal increase in the structural weight. Some of the increases in moving load, also, were accompanied by reductions in the weight of floor which tend to decrease its safety. It is therefore true that, while the present combined weight of structure and moving load is very little larger than that of the designer's preliminary estimate, the increases in the moving load have reduced the safety of the bridge below that contemplated by the designer, and still more below that which it actually possessed before these increases in moving load occurred.



HALF-ELEVATION AND PLAN OF THE PRESENT BRIDGE AND THE PROPOSED MODIFIED STRUCTURE.

Our investigation shows that the stresses in cables, towers, parts of stay system, and floors, due to the most unfavorable probable combination of forces, are far in excess of those considered good and adequately safe by engineers. This is due both to increases of the moving loads above those at first contemplated and to various features of the original design.

We consider it necessary that these excessive stresses should be reduced as soon as possible, and have suggested in the report below how this may be done at a comparatively small cost.

The broad general statements above require amplification, which is given below.

The Accident.—On the evening of July 24th, 1901, it was discovered that nine consecutive suspenders of the bridge were broken. These suspenders were at the center of the main span and on the north cable. Two of the suspenders had been broken a long time, while those next to the unbroken ones were free from rust and had been only recently broken.

The suspender rods which failed were intended to resist tension and such small bending stresses as would arise from a swinging of the rods in the direction of the bridge on lubricated trunnions. The two rods at the middle of span (those which had been broken a long time) were also under a tension, during hottest weather, about one and one-half times as great as in the case of other rods. The rods were of ample strength to withstand all these forces, however, and the failure must have been due to other causes.

An examination of the suspender rods shows that they must (because of their design) be subjected to side bending and that their failure is due to this. We believe the most important cause of side bending is wind pressure. The wind blowing against the platform and cars causes a pressure transverse to the bridge. Much of this pressure, especially near the slip joint at the middle of main span, must be transferred from the platform to the cables above. The only means by which it can be transferred is through the suspender rods, and then only by bending the rods, as the trunnions which were intended to provide for a motion of the rods in the direction of the bridge will prevent any motion transverse to it. The wind pressures transferred by these rods are large in amount and we believe are in themselves, by repetition since the completion of the bridge, sufficient to have caused the failure of the two middle rods.

At least two other causes of side bending act in conjunction with the wind pressure. An examination of the new rods which have replaced the ones which broke shows that they are being pulled to the north by the cable and are bearing hard against the top edges of their trunnions. This must be due to some defect of adjustment or construction by which the rods fail to lie in the plane of the cable, or the trunnions fail to be perpendicular to this plane.

The remaining cause of side bending is the only one (unless the whole design of the suspender rods were changed for the better) which could have been remedied by more careful supervision. The rods were intended for use with *lubricated* trunnions, and the trunnions show no evidence of lubrication. The one removed and taken apart for examination was fixed tightly in the plates by rust and paint and must certainly have caused bending of the rod in the direction of the bridge.

The breaking of the seven other suspenders is directly due to the two rods broken first having been allowed to continue in the structure. This was due to inefficient supervision and inspection, which will be treated more fully below.

The accident shows that the rod suspenders are of insufficient strength to withstand the actual conditions existing, and that similar failures may occur on the other cables. The necessity is therefore apparent of very thorough and close supervision.

It was in our opinion wise to lighten the loads on the bridge by a partial stoppage of traffic when the breaks were discovered, as the indications are that the breakage would otherwise have spread to more of the suspenders and might have reached serious proportions.

The accident is more fully treated in Appendix A.

Deterioration of Bridge and Responsibility Therefor.—We believe the following facts, many of them described in greater detail in Appendices B and C, to show that the officials in charge of the New York and Brooklyn Bridge have been neglectful and careless in their supervision and maintenance of the structure.

Many of the diagonal bars and sway rods of the stiffening trusses have been allowed to wear by rubbing against each other, and many of the suspender ropes by rubbing against the floor of promenade. No effort has been made to prevent such wearing, though it could easily have been prevented at any time since the completion of the bridge.

Water and mud have been allowed to collect and remain in portions of the bottom chords, and road sweepings in bottom of floor beams around suspender stirrups. It is commonly admitted that such conditions should not be allowed in steel bridges, and the existence of them is a proof of inefficient and careless supervision and maintenance.

The saddles supporting the cables on tops of towers, now fixed, were intended by the designers to be movable, and an efficient supervision of the bridge would have used all means necessary to keep them so. Our inspection, however, shows no efforts whatever in this direction, ridges of rust, paint and dirt being found on the bed-plates along the outer rollers.

The trunnions at the bottom of the suspender rods were intended to be lubricated. They show no evidence of lubrication, though this could have been easily provided for.

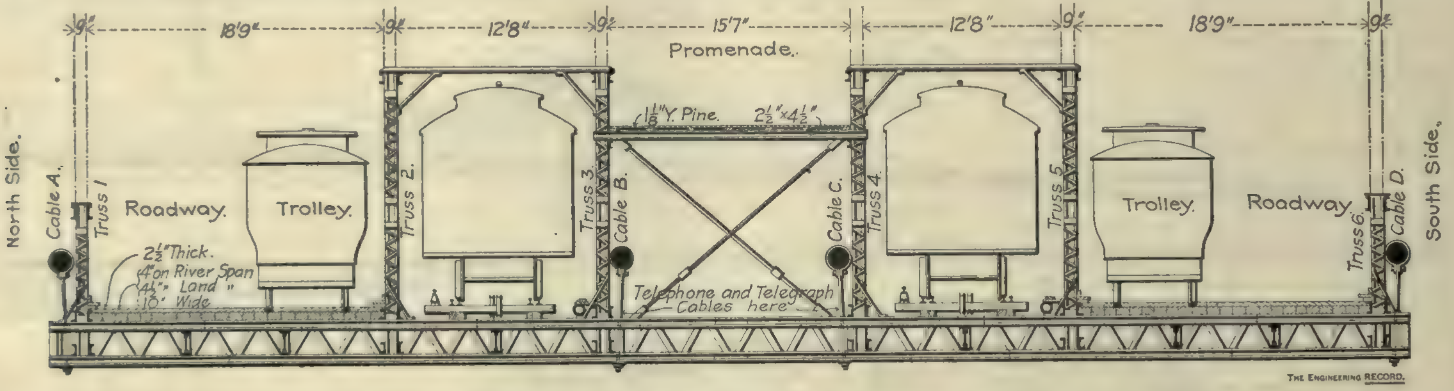
A number of the stirrup rods of the wire suspenders were found improperly adjusted. This condition could occur only under an inefficient method of inspection.

Of the nine suspenders which were discovered to be broken on July 24th last, two had been broken a long time. The presence of these two broken suspenders in the structure, undiscovered, proves that the inspection of the bridge must have been either very infrequent or merely nominal, at least so far as regards this detail. The necessity of a frequent and thorough inspection of this special detail should have been recognized by the Bridge Department, as it was stated by them, after the accident, that similar breakages had occurred at previous times. It was evidently their duty, in view of the recognized liability to breakage of these rods, either to replace them by some new device better adapted to withstand the forces acting, or to at least make such frequent and thorough inspections that any broken rod would have been discovered within a day or two after the break occurred. The inspection actually made, however, was of a nature which allowed the two rods first broken to remain undiscovered in the structure for a long time and until the break had spread to seven others, and it was even said, we do not know with what truth, that even then the breakage was not discovered by employees of the Bridge Department.

It has been stated that no ordinary methods of inspection would have shown the breakage of these rods, and that if the break occurred below the top of the trunnion it could not have been discovered until the broken end appeared above the top.

One of the commonest ways of testing the soundness of such parts of a bridge is by blows of a hammer. A broken rod—or even an unbroken one having very little stress in it—can be detected without difficulty by its sound under such blows. This was recognized by the Bridge Department, as shortly after the accident all the remaining rods of the north cable at center of main span were so tested by them, as shown by defacement of the paint where the rods were struck. This test by hammer blows, however, was even then applied to only a few of the rods on the other cables, though many of these rods were just as liable to failure as those which actually did fail at the northernmost cable.

A merely visual inspection, without the use of the hammer, is also sufficient to show the breakage of a suspender rod. The least lifting of a rod will break the paint film connecting the rod with the top of the trunnion or bring into view a portion of the rod, unpainted or differently painted, which was before within the trunnion. With the former condition of the paint known, either of these changes in appearance should be sufficient to excite suspicion as to the soundness of the rod, and to cause more conclusive tests with the hammer or the wrench.



CROSS-SECTION OF BROOKLYN BRIDGE NEAR THE CENTER OF THE MAIN SPAN.

The method of inspection in vogue on this bridge is at direct variance with the methods in general use on good American railroads. The usual methods (as shown in Appendix E) are to have the inspections made by engineers in person, at stated intervals (once, twice, four times, or even—in one case we have been told of—twelve times per year) and the results recorded on printed forms which make it impossible, without falsehood, to forget or neglect any special features.

The inspection on this bridge seems to have been done entirely by mechanics, at no stated times, and with no record sheets returned to the office as a guarantee that the inspection had actually been made.

In our opinion this method of inspection is nominal only and entirely inefficient. That it cannot be depended upon to keep the bridge in a safe condition is clearly proven by the failure, under its continuance, to discover the two broken rods in time to prevent the break spreading to other rods. The safety of the bridge demands that the method should be changed at once to that generally recognized as the best—an inspection by engineers in person, at frequent stated intervals, and with the results recorded on printed forms. With the bridge in its present condition, we believe that some parts of it should be inspected daily, others weekly, and every part at least monthly.

In addition to the facts given above, we believe the supervision of the bridge has been lax and inefficient in a more general and important way, as specified below:

No exact records have been kept of the condition of the structure, and no complete and correct set of drawings exists. Without these it is impossible to calculate the actual stresses, which must be known before any definite and reliable statement can be made in regard to the degree of safety of the bridge. A careful supervision would have kept such records and would have made calculations of the actual stresses in every affected part whenever any changes were made in either load or structure; it would long since have discovered and remedied the weakness of various parts of the floor.

An efficient supervision would have studied all the published scientific discussions of suspension bridges and would have been warned by statements made by eminent engineers in the Transactions of the American Society of Civil Engineers that large secondary stresses occur in *wrapped* cables of suspension bridges having stiffening trusses with center hinges. It does not require any unusual ability to know, after attention is drawn to the fact, that secondary stresses of considerable amount must exist in the cables of this bridge. The engineers in charge of the bridge should have either calculated these secondary stresses to assure themselves that the stresses are not of dangerous amount, or should have suggested changes which would reduce these stresses to safe amounts.

No statements should have been made in regard to the safety of the bridge until after all available knowledge had been used to determine the stresses, which must be known before any reliable assertion is possible.

The amount of knowledge and care here specified is necessary to secure the safety of the public.

Such deterioration as has occurred has not appreciably diminished the strength of the structure as a whole. This will be taken up below under Safety of the Bridge. The bars and rods which have been somewhat worn by rubbing were larger than necessary to begin with, and are still of ample strength for their duties. The same is true of such members as have had their sections reduced by rust. The immovability of the saddles increases the stresses in tower masonry considerably, but in another way exerts a good effect on the bridge by keeping the stresses in cables at center of main span lower than they would be if the saddles were movable.

Safety of the Bridge Under the Present Loads.—In taking up this part of our report it is necessary to explain just what is meant among engineers by the term safety as applied to a structure.

In discussing the strength of engineering structures the term "factor of safety" is constantly used. By this is meant the ratio between the stress which would cause sudden failure from a single application and that actually existing in the structure or member. The latter stress is called the working stress of the material and the former its ultimate strength.

Though the factor of safety of a structure is by common practice fixed with respect to the ultimate strength of the material, there is a much smaller stress under which it will fail slowly if the application is repeated many times. This stress is called the elastic limit or the elastic strength, and is about six-tenths of the ultimate strength in the case of structural steel and over two-thirds for steel wire.

In the case of structural steel having an ultimate strength of 60,000 lbs. per square inch and a working stress of 20,000 lbs., the factor of safety is said to be 3, though under a stress of 36,000 lbs. per square inch repeated millions of times the structure would slowly fail.

Experience has taught that because of a lack of complete knowledge of the quality of each piece used in a structure and of all the stresses existing, it is never prudent (even when all the known stresses are considered) to use working stresses in excess of about two-thirds of the elastic limit. When the added destructive effect of moving loads is not included in the stress, the working stresses are made much smaller.

It is evident, therefore, that the same so-called factor of safety gives very different degrees of real safety, according to the kind of material used and according to the methods and completeness with which the stresses in the structure are determined.

If the material used is very uniform in quality and with its elastic limit high in proportion to its ultimate strength, the real safety of the structure will be greater than otherwise. If the stresses used in proportioning a member include all the secondary stresses, the real safety obtained with the same "factor of safety" is much greater than if only the principal stresses are considered.

The only safe course in dealing with uncommon structures or details is to calculate all the determinable stresses and then choose such a factor of safety that there is a certainty that the actual working stresses which may occur shall always be well below the elastic limit, in all parts of the structure. This certainty of safety can be attained only when the details are so designed that those stresses which cannot be accurately calculated are small.

The mere statement that a certain bridge has a given factor of safety means little. Unless it is known how the stresses were calculated, what ones were included and what omitted, what is the uniformity of the material and the ratio between its elastic limit and its ultimate strength, and what are the details of the bridge, no opinion of value can be formed as to its real safety.

The present safety of the bridge can therefore be determined only by calculating all the stresses of considerable size and then comparing these stresses with the present strength of the corresponding members, as determined from the working stresses considered safe by the best practice.

If the safety is found to be defective, this may be due to any one of the following four causes:

(1) Physical deterioration of its materials or members;

(2) Changes made in the structure since its completion;

(3) Increases of moving loads beyond those for which the bridge was designed; and

(4) Defects in the original design.

(1) Physical Deterioration.—This might ensue from a reduction of the sections of members by rusting or wearing, or from a reduction in the strength of the steel due to a repetition of stresses near the elastic limit.

The latter cause cannot have occurred except in a few details; notably the stirrups of stays and of some of the suspenders and in the suspender-rods near the center of main span. The physical examination shows that the reductions of section by rust and wearing are in no case serious and do not exist in the members having the smallest factors of safety.

Electrolysis has often been mentioned in newspapers as a possible cause of weakening of the bridge. This is merely a form of rust caused by electricity under certain conditions, and there is no evidence that these conditions exist in the bridge.

In our opinion no material loss of strength from physical deterioration has occurred in the bridge.

(2) Changes Made in Structure.—The only change known to us is a lightening in the weight of railroad floors by widening the spaces between ties and omitting the tie-spacers (guard rails). This change reduces the safety of the structure locally in case of derailment, but if it had not been made, the already too small factor of safety in the cables would have been still smaller.

(3) Increases of Moving Loads.—The moving loads on the span as a whole have already been partially treated. They are seen to be much larger than those proposed by the designer.

The load from trolley cars varies greatly with the interpretation and enforcement of the 102 ft. spacing between cars. The Board of Experts which in 1897 reported on the safety of the bridge and the practicability of allowing trolley cars and elevated trains to use it recommended that this spacing be made 102 ft. *clear distance* between cars, while the Bridge Department, to judge from a report made in December, 1898, seems to have adopted a spacing of 102 ft. *front to front*. We have adopted the latter as our moving load, as it may be inferred to be the regulation and in any case seems to us nearer the actual condition. This interpretation increases the load from present heaviest trolley cars to about 136% of what it would be for 102 ft. clear distance and to about 108% of what would be the full moving load on the bridge with that spacing. It increases the sum of the moving and fixed loads by only about 2%, however, so it is evident that no change in the spacing of trolley cars—except such a large one as would seriously interfere with the use of the bridge—can effect any decided increase in the safety of the bridge. The restrictions as to minimum spacing of cars, however, should be strictly enforced.

The above refers only to moving loads affecting the main members of the bridge, as the cables. Those affecting the floor only, such as weights on wheels, have also to be considered. Only in one instance have the wheel loads been increased above those proposed by the designer, this increase being the change in weight from 32 tons to 44 tons of the motor or grip cars using the railroad tracks. It is not known whether the wooden stringers were strengthened when this increase of weight was made, but in either case both these stringers and some other parts of the floor are now under stresses greater than are considered good practice.

Much has been published as to the large weight of extraneous dead load on the bridge in the form of mail tubes, telegraph and telephone cables, etc. We have found no useless dead load on the bridge, and the combined weight of mail tubes and telegraph and telephone wires is only 1.5% of the total moving and dead load.

It is evident that of the three causes just described only one—the increase in the moving load—has had any serious effect in decreasing the safety of the bridge. This loss of safety could, of course, be recovered by reducing the moving loads to their former amounts, but to do this would reduce the usefulness of the bridge very greatly, and should not be considered except as a very temporary arrangement or a last desperate expedient.

Because of certain unperceived defects in the original design, however, the bridge has never actually been as strong or as safe as it was believed to be. These defects are of such a nature that, although serious in their effect, they can be remedied in a comparatively short time and at a comparatively small cost. It is believed, also, that when these defects are removed the bridge will not only be safe under its present loads, but that these loads may even be safely increased.

The safety of the bridge, therefore, should be increased by remedying the defects in the design.

(4) Defects in the Original Design.—In considering the defects of the design it should be borne in mind that this bridge was designed over twenty years ago, when steel as a material for bridges was just coming into use. The science of bridge designing was then very much cruder than now and very little attention was paid to secondary stresses. It is difficult at the present day, even by an effort, to realize the changes which have occurred since that time, in the point of view. Many of the features which now seem self-evident errors have been realized as such only from the lessons taught by their use in early bridges.

We therefore hope that our criticisms will be accepted as referring to the design, not to the designer. Our effort has been to measure the structure as it now stands, irrespective of its origin or the conditions under which it was designed, by the standards of the best present practice in bridge design.

Before mentioning the principal defects in design which act to lessen the safety of the bridge, we wish to point out that the computations on which our conclusions are based are in many respects necessarily incomplete and inexact.

The lack of adequate plans of the bridge is such that a complete survey of the structure would be necessary in order to obtain a full and reliable knowledge of its members. Such a survey would alone take more time than that allowed for our entire investigation.

We have made no investigation of the stresses caused by wind, as the lack of plans and the lack of time were each in themselves sufficient to prevent our doing so. The same statement will apply to all stresses in the end spans.

We have therefore confined our investigation to the main span, where the observed failures occurred, and to its action under vertical loads only. The time allowed us was barely sufficient for even this, as the structure is a very complicated one, resisting either vertical or horizontal forces by means of three combined systems, and required the development of many special original formulas for its calculation.

Many of the details of this bridge are entirely different from those of ordinary bridges and need careful study. A much more extensive investigation would be necessary before it would be possible to point out all the defective parts that must be improved before the bridge can be made as safe as is now considered good practice.

Our investigation has, however, been both complete enough and exact enough for us to state conclusively that the bridge does not conform to the usual standards of safety; that improvements increasing its safety are imperative, and that such improvements can be made at a comparatively moderate cost and without materially interfering with traffic.

The principal defects of design observed as causing a decrease in the safety will now be mentioned.

Excessive Stresses in Cables at the Center Hinge or Slip-Joint.—This is the most serious cause of danger in the bridge. Our calculations show the maximum stresses to be, if no account is taken of the loads borne by the stay system:

From Fixed and Moving Loads, 44,800 lbs. per sq. in.

From Bending of Cable as a whole, 28,600 lbs. per sq. in.

From Bending of Individual wires, 2,000 lbs. per sq. in.

Total, 75,400 lbs. per sq. in.

The stay system does carry some of the loads, though it is impossible to say how much, since the original adjustment has been changed by the failure of the bottom chords in 1898. It is believed that if the stresses in the cable from fixed and moving loads are assumed to be reduced 10% because of the help afforded by the stays, an ample allowance will have been made. The strength of the stay system is greatly reduced by the weakness of its end connections, in which failure would occur long before the strength of the ropes is reached.

If the 75,400 lbs. per square inch stress above be reduced by the amount which may perhaps be eliminated by the stays, the stress in the cables from above cause is 71,000 lbs. per square inch. This is about 18% in excess of what we regard as the permissible working stress, 60,000 lbs. per square inch.

This stress of 71,000 lbs. is, however, increased by the wind pressures, but to what extent is not yet known. The condition, therefore, is a very serious one—that of a stress in the cables much above the safe limit, but with its exact amount unknown.

Means by which the stresses in cables due to bending may be largely reduced are described in Appendix D. They consist in removing the wrapping from cables for a few feet at each slip-joint and using sleeves at these points to fix the least radius in which the cables can bend. We believe that by these means the bending stresses may be reduced to one-fifth or less of their present amount, and that the work will entail no serious interruption to traffic, can be completed within three or four months after the money is available, and at a cost of perhaps $30,000. No estimates have been made, however, and the time and cost given are merely guesses.

It should be added that the full maximum stress in the cables cannot occur at present, as the hottest weather is one of the conditions necessary to produce it.

Wind Stresses in Center Suspenders.—The transference of the wind pressures from the trusses to the cables through these rods causes bending in the rods, and we believe this cause alone is sufficient to account for their failure. A new design should be adopted by means of which tension only would occur in the suspenders. The wind pressures should be transferred from floor to cables by a separate detail. In the meantime any serious results from their possible failure may be guarded against by frequent inspections.

Excessive Stresses in Masonry of Towers.—The maximum pressure existing in the masonry of the towers, with saddles immovable as at present, is (neglecting wind pressure) at least 39.6 tons per square foot. The exact amount is uncertain and may be considerably more. The working stress should not be more than 20 tons per square foot. Even this is generally considered a high value.

Making the saddles movable would reduce the maximum pressure to about 35 tons per square foot and would diminish the present uncertainty as to the exact amount; it would, at the same time, however, increase the stresses in the cables from bending, already too high and not accurately known.

A means is suggested in Appendix F by which the pressure in the masonry can be reduced to about 25 tons per square foot. It would at the same time reduce the stresses in the cables and anchorages to an extent sufficient to permit strengthening the floors and increasing the moving loads by relaxing the restrictions on spacing of trolley cars, without harm to the bridge from the resulting additions to its weight.

This improvement consists in strengthening the stay system, releasing the saddles from their fixed positions and adding anchorages under each shore span, as shown in the drawings. The idea of the anchorage itself is an old one, having been suggested for the design of this bridge and being a feature of one of the designs for a bridge over the Hudson; some of the features accompanying it here we believe to be new, however.

Excessive Stresses in Floors.—Main Floor-beam.—The actual stress in the chords is 15,500 lbs. per square inch and the working stress should be only 14,000 lbs. The larger stress is, however, the result of increase in the loads and not of defects in the design. The stress can easily be reduced to the desired working stress by increasing the length of the cover-plates.

Intermediate Floor-beams of Railroad Tracks.—The actual stress is 27,000 lbs. per square inch and should be only 14,000 lbs. The excess is due partly to defects in the design and partly to increase in loads.

Intermediate Floor-beam of Roadway.—The stress is 23,000 lbs. per square inch and should be only 14,000 lbs. The wheel loads have not been increased.

Channels Supporting Intermediate Floor-beams.—Those along the outer high truss have stresses of 34,000 lbs. per square inch and those along the inner high truss 17,000 lbs. The excess is due partly to design and partly to increases in loads. The working stress should be only 14,000 lbs.

Wooden Stringers of Railroad Tracks.—These have actual stresses of 1,750 lbs. per square inch and should have only 1,300 lbs. In cases where the joints come between floor-beams the stringers have still less strength and most of the wheel load must be carried by the rail. This is extremely bad practice.

Four-by-ten-inch Planks of Roadways.—Those below trolley wheels have 3,140 lbs. stress and those below wagon wheels 1,550 lbs. The stress should not be more than 1,300 lbs. In neither case have the wheel loads been increased.

If the improvement of stay system is made, so that the dead weight of bridge may be safely increased, all of above defects can be easily remedied. While we have made no plans or estimates and the statement is merely a guess, we think that the entire improvement can be made at a cost of from one-half to three-quarters of a million dollars and within less than three years' time. The necessary calculations are very intricate and difficult, and it might take all of the first year to make the survey of the structure, finish the computations and complete the plans.

Nothing has been said as to the safety of the anchorages. Our computations show them to be amply safe. Their factor of safety against sliding is 2.45 with the present loads, while ordinary practice requires only 2.

Before closing, we shall very briefly repeat our conclusions, as follows:

We find that some deterioration of the bridge has been allowed to occur because of improper supervision and inspection, but that at present (because of repairs) no important deterioration exists and that the structure is practically as strong now as when completed.

Its safety, however, due to increases in the moving loads, is less than when the bridge was completed, and because of defects in the design, has never been so great as was supposed and is now much below the degree considered good practice for ordinary bridges.

We believe the present margin of safety to be so small that the necessity for repairs is very urgent, and have suggested means by which the safety can be largely increased without materially interfering with the traffic and at a comparatively small cost.

We believe the present methods of supervision, inspection and maintenance to be very faulty, and not such as will with any certainty keep the bridge in a safe condition.

In closing, we wish to acknowledge the courtesies of the Bridge Department, which has aided our investigation in many ways, both in the field and in the office; also to thank the Brooklyn Rapid Transit Co. for a list furnished us giving the weights and weight distribution of each class of their cars in use on the bridge.

Appendix A.—The Accident and Its Causes.

The accident to the New York and Brooklyn Bridge which was the cause leading to your inquiry into the safety of the structure was the discovery, on the evening of July 24th, 1901, that seven suspender-rods and two cable-bands had broken. These nine broken suspender connections were consecutive in position and were located at the middle of the river span, on the northernmost cable.

An examination of one of the broken cable-bands showed that the fracture was recent and sudden throughout the whole section. About 50% of the fractured area was coarsely crystalline, indicating (for this particular band, at least), a poor and untrustworthy quality of metal.

All the broken suspender-rods had been passed through the fire before our appointment, to remove the nuts and to weld new ends to the broken rods so they could be re-used in the bridge. This heating of the rods renders their subsequent examination of little value in determining the age of the breaks. The examination did show, however, that in some cases, at least, the breaks had been gradual and that a zone through the middle of rod had broken last.

It is stated by the engineers of the bridge, who had opportunity to examine the broken pieces before they were heated, that two of them had been broken for a long time. It is said that these two were the two in the middle of span, next on each side of the slip-joint. It is also said that most of the other rods showed evidence of gradual failure and that one, near an end of the broken group, showed a new, sudden fracture throughout its whole section; also that the two broken cable-bands, which were sudden fractures, formed the two ends of the broken group.

A careful study of the subject convinces us that the following causes all contributed to the failure of these rods:

(1) *Temperature Stresses.*—The temperature stresses are much larger in summer in the suspenders near the middle of the river span than in any others. This is due to the angle which must be formed in the cables near the sliding-joint, which angle (or sharper curvature) can exist only because of the vertical pull on the cables being greater there than where no angles are to be found.

It is estimated in Appendix D that the extra stress coming on each of the eight middle suspenders from this cause is nearly nine tons with the saddles immovable as at present, and that it was still larger before the saddles ceased to move. The stress coming on each ordinary suspender from dead weight and moving load is about twelve tons, which is reduced to about eight and one-quarter tons for the middle suspenders by the closeness together of the two middle floor-beams. As the temperature stress in the ordinary suspenders is very small, the combined stress from loads and temperature will be about seventeen tons for each middle suspender and about twelve tons for each of the others.

(2) *Rods Not Vertical.*—All stresses in the middle suspender-rods are increased by the want of verticality of the rods during extremes of temperature. On some of the cables the middle rods are only 16 ins. long, while (even if well adjusted) they may be as much as 3½ ins. out of the vertical; the increase of stress because of the inclination being in this case nearly 3%.

The increases of stress in the middle rods already mentioned are pure tension. While they are of considerable importance, the strength of the rods (118 tons breaking-strength each) is ample to withstand them, and they are probably unimportant in comparison with the stresses which are produced by side-bending, as described below.

(3) *Friction of Trunnions.*—The force necessary to overcome the friction, especially when trunnions are unlubricated, is certain to cause large bending stresses in the rod, and the one trunnion taken apart was found to resist motion by a side-bearing as well as by axle-friction. These bending-stresses will be much more sudden, frequent and harmful from the passage of moving loads across the bridge than from the slower temperature-changes, but their amounts are hardly computable.

(4) *Bending Transverse to Bridge.*—All the rods which have been used to replace those which failed are bearing against the upstream edge of trunnion-holes at top, showing that there is a constant bending stress in these rods transverse to the bridge. This bending stress must be increased suddenly at each passage of moving load.

A very important cause of side bending is wind pressure. The wind pressure on the structure produces a lateral deflection of stiffening trusses. The stiffening trusses of the two halves of span will, after deflection, form an angle at center hinge and the cables connected to them will form a bend. A large part of the wind pressure on trusses and floor is transferred at bend to the cables by means of the suspenders. The amount of wind pressure transferred by these suspenders is dependent on the horizontal curve of stiffening trusses and their angle with each other at the slip-joint, and could be calculated if sufficient time were available.

In a design made by us for a projected Hudson River Bridge which has center hinges, and is in this respect similar to the Brooklyn Bridge, the force transferred to cables at center has been calculated and special provision has been made for its transference. We therefore know that the wind pressure to be transferred to cables at center of bridge is large, though we have not calculated its actual amount in this case.

Whatever its amount, it must be transferred by the suspenders at center. The consequence is an excessive bending stress in these suspenders, which we regard as the most important cause of their failure. An entire change in the design is necessary to transfer this wind pressure safely.

All of above causes for excessive stress on the middle suspender-rods are inherent in the design and in only one case—(3)—can the stress be lessened by careful maintenance. A thorough and frequent lubrication of the trunnions should reduce the stresses arising from (3) to a very small amount. Such a lubrication was contemplated by the designer of the trunnions and could be quickly and easily made by drilling a small hole over each trunnion. If the proper oil or grease were used, perhaps with the addition of graphite, the application would not need to be made very often. The trunnions show no sign of lubrication, and the one taken apart was fixed tightly in the plates by rust and paint.

Rods Not Upset.—When compared with present standards, the whole design of the suspender-connections must be considered as unsatisfactory. In one respect, however, even without changing the other unsatisfactory features of the design, the suspender-connections can be easily and greatly improved.

The rod-suspenders and the stirrups for wire suspenders are all made from rods not having upset ends, thus placing the weakest part of the rod—the threaded portion—where it is inaccessible to inspection and painting, and yet especially exposed to the conditions causing rust. The strength of the 2½-in. diam. suspender-rod with ends not upset is only about two-thirds that of its full section, and only equal to that of a 2-in. diam. rod with its ends upset; but the latter, while of the same total strength, has its weakest section in the body of the rod, where failure, should it occur, will be in full view, and where the rod will be perfectly accessible to inspection and painting. Though it may not be economical to use upset ends on very short rods, the advantages they possess in this case should far outweigh the small increase in cost.

Two other points should be noted in connection with the accident.

Some of the newspapers reported that when the broken rods were discovered, measurements showed that the floorbeams at these rods had sagged several inches at their upstream ends, or that the cable had lifted that amount. This is manifestly impossible, as a small part of such a rise would bring the cable above the line joining the two first unbroken suspenders, and such a sag would cause the ruin of the floorbeam. It is a fact, however, that the distance from cable to floorbeam was, and is, greater at the northernmost cable than at any other, this cable being now about 7 ins. higher than the others. The reason for this is apparent from an inspection of the table, which shows that for some years past the span of the northernmost cable has been longer by several inches than those of the others, thus causing the center of this cable to hang at a higher elevation.

SELECTED OBSERVED POSITIONS OF SADDLES, IN INCHES, SHOWING THAT THE SADDLES ARE NOW IMMOVABLE.

Date.	Positions of Saddles. New York Tower. A	B	C	D	Brooklyn Tower. A	B	C	D	Average Position of Saddles. Brooklyn.	New York.	Movement of Saddles from Average Positions of May 26, 1883. Brooklyn Tower.	New York Tower.	Changes in Length of Main Span (Average of the 4 Cables) since May 26, 1883.
1883..May 26	4 9/16	4 10/16	4 11/16	4 10/16	3 8/16	3 15/16	3 13/16	3 5/16	4 10/16	3 11/16	0	0	0
1890..December 24	5 2/16	5	4 14/16	4 12/16	3 8/16	4 10/16	4 12/16	4 12/16	4 15/16	4 13/32	—5/16	—23/32	—33/32
1891..May 5	5	5 2/16	4 13/16	4 8/16	3 8/16	4 12/16	4 12/16	4 10/16	4 27/32	4 13/32	—7/32	—23/32	—15/16
1892..April 30	5	4 14/16	4 14/16	4 8/16	3 12/16	4 10/16	4 12/16	4 4/16	4 13/16	4 11/32	—3/16	—21/32	—27/32
1893..March 24	5 2/16	5 2/16	4 10/16	4 8/16	3 10/16	4 10/16	4 14/16	4 8/16	4 27/32	4 13/32	—7/32	—23/32	—15/16
1894..January 24	5	5 3/16	4 13/16	4 8/16	3 10/16	4 10/16	4 14/16	4 6/16	4 27/32	4 13/32	—7/32	—23/32	—15/16
1895..January 14	5	5 4/16	4 13/16	4 8/16	3 10/16	4 10/16	4 14/16	4 9/16	4 14/16	4 13/32	—4/16	—23/32	—31/32
1896..November 14	5 4/16	5 3/16	5	4 12/16	3 12/16	4 12/16	4 14/16	4 8/16	5 1/32	4 15/32	—13/32	—25/32	—19/16
1897..June 18	5 4/16	5 3/16	5	4 12/16	3 12/16	4 13/16	4 14/16	4 10/16	5 1/16	4 8/16	—7/16	—13/16	—20/16
1898..May 2	5 4/16	5 6/16	5 2/16	4 14/16	3 13/16	5	5 2/16	4 10/16	5 5/32	4 10/16	—17/32	—15/16	—47/32
1898..July 30	6 8/16	7 10/16	7 8/16	8 2/16	3 13/16	5 14/16	6 6/16	6 12/16	7 7/16	5 11/16	—2 13/16	—2 0/16	—4 13/16
1898..November 30	6 2/16	7	7	7 14/16	3 12/16	5 6/16	5 8/16	5 4/16	7 9/16	4 31/32	—2 6/16	—1 9/32	—3 21/32
1899..January 11	5 15/16	6 13/16	6 13/16	7 9/16	3 13/16	5 3/16	5 6/16	5	6 13/16	4 13/16	—2 2/16	—1 2/16	—3 4/16
1899..August 10	6	6 13/16	6 10/16	7 4/16	3 14/16	5 6/16	5 9/16	5 2/16	6 21/32	5	—2 1/32	—1 5/16	—3 11/32
1900..January 16	6 2/16	6 12/16	6 10/16	7 2/16	3 14/16	5 6/16	5 6/16	4 15/16	6 21/32	4 15/16	—2 1/32	—1 4/16	—3 9/32
1900..August 29	6	6 13/16	6 10/16	7 2/16	4	5 9/16	5 9/16	5 2/16	6 12/16	5	—2 0/16	—1 5/16	—3 5/16
1901..February 19	6	6 10/16	6 9/16	7 2/16	4	5 6/16	5 6/16	5	6 9/16	4 15/16	—1 15/16	—1 4/16	—3 3/16
1901..May 22	5 14/16	6 12/16	6 5/16	7 3/16	4	5 4/16	5 4/16	4 14/16	6 17/32	4 27/32	—1 29/32	—1 5/32	—3 1/16
1901..July 31	6	6 11/16	6 9/16	7 2/16	4 1/16	5 5/16	5 6/16	5	6 19/32	4 31/32	—1 31/32	—1 9/32	—3 4/16

The positions given in inches are supposed to be distances measured toward river from a line 12 in. shoreward from the center-line of each tower. The minus signs (—) indicate movements toward river or shortening of river-span. Cable A is the northernmost cable.

The bridge was opened for traffic on May 24, 1883. The average positions of May 26 are for Brooklyn Tower 1 1/16 ins. and for N. Y. Tower 3/16 ins. more toward the river than before the moving-load was allowed on the bridge. The positions of July 30, 1898, were after the crippling of bottom chords by stay-system.

The positions of the individual saddles show that since May 28, 1883, the span of Cable A has shortened 2 ins., that of B 3 7/16 ins., that of C 3 7/16 ins., and that of D 4 3/16 ins. Field measurements show that Cable A is at present 5 ins. to 7¾ ins. higher above the two middle floor-beams than are the other three cables; which fact may be largely attributed to the longer span of Cable A.

The other point to be mentioned pertains to the repair of the broken suspender-rods. We were told that the rods used in the bridge to replace those that were broken were made by welding new ends to the bodies of the broken rods. These rods are said to be steel, of 75,000 lbs. per square inch ultimate strength and of 45,000 lbs. elastic limit. It is a common belief among engineers that welds in steel of this degree of hardness are not only difficult to make, but uncertain, and not to be relied upon even when seemingly successfully made.

APPENDIX B.—THE FIELD INSPECTION—METHODS AND RESULTS.

The field inspection of the structure, as already stated, was begun on Saturday, July 27th. From that date to August 9th, inclusive, a part or the whole of every day was devoted to it by one of us, only such time being used elsewhere as was necessary to collect data for the computations of strength. Since August 9th several additional days, at disconnected times, have been given to the inspection, which was finally completed on August 28th.

The date fixed by you for the completion of this report, even though advanced somewhat beyond the time you yourself wished, seemed to us very short for such an important work. The work consisted, in addition to the field inspection, of the collection of data in regard to the structure and its loads, of calculations to determine its strength and safety, and of the writing of the report; and no more time could be devoted to any one of these divisions than would allow of all of them being completed by the time specified.

Rivets.—The restricted time which could be given to the field inspection made it necessary to abridge this in some respects from what it would otherwise have been. The principal omission was that but a few of the rivets were tapped and examined for tightness. There are an immense number of them, and many in the floor could have been reached only by the use of a scaffold and a small gang of men to move it, making it impracticable to cover their complete inspection within the time available. Those which were tested, however, were found tight and in good condition, giving us some reason to suppose that the untested ones were likewise.

The testing of all other parts of the structure was done as thoroughly as there can be any necessity for. It was done in person, not through assistants, and was such as enables us to speak with confidence of the present physical condition of the bridge.

As the safety of the bridge lies mainly in its suspenders, cables and towers, and is less influenced by the stiffening trusses—also because the failure of July 24th occurred in the suspender system—the inspection was directed principally to the cables and suspenders, and to their connections.

Cables.—The strands of each cable were examined by eye in each anchorage, up to the point where the anchor bars are imbedded in the masonry. They were all found dry, well painted, and in good condition, with no influences which should tend to cause deterioration.

The cables were also examined by eye at practically all points between the anchorages. Where the cables were high, this was done by walking up and down the two middle cables, through the tops of the towers, and observing the cable under foot and the adjoining ones. Though this examination was necessarily a surface one only, it showed all parts of the cables to be well painted and presumably in good condition. At a single place, near the middle of river span on Cable B, A being the northernmost cable, a break about one-eighth inch wide was observed in the paint and cable wrapping, through which the straight wires of cable showed with their galvanizing in perfect condition. Toward the anchorages, however, where the main floorbeams are above the cables and are supported by means of struts or posts resting upon the latter, the foot of each post hides a short length of cable so that it cannot be examined. It is possible, though not probable, that rusting may have occurred in the cables at such points. Even if this were the case, the section of cables at these points is larger than necessary, as the stress here is less than at the towers.

The cables were also examined where they pass through the tops of the towers, and were all found to be dry, well painted, and in good condition.

Saddles.—The saddles, however, in which the cables lie, and which were intended to move back and forth in the direction of the bridge to allow an adjustment of the bridge to the different conditions of temperature and moving load, were found practically fixed and immovable. This immovability of the saddles causes a slight bending of the towers, and raises the maximum compression in the masonry, already much greater than is considered good practice, to a still higher amount.

Masonry of Towers.—Our computations show the tower masonry to have been exposed to what most engineers would consider a very excessive stress ever since the bridge was completed. A careful examination of the parts under greatest pressure, however, though made with a powerful marine glass from a distance of only 10 to 20 ft., shows no visible signs of deterioration. Inquiry also showed that no trouble had ever been had with the pointing mortar between the stones at the places where the greatest pressure occurs, and that this pointing has never been replaced since the completion of the bridge. Both report and appearance indicate that the masonry is of an excellent quality and able to bear with safety as great a pressure as it would ever be considered safe to use in the main body of granite masonry. The fixedness of the saddles, and its effect upon the masonry, are treated more fully in Appendix D.

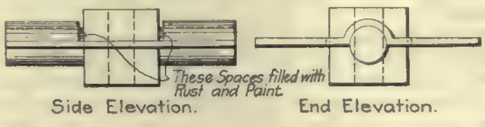
It should be added that while the saddles were intended to be movable by the designers, and that while the fixed condition of saddles increases the stress in the tower masonry, our computations show that this fixedness causes a decrease in the very large secondary stresses in cables at the center of main span.

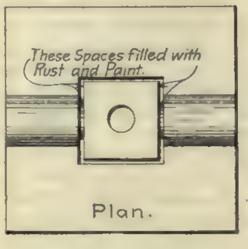
Suspenders and Stays.—The suspender system was inspected with great care, as some features in its design make it peculiarly liable to rust influences and to the development of large secondary stresses. Every wire suspender and wire stay in the bridge was tested by shaking to ascertain whether it actually had tension in it; each rod of every suspender stirrup and of every stay stirrup was tested by visual examination and by blows of a hammer for tension, bearing of nuts, condition of paint, etc.; and all the rod suspenders were examined by eye and (with a very few exceptions) by blows of a hammer.

The general condition of the suspender and stay systems was found to be good. In a few cases, however, due to careless adjustment, the stress in the wire suspender was found to be all borne by one rod of the stirrup, or to be producing, because of eccentric bearings, a side-bending on both rods. These cases are more fully described in Appendix C. A new rod suspender used to replace one of the broken ones was found to be under no stress whatever, being so loose that it could be turned by the hand. Such cases were reported to the Bridge Department for remedy soon after their discovery.

Suspender Stirrups.—The conditions tending to produce rust of the suspender stirrups were, in many cases, very bad, as described more fully in Appendix C. They consisted briefly in the presence of an inch or two of road sweepings a short way above the lower nuts, and of the upper nuts having been turned down a short distance without a subsequent painting of the thread left exposed above the nut, thus making the admission of water into the nut a possibility. At our request two suspender stirrups were taken apart for examination. They were found to be in perfect condition within the nuts, the threads there being as bright as new, but to have been reduced about 1/16 in. in diameter by rust at points below the upper nuts and above the lower nuts, or to about 90 per cent. of their strength when new.

Rod Suspenders.—One of the rod-suspenders near middle of main span was also taken apart to allow an examination of the rod and of the parts of trunnion at its lower end. It was found that the rod within the trunnion had been reduced about 1/16 in. in diameter by rust, or to about 94 per cent. of its strength before rusting. The threads within the nut were bright and unrusted. The trunnion showed no signs of lubrication. The lower trunnion plate was very rusty, while the upper was much less so, and showed signs of a slight motion of the trunnion. The main resistance to rotation, however, came from an end bearing (of the cubical block forming the middle of trunnion) against the trunnion plates, as in sketch, which shows trunnion and upper plate only.





This end bearing held the trunnion in such a tight grip that even after removing the lower plate, and while the trunnion and upper plate lay on a plank walk, blows from a spike-maul were necessary to cause rotation, those from an ordinary machinist's hammer not being sufficient.

Suspender Ropes.—The inspection shows that many of the wire ropes of suspender system have been allowed to wear slightly, and that the wearing still continues. The floor of promenade has a motion sideways of about 2 ins. from loads on one side only of the bridge, and this motion causes the plank floor of promenade to wear against many of the suspender ropes where they pass through the floor. This wearing could easily be prevented either by covering the ropes at such points or by enlarging the holes in planks through which they pass. The amount of the wearing is as yet insignificant.

The six stiffening trusses were examined for condition of paint, amount of rust, wearing of parts, etc.

Slip Joints.—The examination shows that all the slip joints at middle of river and land spans are working well and are sensitive to the action of moving loads. Though unlubricated, and unsightly from rust, the joints are working well without the lubrication, and the only harm which has resulted from the rust is to the appearance of the structure. It may be well to say, in view of the many statements lately made in newspapers as to the harmful influence of rust on the bridge, that examination shows the structure to be, in general, unusually well painted (at least so far as it can be visible to the critics), and to be quite free from harmful rust.

Rust Conditions.—The conditions tending to produce rust are bad in some cases, however. Those in connection with the suspender stirrups have been already mentioned; also the fact that not much weakening seems to have resulted from them as yet. The examination showed that the conditions tending to produce rust have been very bad in the case of the bottom chords where they pass through the towers, and of the bottom-chord pockets at slip joints of end spans. As more fully described in Appendix C, several inches of water or mud were found standing in many of the bottom chords at these places, due to the drainage holes having been allowed to fill up with dirt. At our request the water and dirt were removed so that an examination could be made for possible rusting. In the course of the cleaning several new drain holes were drilled, giving good opportunity to see the section of the metal; but the subsequent examination failed to show that rusting had resulted to a harmful degree.

Diagonal Bars Worn.—The inspection shows that the diagonal bars of the four high trusses have been worn by rubbing against each other and against the posts at intersections. In most of the bars so affected the wear now amounts to about one-sixteenth of an inch, or to about ten per cent. of the section of the thinner (double) bars, while in a few cases the wear is more, perhaps as much as one-eighth inch. It is estimated that about one-third of the diagonal bars in the four high trusses are so affected, and the wearing is still in progress.

Though the strength of the bars is somewhat reduced by this wearing, probably to a greater degree than the loss of section, the strength of the truss is not, as these bars still have an excess of section. The wearing can easily be prevented, however, by protecting the bars with sheet metal or some similar material at intersections.

Sway Rods Worn.—A similar wearing was found in many cases at the intersection of the sway rods connecting the two middle trusses together, beneath the promenade. This also has had as yet no serious effect on the strength of the structure as a whole.

Tracks of Bridge Railway.—One of the most serious features observed during the inspection is neither the result of deterioration, nor directly a question of strength. The tracks used by the bridge trains are laid on 5 x 7-in. ties, spaced 17 ins. apart in the clear, and with no guard rails or tie spacers used in connection with them. The drawings furnished us show two wooden guard rails and the ties spaced 8 ins. apart in the clear; but the changes are, said to have been made when the gauntleted tracks were placed on the bridge.

The most careful practice in bridge floors by American railroads is to space the ties 4 ins. apart in the clear and use four guard rails, and the least provision (at least on reputable railroads) is to use an 8-in. spacing and two guard rails. The most common provision is probably a spacing of 6 ins. and two guard rails. The ordinary practice of the elevated railroads of this city is to use four guard rails and a spacing of 4 to 6 ins.

The low speed of the bridge trains (that of the cables is only 11.3 miles per hour) and the fact that most of the trains are hauled by cable, makes the probability of derailment much less than is the case with trains hauled at high speeds by steam locomotives; and the low speed and absence of heavy locomotives makes the damage which would probably result from a derailment much less. Notwithstanding these considerations, however, the bridge tracks, in their present condition, seem to us to subject the structure to very unwarranted risks in case of derailment, and the tracks should, in our opinion, be modified by making the clear distance between ties only 6 ins., and by the addition of two guard rails dapped over ties.

Appendix C.—Ways in Which the Bridge has Been Allowed to Deteriorate for Lack of Proper Inspection and Maintenance.

Stirrup-Rods Allowed to Become Improperly Adjusted.—Some of the stirrup-rods of wire-rope suspenders were found to have been readjusted carelessly, so as to cause either eccentric or unequal and eccentric pulls in the two rods forming stirrup. This unequal or eccentric pull was caused merely by screwing down the two nuts on top ends of stirrup rods unequal amounts, so as to throw all the bearing on one rod (1), or on the edges of the two nuts (2). In the first case the available strength of the stirrup is reduced to about one-twentieth, and in

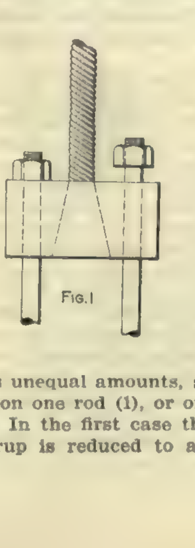


Fig. 1

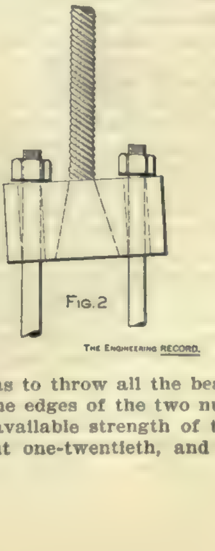


Fig. 2

The Engineering Record.

the second case to about one-fifth of what it would be with full and equal bearings on the two nuts. Eccentric stresses are also caused in the wire rope where it enters the cast socket.

This faulty adjustment was noted by specific position-numbers in about twenty places, and about as many more cases were seen, but not specifically noted. As the total number of wire suspenders in the bridge is 1,096, the proportion having their available strength largely reduced by faulty adjustment is certainly not great. In many cases, however, the faultily adjusted suspenders were found near (not next) each other, in groups of two or three, giving a weak spot in the suspender system in which failure would occur under much less stress than in the well-adjusted portions, and from which it would then tend to spread to the adjacent well-adjusted suspenders. The faulty adjustment of suspenders, therefore, seems to us much more serious than is indicated by the relatively small number of cases.

This faulty adjustment is plainly evident to any ordinary conscientious visual inspection, and a failure to observe and correct it, even in the comparatively few instances found, indicates a faulty and inefficient method of inspection. In some cases the nuts had been turned down since the last painting, and the unequal lengths of unpainted thread exposed above the two nuts showed plainly that previous to this careless turning down the two nuts each had full bearing.

Trunnions of Suspender-Rods Not Kept Lubricated.—The conditions found in the trunnion taken apart for examination are described in Appendix B, and the various forces acting on the rods passing through trunnions in Appendix A. Many of the causes tending to break these rods have their origin in the original design of the structure, and it is improbable that any amount of watchfulness and care—unless exercised in replacing these suspender-connections by an improved design—could have prevented the breaking of the two middle suspenders.

One of the causes, however—the forces tending to bend the rods in the direction of the bridge—could have been very largely prevented by an efficient lubrication of the trunnions. The designer of these trunnions has publicly stated that their proportions and strength were governed by the assumption that they would act as lubricated journals. The lack of lubrication was one of the causes leading to the failure of the rods and to the interruption in the use of the bridge, and it is our opinion that this omission of lubrication may be regarded as a deterioration of the structure from a lack of efficient maintenance.

Spreading of Breaks in Suspender-Rods.—While it is our belief that the breakage of the first suspender-rods was mainly due to features of the original design, we also believe that the first efficient inspection after such a break occurred would have resulted in the discovery of the broken rods. A broken rod—or even one which, while not broken, has very little or no stress in it—can be detected without difficulty from its sound under blows from a hammer. The complete breakage of a rod can also be detected by the eye without waiting for the cable to rise enough to draw the fractured section above the top of the trunnion. The least lifting of the rod will break the paint-film connecting the rod with the top of the trunnion, or bring into view a portion of the rod, unpainted, or differently painted, which was before within the trunnion. Knowing the former condition of the paint, either or both of these changes in appearance should be sufficient to excite suspicion as to the soundness of the rod, and to cause more conclusive tests with the hammer or the wrench.

The fact that two suspender-rods had been broken for a long time without discovery, and that the breakage was permitted to spread until seven additional suspenders had failed, cannot be regarded otherwise than as an indication that the inspections were too infrequent, or that the methods of inspection were inefficient.

Suspender Ropes Allowed to Wear.—Many of the wire suspender ropes have been allowed to rub, and to wear slightly, against the floor boards of the promenade floor. This has occurred only outside the limits of the stay systems. A partial count shows that about two-thirds of the suspender ropes not crossed by stays are so affected, and are still rubbing and wearing. The wear is very small as yet—consisting in only a very few cases of as much as the half of two or three wires—but could easily have been prevented entirely by binding a piece of sheet lead, tin, rubber, rubber fiber or similar material to each suspender where it passes through floor, or by enlarging the holes in the boards. The former has, in many cases, been done, within the limits of the stay-system, to both suspenders and stays.

Diagonal Bars and Sway-Rods Allowed to Wear against Each Other.—The diagonal bars of the four high stiffening trusses (trusses Nos. 2-5) have been in very many cases allowed, at intersections, to rub and wear against each other and against the vertical posts. This action is still going on, and it is estimated that about one-third of all the diagonal-bars of the four high trusses are so affected. The wearing is usually about 1/16 in., representing a loss of about ten per cent. of the original section of the thinner (double) bars, and, in a very few cases, a wear of about ⅛ in. was found. The vertical posts are also worn slightly at the corresponding points.

The transverse diagonal rods connecting trusses 3 and 4 with each other, and lying in vertical planes below the promenade, are also, in many cases, rubbing and wearing where they intersect each other. The part lost by wear is generally larger, proportionally, than in the bars.

The wear of both bars and rods could easily have been prevented by interposing sheet metal, rubber fiber, or other similar material between the parts.

Widening the Spaces between Track-Ties and Removing Tie-Spacers (Guard Rails.)—The drawings furnished us show the ties spaced 8 ins. apart in the clear, and with two wooden tie-spacers or guard rails, and this is believed to have been the construction of the railroad floors previous to the use of the bridge by trolley cars. The ties are now spaced 17 ins. apart in the clear and the wooden tie-spacers have been omitted.

This was doubtless done to prevent an increase in the total loads on the bridge when the moving loads were increased by the trolley cars. In our opinion this change in the floor subjects the structure to more danger than would have arisen from the increase in weight, and is a constant menace to safety.

The Continued Use of Wooden Stringers of Insufficient Strength in the Railroad and Trolley Tracks.—It seems probable that the stringers were allowed to remain unchanged when the wheel loads were increased. Whether this is the case or not, they have for a long time past been stressed far beyond the limits of ordinary good practice. Care has not even been taken, in the railroad floor, to keep the joints of the stringers over the main floorbeams; in such places the rail itself must be the main carrier of the load, which is a condition outside the limits of good practice.

It seems probable that these insufficiently strong stringers also have been kept in use in order to prevent an increase in the weight on the bridge, in which case a somewhat remote danger has been avoided at the expense of incurring a much more probable one. The ordinary working stresses and assumptions governing the use of wooden stringers are matters of common knowledge among engineers, and there seems no reason why this bridge, carrying, perhaps, more passengers than any other in the world, should not be made to conform to these ordinary requirements.

Lack of Reliable Plans of Structure.—There is no complete set of plans showing fully and reliably the present features of the structure. Those which do exist are few in number, insufficient and unreliable, and, in many instances, without date. Some of them show the structure not only not as it is at present, but as it never has been. A fire destroyed part of the plans some years ago, but ample time has elapsed since to allow of their being replaced by others showing the actual construction.

Efficient supervision should, in our opinion, include the securing and maintenance up to date of a complete and reliable set of plans showing the actual features of the structure; plans of sufficient completeness and reliability to allow a decision to be made from them with confidence on all questions of strength.

To the above may be added certain conditions tending to cause rust which have been allowed to exist, but which our examination does not show to have as yet resulted in any appreciable harm to the structure.

Water and Mud Allowed to Collect in the Bottom Chords of Stiffening Trusses.—No efficient provision has been made to keep water and dirt from gathering in the bottom chords where they pass through the towers, or in the pockets at the foot of end-posts at slip-joints of land spans. In the case of the latter, small drain holes exist, but had been allowed to fill with dirt, while the former are supposed to have been originally self-draining but to have become clogged with dirt.

There are twelve lower chords running through towers, and in four of these water was found to depths of 2 ins., 5 ins., 8 ins. and 8½ ins., respectively, and nearly all contained large quantities of dirt, mostly wet horse manure. In the pockets at the bottom of end-posts water was found in seven of the twenty-four pockets to depths of 5½ ins., 6 ins., 7 ins., 7 ins., 8 ins., 8 ins. and 8 ins., respectively. Dirt and mud were also found at the bearings of bottom chords on the anchorages.

These bad conditions could have been prevented at any time since the completion of the bridge by providing large drain holes which could not become clogged by dirt, filling such places with concrete so that the water and dirt could not enter, or by some similar means.

Sweepings around Base of Suspender Stirrups.—In practically *all* cases of *long* stirrups to wire suspenders of cables A and D, the sweepings (mainly horse manure) from floor have been allowed to accumulate to a depth of two or three inches in a pocket at bottom of floorbeam around bottom of outer rod of stirrup. Similar accumulations were observed in a few of the rod-suspenders of end-spans.

The sweepings show wet after rains and cause a condition favorable to rusting, but the removal and examination of a single rod showed no appreciable rusting in that case. The bad condition can be removed, however, by using board covers to prevent the collection of sweepings in these pockets.

Threads of Suspender Stirrups not Painted above Nuts.—In very many instances (probably over one-third of the wire suspenders) the two top nuts of the stirrups connecting suspenders to floorbeams have been turned down from ⅛ in. to ½ in., and the thread thus left exposed not since painted. This would seem to permit a more or less free access of water into the nut along the thread and a possible rusting of the thread. In very many cases blows of a hammer on the stirrup-rods shook down rust (sometimes a half teaspoonful) from within the hole in cast block through which the stirrup-rods pass; and in one case, even, about a tablespoonful of water was jarred down from around one of the stirrup-rods.

The removal of this rod, however, and of one or two others, showed that in those cases the rusting was due to the design and to influences acting from below, and not to the unpainted threads above. The possibility should be removed, nevertheless, by painting these threads.

Rust and Dirt Accumulated under Rollers at Edges of Saddles.—Dirt, rust and paint have been allowed to accumulate under the front and rear rollers of saddles at the top of towers. It is impracticable to examine any but the end rollers, the design preventing either examination or cleaning of the intermediate ones. It would be easy, however, to keep the outer sides of the end rollers free from dirt, and this has not been done, samples having been found and taken of dirt ridges (rust, paint and dirt) one-half inch high just in front of, and bearing the impress of rollers. In one case, even, a steel wedge (the "plug" of a plug and feather) was found embedded in the ridge of dirt. In several cases, also, the outer rollers are badly skewed with the saddle.

Hasty observations under moving loads seem to show that the saddles are now practically fixed and immovable on the towers, with rollers not acting, and measurements made by the Bridge Department of the position of saddles show this conclusively—the saddles having the same position in summer as in winter for several years past. This is evident from an inspection of the partial record of saddle positions given in the table.

This fixedness of the saddles was a condition not contemplated by the designers of the bridge. It was at first considered by us to be a serious deterioration in the safety of the structure, which view would be shared by engineers in general. Further estimates of strength, however, showed that while the cessation of motion had indeed increased the stresses in the tower masonry quite materially, it had at the same time caused a decrease in the large and hitherto unappreciated secondary stresses in the cables at the middle of the main span, so that the net effect of this stoppage of motion in the saddles is probably a benefit to the bridge.

Even had our computations shown that it is desirable to have the saddles movable, it is very doubtful if any ordinary care in supervision would have prevented them from becoming fixed. The stays passing over the saddles are in every instance bearing hard against the shore edge of the bed-plate, and prevent any further motion toward the river unless slip should occur between them and saddle. In addition, the condition of the inaccessible intermediate rollers may be (and probably is) so bad as in itself to prevent motion of the saddles. The conditions observed at the outside rollers (and which were easily preventable) are, however, probably sufficient in themselves to prevent motion.

In Appendix F certain changes are suggested by means of which the saddles could be made movable, so relieving the stresses in the masonry, and at the same time a reduction secured in the secondary stresses of cables.

The Convention of the American Institute of Architects.

The American Institute of Architects held its thirty-fifth convention at the Pan-American Exposition on October 3-5, and the proceedings were naturally largely influenced by the place of the sessions. At the outset, the president of the exposition company, John G. Milburn, paid a warm tribute to the architects of the enterprise, "who, for a compensation far below what would be given in any other than a public matter, in other words, more out of public spirit than anything else, devoted their time, energy and talents to producing something reflecting credit on American architecture and interesting as a matter of study in its novelties and experiments."

Of the papers presented, five related to exposition subjects; "Some Phases of Exposition Making," by Mr. Carleton Sprague; "the Management and Design of Expositions," by Mr. Thomas R. Kimball; "the Exterior Color Effects of the Pan-American Exposition," by Mr. C. V. Turner; "Government Architecture at Expositions," by Mr. E. A. Crane; "the Electrical Installation and Decorative Effects of the Pan-American Exposition," by Mr. Luther Stieringer. The last appears on page 349 of this issue.

The other leading topic before the convention was government buildings, a subject as fruitful of discussion among architects as professional ethics among civil engineers. It was brought up by a paper by Mr. John H. Rankin on "the Effectiveness of the Tarsney Act," and continued by one by Mr. Wm. A. Boring on "Building Construction under the Tarsney Act, and Suggestions for Modifying the Regulations thereof."

The resolutions passed at the convention read as follows:

Resolved, That a committee be appointed by the chair, to consist of himself and four other members of the Institute, who shall study the question of a National Art Commission, report to the Board of Directors, and, with the consent of the board, petition Congress on behalf of the American Institute of Architects to create such a commission.

Resolved, That a permanent committee on competitions, composed of three members, be appointed by the chair, to give advice to those desiring information, and to induce reputable architects to refrain from entering improper competitions.

Resolved, That a committee on municipal improvements, composed of three members, be appointed by the chair, to co-operate with other societies having municipal improvements as an object.

Resolved, That a committee of five, inclusive of the chair, be appointed to secure the formation of a national bureau of architecture, under whose administrative charge shall be placed the architectural work of all the departments of the National Government, the work to be executed under a law similar to the Tarsney Act, which should, however, be mandatory and not optional.

Resolved, That a committee of five be appointed by the chair, to organize a world's congress of architects, to be held in St. Louis in 1903 in connection with the centennial celebration of the Louisiana Purchase.

Resolved, That one delegate from each of the national societies of sculpture, mural painting, landscape architecture and civil engineering, be hereafter invited to attend the annual conventions of the Institute; said delegates to have all the privileges of the floor, except that of voting.

Resolved, That a committee of three be appointed by the chair to ascertain the views of the members of the Institute as to the desirability of adopting in this country the metric system of measurements; said committee to confer with the superintendent of the Bureau of Standardizing, and to represent the views of the members of the Institute before Congress.

The following architects were honored by election, on the nomination of the Board of Directors, as Fellows of the Institute: W. A. Boring, J. G. Howard, W. G. Notting, Thomas R. Kimball and F. M. Howe.

The following officers of the Institute were elected for the ensuing year: President, C. F. McKim, New York; first vice-president, Frank Miles Day, Philadelphia; second vice-president, Alfred Stone, Providence, R. I.; secretary and treasurer, Glenn Brown, Washington. Members of the Board of Directors for three years: Walter Cook, New York; W. S. Eames, St. Louis; Cass Gilbert, New York. The next meeting will be held in Washington, October, 1902.

Personal and Obituary Notes.

The R. H. Tingley Company has removed its consulting engineering offices in New York to 32 Broadway.

Mr. Philip Prioleau has been re-elected city engineer of Jacksonville, Fla., a position he has held for a number of years.

Dewitt C. Smith, formerly city engineer of Schenectady, N. Y., died October 6 at a sanitarium near Saratoga, aged 48 years.

Mr. D. M. Nesbit, M. Am. Soc. H. & V. E., of Ashwell & Nesbit, Ltd., heating engineers of London, will shortly visit this country.

Mr. Robert Woods has been appointed chief engineer of the Ft. Wayne & Southwestern railroad, with headquarters at Indianapolis.

G. S. Batterman, general superintendent and chief engineer of the Boston & Montana and Butte & Boston mining companies, died October 7, at Butte, Mont.

Prof. G. A. Gerdtzen, a graduate of the University of Wisconsin in 1892, has been elected assistant professor in mechanical engineering at the University of Illinois, at Champaign.

Prof. Walter Alexander has resigned as assistant professor in mechanical engineering at the Armour Institute to accept a similar chair at the University of Missouri, at Columbia, Mo.

Mr. A. W. A. Eden has severed his connection with the East Berlin office of the American Bridge Co. to join the engineering staff in charge of the Atlantic Ave. Improvement of the Long Island R. R.

Mr. Julius W. Bugbee, who has been the chemist of the sewage disposal works at Worcester, Mass., for a number of years, has been engaged for similar work at the disposal works recently completed by the city of Providence, R. I.

Mr. J. T. Wyche, for some time resident engineer at Laramie, Wyo., for the Union Pacific railway, has been promoted to be division engineer, with headquarters at Kansas City, Mo.

The Central States Water-Works Association at its convention, October 1-3, at Evansville, Ind., elected the following officers for the ensuing year: President, Joseph J. Pater, of Hamilton, O.; vice-presidents, Joseph D. Blair, of Cincinnati; George McElhenny, of Evansville; W. H. Glore, of Covington, Ky.; John Morton, of Nashville, Tenn.; Henry Burton, of Port Huron, Mich.; S. F. Tompkins, of Joliet, Ill.; Clark Howell, of Charlestown, W. Va.; secretary, William Allen Veach, of Newark, O.; treasurer, Charles E. Rowe, of Dayton, O.; executive committee, C. W. Wiles, of Delaware, O.; A. W. Evans, of Zanesville, O.; W. H. Stephens, of Lima, O.; finance committee, T. R. Cooke, of Toledo, O.; John Langan, of Tipton, Ind.; A. W. Inman, of Massillon, O.; editor, Lehman B. Holt, of Cleveland.

The Licensing of Superheaters in connection with steam boilers is provided for in a decree issued in March, 1900, by the German Minister of Commerce. The addition of a superheater to an existing boiler is regarded as an important modification in the construction or operation, and is dealt with under the regulations prescribed for such. Three cases are considered, these being the ones most frequently met with, namely, the installation of superheaters as a part of a newly-erected boiler plant, their addition to an already licensed boiler, and the installation of a separately fired superheater. In the first case, the boiler and superheater are tested and licensed together, the test being the same. This is the more convenient, since both are usually made by the same firm. In the second case the test is made as a part of the periodical inspection, at the regular time, though a request for a special inspection will be granted. In the third case, that of the isolated superheater, neither test or license is necessary, though the test under water pressure is advised and usually applied.

An Excavating Wheel 65 feet in diameter and weighing, with its supports, about 1,000,000 pounds, is being made by the Robert Poole & Son Company, of Baltimore, for the Calumet & Hecla Mining Company, to carry away refuse from stamp mills. It will have buckets all around its periphery, which, as the wheel revolves, will scoop up the refuse and dump it into a trough at the top of the wheel, whence it will be carried away by water in a sluiceway. The shaft, which was ordered from the Krupp Works, is 27 feet long, 32 inches in diameter, 16 inches in bore through the center, and weighs 42,000 pounds. The wheel is made in 20 segments. There is also a hub at each end of the shaft, and running from these to the different segments are 40 steel arms, the completed structure having the appearance of a large bicycle wheel. It is to be driven from an electric motor by means of a 3-foot pinion, and each segment of the wheel has 26 teeth on the outside rim, a total of 520 teeth for the 20 segments. In operation the wheel is to make about 10 revolutions per minute. It was designed by Mr. E. D. Leavitt, of Cambridgeport, Mass.

The Flow of Air past Obstacles is the subject of an interesting paper by M. Marey in "Comptes Rendus" for June 3, 1901. For studying the changes in the direction and velocity at different points of a column of air which is made to flow past an obstacle of given size and shape, the author employs thin columns of smoke which are injected into the air column. The flow takes place in a box of square section (the side of the square being 50 cubic meters), one of whose sides consists of a sheet of glass, so that the appearance of the smoke-lines may be photographed. The air and smoke are passed through suitable filters, so that when no obstacle is interposed the smoke-lines are straight and parallel to each other; 58 smoke-lines are employed by the author. The direction of the smoke-lines gives that of the air-current at any point. In order to study changes of velocity, the author adopts the ingenious expedient of throwing the series of small tubes through which the smoke is injected into lateral vibration by means of an electric trembler of known frequency. The effect is to produce sinuosities in the smoke-lines. These sinuosities are equidistant, so long as the velocity along a given line is constant. If the velocity varies, its variation is deducible from the changes in the intervals between consecutive sinuosities.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND
MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Grand Rapids, Mich.—Bids are wanted Nov. 12 for furnishing the city with a supply of water, as advertised in The Engineering Record.

Atlantic City, N. J.—Bids are wanted Oct. 28 for furnishing a quantity of cast-iron pipe, as advertised in The Engineering Record.

Savannah, Ga.—Bids are wanted Oct. 30 for the installation of an air lift pumping plant, at the water-works, as advertised in The Engineering Record.

Chicago, Ill.—Bids are wanted Dec. 4 for the buildings and machinery of the Bridgeport Pumping Works, as advertised in The Engineering Record.

Columbus, O.—Bids are wanted Oct. 15 for furnishing or for furnishing and installing at the East Side pumping station one cast iron base for low pressure pump end on No. 1 7,500,000 Holly triple expansion engine, said plate to be machined and finished complete. Clarence M. Addison, Clk. Bd. Pub. Wks.

Deer River, Minn.—Bids are wanted Oct. 15 for a water-works system. Thos. F. McGilvray, Design. Engr., Duluth; W. A. Everton, Village Recorder.

Farmington, Mo.—Bids are wanted Oct. 22 for drilling a deep well, 9 in. in the clear, for the city water-works. Address, Dr. J. W. Braham, Chmn. Com., Farmington.

Washington, D. C.—Bids are wanted Oct. 19 for furnishing 1,400 lin. ft. of 36-in. cast iron water pipe. Lansing H. Beach, Commr., D. C.

California, Mo.—City Clk. J. B. White writes that the City Council is considering the question of constructing water-works, but nothing definite has as yet been done.

Payette, Idaho.—W. G. Whitney, of Payette, writes that he is interested in the proposition to construct an irrigation system in Canyon County. Estimated cost of work, $150,000. A. J. Wiley, of Boise, Idaho, is the Engr. in Charge.

Wallace, Idaho.—See "Power Plants, Gas and Electricity."

Mansfield, La.—A. M. Rives, Clk. of the District Court, writes that on Oct. 2 it was voted to construct water-works and an electric light plant.

Oregon, Wis.—The Village Clerk writes that if a favorable vote is taken it is proposed to extend the water mains and fire hydrants, at a probable cost of $3,000.

Bath, Pa.—J. H. Silfies, of Bath, has been instructed to prepare plans and specifications for the reservoir which is to be built next spring at a cost of $20,000.

Sterling, Ill.—Press reports state that the Sterling Water Co. is making plans to extend its system at the expense of $25,000, covering all districts adjacent to the city. Pres., James P. Baxter, of Portland, Me.

Jonesboro, Ark.—The proposition to purchase the water plant is under consideration by the city.

Primghar, Ia.—This city is stated to have voted for a municipal water-works and gas system.

Woodmere, Mich.—The proposition to issue $93,500 water-works bonds carried at the election held Sept. 30.

Cambridge, Minn.—Press reports state that J. J. Flather, of Minneapolis, will do the engineering work for the water-works system.

Richmond, Utah.—Articles of incorporation of the Rocky Ridge Water-works Co., organized at Richmond, have been filed with the Secretary of State. Its purpose is to maintain a water-works system in the southern part of Richmond City. W. C. Burnham, Pres.; J. A. Anderson, Vice-Pres.; George M. Thompson, Sec'y and Treas.

Osceola, Ia.—The citizens on Sept. 27 voted in favor of water-works. The contract for construction is stated to have been awarded to W. M. Peatman, of Centerville, Ia. Cost said to be about $16,000.

Avon, S. D.—Press reports state that a system of water-works will be installed.

Berlin, N. H.—The City Water Co. has been incorporated at Portland, Me., with a capital of $100,000, for the purpose of supplying Berlin and other places with water-works. Promoters, H. M. Verrill, C. D. Booth and E. Caswell, of Portland.

Pittsfield, Mass.—City Engr. A. A. Fobes writes that the following bids were opened Sept. 27 by the Board of Public Works for completing the Ashley Lake dam:

Quantities, etc.	Thos. Kearney, Little Falls, N. Y.	Jno. Donahue, Springfield, Mass.	Geo. M. Atkins, Palmer, Mass.	C. N. Taylor, Wellesley, Mass.	Troy Pub. Wks. Co., Utica, N. Y.	Dwyer Bros., Dalton, Mass.	Frank Pidgeon, Saugerties, N. Y.	O'Connell & Son, Holyoke, Mass.	John Beattie, Leete Island, Conn.
Earth excav., 300 cu. yds.	$0.55	$0.70	$0.40	$0.60	$0.75	$1.00	$0.68¼	$1.25	$1.00
Earth embankment, 5,000 cu. yds.	0.45	0.50	0.45	0.50	0.40	0.65	0.63	0.75	1.00
Lumber in place, 5,000 ft. B. M.	25.00	40.00	40.00	40.00	30.00	30.00	31.50	50.00	60.00
Concrete, 1,450 cu. yds.	7.00	7.75	8.00	8.25	7.50	8.00	8.40	8.25	8.75
Uncoursed rubble, 150 cu. yds.	6.50	6.50	6.00	8.25	10.00	9.50	10.50	7.25	7.50
Coursed rubble, 250 cu. yds.	7.50	9.25	14.00	10.25	15.00	10.00	12.60	21.00	19.00
Spillway	182.75	172.00	200.00	100.00	250.00	175.00	135.45	250.00	232.20
Coping, 3,170 sq. ft.	1.00	0.90	1.00	1.10	1.25	1.25	1.31¼	1.75	2.00
Cobble paving, 540 sq. yds.	0.90	1.00	1.00	1.00	1.00	1.00	1.57½	0.75	1.50
Gate house	685.00	800.00	700.00	800.00	500.00	1,100.00	1,155.00	700.00	1,200.00
Laborers, per day	2.00	2.00	2.00	1.80	2.00	1.75	2.00	2.00	1.60
Masons, per day	4.50	4.00	4.00	4.50	5.00	4.00	5.00	4.00	3.50
Helpers, per day	2.00	2.00	2.50	2.50	2.00	2.00	2.50	2.75	1.80
Single teams and drivers, per day	3.50	3.00	4.00	3.50	3.00	3.00	3.00	3.00	3.00
Double teams and drivers, per day	4.50	4.50	5.00	5.00	5.00	4.00	6.00	4.50	4.75
Foreman, per day	4.00	5.00	5.00	5.00	5.00	5.00	5.00	4.50	5.50
Totals	$20,064	$21,800	$23,180	$23,570	$23,753	$25,003	$26,719	$29,578	$32,745

Ryan, Ia.—The town is stated to have voted to construct a system of water-works.

Winthrop, Minn.—Bids are wanted Oct. 16 for drilling a well for the water-works system. C. E. Larson, Village Recorder.

Hamilton, Mont.—The Canyon Creek Reservoir Co. has been incorporated with $2,000 capital stock, to supply water to this place. Water will be taken from Canyon Creek, 8 miles above, its mouth, where a reservoir will be constructed. Incorporators: J. C. Putnam, J. J. Brooks and others.

Jasper, Ala.—Propositions to construct water-works and electric lights are said to be under consideration.

Minneapolis, Minn.—Supervisor J. H. McConnell, of the Water-Works Department, estimates that it will cost $1,256,146 to secure pure water for Minneapolis.

Hampton, Va.—A. L. Osgood, of Philadelphia, is said to be at the head of a syndicate which has asked for a franchise to establish a water-works plant in this section.

Portage, Wis.—The city has taken possession of the water-works, it having been decided at a special election to buy the plant for $42,500.

Versailler, O.—The Village Council has passed an ordinance providing for the issue of $10,000 bonds for the extension of the water-works and electric light plant. A. Calderwood, Mayor.

Silverton, Colo.—An ordinance has been passed providing for the issue of $40,000 bonds for the purchase by the city of the plant and system of the Silverton Water Supply Co.

Everett, Wash.—The Everett Water Co. is said to contemplate improvements to cost about $600,000.

Troy, N. Y.—Prof. W. G. Raymond, consulting engineer of the Water-Works Dept., has recommended additional water mains for the high localities of the city; estimated cost, $35,000.

New Castle, Del.—Petitions are being prepared for presentation to the next Legislature for a sinking fund loan of $25,000, for the purpose of erecting a municipal water-works.

Greeley, Colo.—Press reports state that the capacity of Eaton reservoir is to be increased at a cost of $15,000. Ex-Gov. B. H. Eaton is the largest share owner.

Elysian, Minn.—Bids are wanted Oct. 15 for a 10-H.-P. gasoline engine for power for the water-works.

Washington, D. C.—W. A. McFarland, Supt. of the Water Dept., recommends that the bid of Geo. A. Fuller Co., of Chicago, be accepted for constructing Trumbull St. pumping station, of brick and Vermont marble, for $314,282.

Kansas City, Mo.—The Mayor has signed the ordinance appropriating $5,000 for the purpose of engaging John Donnelly and S. A. Mitchell, Kansas City, and G. H. Benzenberg, of Milwaukee, to examine the city's water-works system and report to the Council what steps should be taken to secure an adequate water supply.

Meadville, Pa.—Rudolph Hering and Geo. W. Fuller, of New York City, in a recent report recommend the sinking of 15 wells in the vicinity of the experimental wells west of Vallonia, and the removal of the pump station to that point; the estimated cost is given as follows: Wells, $3,200; pump and boiler house, $6,600; 4,000,000-gal. pumping engine, boilers, etc., $30,000; 6,000 ft. of 16-in. pumping main, including river crossing, etc., $17,200; total, $57,000.

Bay City, Tex.—The Southern Canal Co., of Bay City, has been incorporated, with a capital stock of $50,000; purpose, to construct and maintain a system of irrigation. Incorporators: D. P. Moore, William E. Austin and G. M. Magill.

Westbranch, Mich.—The Village Council has decided to establish a municipal system of water-works.

Oshkosh, Wis.—W. G. Maxcy, President and Treasurer of the Oshkosh Water-works Co., has been appointed receiver for the concern and his bonds fixed at $50,000.

Allegheny, Pa.—City bonds worth $1,098,000 have been sold; said bonds are for increasing the water system, street improvements, extensions of the electric light system, extension of the sewer system, improvements and additions to the City Home, etc.

Fayette, Miss.—Bids are wanted Oct. 28 for furnishing material and constructing a system of water-works; separate bids will be received for constructing the well, as advertised in The Engineering Record.

It is stated that bids will be received by the Mayor and Board of Aldermen until Oct. 26 for $14,000 water-works and electric light bonds.

Terry, Miss.—Bonds to the amount of $10,000 have been voted for water-works.

Ft. Mansfield, R. I.—See "Government Work."

Farmersville, Tex.—Town Secy. D. L. Rike writes that contracts will be let in November for the construction of water-works, estimated to cost $12,000.

Evansville, Wis.—The City Council has engaged F. E. Green, of Janesville, Wis., as consulting engineer in the construction of water-works in this city.

Ft. Collins, Colo.—The Water-Works Committee has decided to employ an engineer to make a survey and draw up plans and specifications.

Mineola, L. I., N. Y.—Bonds have been issued by the village for the purchase of the water-works from the Hempstead Water Co.

Carthage, Mo.—The Council is reported to have engaged Burns & McDonnell, of Kansas City, to prepare estimates for a complete system of water-works.

Sioux Falls, S. D.—City Engr. S. B. Howe writes that Loweth & Wolff, of St. Paul, who have drawn plans for a water-works system for this city, estimate the cost of construction at $210,800.

Laurel, Neb.—Engr. in Charge Arnold C. Koenig, of Grand Island, Neb., writes that contracts for furnishing materials (F. O. B. Laurel) and constructing a system of water-works have been awarded as follows: Pipe, 2,000 tons of 4, 6 and 8-in., to Jas. B. Clow & Son, of Chicago, at $35, $33.40 and $30.40, respectively; hydrants to the Ludlow Valve Mfg. Co.; a 720,000-gal. duplex horizontal compound steam pump to Stilwell-Bierce & Smith-Vaile Co., Chicago, for $756,- steel standpipe 12 x 60 ft. with concrete foundation, to Chicago Bridge & Iron Co., Chicago, for $2,325; laying cast-iron pipe to E. C. McCashland, of Grand Island, at 18 cts., 22 cts. and 26 cts., for 4, 6 and 8-in. pipe, respectively.

SEWERAGE AND SEWAGE DISPOSAL.

Trenton, N. J.—Bids are wanted Oct. 15 for constructing sewers in several streets. C. Edward Murray, City Clk.

Greenville, Pa.—Bids are wanted Oct. 19 for $5,000 sewer bonds. A. J. Gillespie, Boro. Sec'y.

Youngstown, O.—Bids are wanted Oct. 26 for constructing a sewer in a portion of Tod Ave. C. E. Cross, Clk. Bd. City Commrs.

St. Paul, Minn.—Bids are wanted Oct. 14 for constructing sewers in portions of 3 streets. C. H. Bronson, Clk. Bd. Pub. Wks.

Rochester, Ind.—Wm. H. Stacy, Pres. of the Bd. of Village Trustees, writes that all bids received Sept. 30 (lowest, $20,897) for the construction of sewers in various streets, have been rejected and new bids will be opened Oct. 24; as advertised in The Engineering Record.

New Philadelphia, O.—Bids are wanted Oct. 31 for constructing about 2½ miles of 6 to 20-in. pipe sewers. R. J. W. Dodd, Clk. City Council; Paul R. Murray, Engr.

Brazil, Ind.—Bids are wanted Oct. 15 for constructing a trunk sewer in Beach St. Jos. W. Williams, City Clk.

Cleveland, O.—Bids are wanted Oct. 16 for delinquent house sewer and water connections, preparatory to paving on portions of 12 streets. Chas. P. Salen, Dir. Pub. Wks.

Hudson, N. Y.—Bids will be received Nov. 8 for a sewage disposal plant at the House of Refuge for Women, Hudson. Herbert E. Mills, Pres. Bd. Mgrs.; G. L. Heins, State Archt., Albany.

Columbia, S. C.—Press reports state that J. L. Ludlow, of Winston, N. C., has been retained by this city to design a sewerage system.

Lowell, Mass.—The Common Council has passed an order to borrow $4,500 for a sewer in Central, Chapel and Agawam Sts.

Kankakee, Ill.—City Engr. R. D. Gregg writes that sewer contracts for which bids were opened Oct. 1 (in all 12,200 ft. of rock and tile sewer), have been awarded as follows: Soldier Creek sewer to D. Sinclair, of Kankakee, for $19,500; Riverview sewer to Jas. Healy, of Morgan Park, Ill., for $8,500.

Allentown, Pa.—The City Council has passed ordinances making appropriations for the 12 storm water sewers authorized by the $100,000 loan.

Utica, N. Y.—City Engr. Paul Louis Schultze estimates the cost of constructing a trunk sewer from the Mohawk River to the intersection of Clinton and Erie Sts., at $12,500.

Springfield, O.—As directed by the Board of Public Affairs, City Engr. W. H. Sieverling has made a preliminary estimate of the cost of improving the sewerage system. The proposed plans call for the construction of 2 trunk sewers connecting with 2 intercepting sewers, with lateral sewers in every dedicated street in the city, in all about 46 miles of sewers, estimated to cost $615,000.

South Bethlehem, Pa.—A vote will be taken at the coming election on the proposition to issue $100,000 bonds for sewerage purposes.

Indiana, Pa.—A proposition is under consideration for the issue of $25,000 bonds for main sewers.

Milwaukee, Wis.—The contract for section 8 of the 30th St. tunnel sewer has been let to James O'Donnell, of Milwaukee, at $25.50 per ft. for the 1,590 ft. of sewer.

Dayton, O.—The contract for constructing Main St. storm sewer, to be built from Third St. to the river, has been awarded to William Rehling at his bid of $4,954, the lowest price on pipe.

Blackwood, N. J.—The Almshouse and Asylum Committees of the Board of Chosen Freeholders have under consideration plans for a sewerage system for the county buildings.

Niles, O.—It is stated that bids are wanted Oct. 21 for constructing sewers as follows: 150 cu. yds. rock excavation; 2,680 cu. yds. earth excavation; 110 cu. yds. masonry, and 1,876 ft. of 6, 10, 15 and 24-in. pipe sewer. Wm. Wilson, City Engr.

Ottawa, Ont.—It is stated that bids are wanted Oct. 16 for constructing pipe sewers in Somerset and Pine Sts. Newton J. Ker, City Engr.

Montclair, N. J.—It is stated that bids are wanted Oct. 14 for constructing an 8-in. pipe sewer in Grove St. Harry Trippett, Town Clk.

Harrisburg, Pa.—City Engineer Cowden is said to be preparing plans for two new sewers to be constructed in the upper end of the city.

Plymouth, Pa.—An ordinance has been passed by the Borough Council authorizing the issue of $30,000 bonds for the construction of a system of sewers and street paving. Wm. Walters, Boro. Pres. A vote of the people is to be taken Nov. 5 on said bond issue.

Geneva, O.—The Village Council has under consideration the proposition to construct a sewerage system.

Niagara Falls, N. Y.—The Common Council has authorized the issue of $115,000 sewer bonds, $92,000 of which will be issued for the extension of the trunk sewer from Sugar St. to 22d St.

Washington, D. C.—The District Commissioners have ordered that a trunk sewer be constructed along Connecticut Ave., northwest from Rock Creek to Cathedral Ave., at an estimated cost of $14,710.

Croswell, Mich.—Press reports state that a sewerage system is to be constructed this fall.

Long Island City, N. Y.—Bids are wanted Oct. 23 (change of date) for a sewer in Broadway, in the Boro. of Queens; also the erection of a disposal plant in connection with same. Jas. Kane, Commr. of Sewers, N. Y. City.

Springfield, Mo.—A bill has been passed ordering the construction of sewers in district No. 16 of section No. 2 of the sewer system of Springfield.

Owatonna, Minn.—Bids will be received Oct. 15 for constructing sewers in several streets. Lyman B. Warren, City Recorder.

Sag Harbor, L. I., N. Y.—The question of constructing sewers is again being agitated.

Newberry, S. C.—The Commissioners of Public Works will, on Oct. 24, elect an engineer to make surveys, plans and specifications, and supervise the construction of a sewer system for the city. W. S. Langford, City Clk.

Albany, N. Y.—The Common Council has passed an ordinance providing for the construction of a vitrified stoneware pipe sewer under the west side of Broadway between Steuben and Columbia Sts.

Lockport, N. Y.—City Engr. Julius F. Frehsee writes that the contract for Lock St. and Richmond Ave. drain has been awarded to C. N. Slainthorpe & Co., 126 Main St., for $13,990. The work includes 3,369 ft. of 10 to 18-in. pipe in 7½ to 11-ft. cut., 10 manholes and 107 branches.

Denver, Colo.—B. M. Hughes, Jr., Sec'y of Board of Public Works, writes that contracts have been awarded as follows for constructing sewers in four sub-districts: To J. M. O'Rourke Const. Co., Sub-Dist. 16, for $4,321; Waldo & Cramer, Sub-Dist. 17, for $6,435; Waldo & Cramer, Sub-Dist. 24, for $12,201; Hugh Murphy, Sub-Dist. 23, for $7,175.

Jersey City, N. J.—C. A. VanKeuren, Ch. Engr. of the Board of St. & Water Commrs., writes that the following bids were opened Oct. 8 for the construction of a sewer in Newkirk St., Baldwin Ave. and Academy St.: P. J. Connolly, 97% of the engineer's estimate; M. T. Connolly, 96%; A. A. Van Winkle, 90%; Henry Byrne, Jersey City, 78%; E. P. O'Neill, 96%. The engineer's estimate on the principal items being as follows: 2,430 ft. of 36-in. cast iron sewer at $6 per lin ft.; 810 ft. 30-in. circular brick sewer at $2.75 per lin. ft.; 212 ft. 24-in. circular brick sewer at $2.25; 3 special steel connections, each $150; 18 ⅛-in. bends, each $55; 2,120 cu. yds. of rock excavation at $2.50; 40,000 ft. B. M. capping at $32 per M. ft.; 40,000 ft. B. M. flooring at $28 per M. ft.; 9 receiving basins, $85 each; 6 automatic air valves, $75 each. Work to be completed in 250 working days.

The lowest bid received for the construction of a sewer in McAdoo Ave. was from E. W. Conlon, of Jersey City, at 77% of the engineer's estimate, which was as follows on the principal items: 1,480 ft. of 24-in. brick sewer at $2.25 per ft.; 800 ft. 36-in. brick sewer at $3; 1,500 cu. yds. rock excavation at $2.50 per cu. yd.; 7 receiving basins at $85 each. Work to be completed in 130 working days.

Boston, Mass.—Bids were opened Sept. 27 by the Metropolitan Water & Sewerage Board for building 9 sections of the High Level Sewer in Quincy and Milton. Bids for Section 52 were as follows: A, H. P. Nawn, Boston, Mass., $199,486; B, Beckwith & Quackenbush, Herkimer, N. Y., $189,989; C, Thos. F. Moore, Syracuse, N. Y., $188,562; D, Met. Contracting Co., Boston, Mass., $175,763; E, Nat'l Contracting Co., New York, N. Y., $167,376 (awarded). For detail bids see accompanying table.

Detail bids for Section 52, Met. Sewerage Works.

Items and Quantities.	A	B	C	D	E
Earth excav. in trench, 132 x 147-in. sewer, 2,567 ft.	$24.00	$25.13	$24.21	$16.35	$12.50
Rock or earth excav. in tunnel, 132 x 147-in. sewer, 207 ft.	54.00	60.00	55.75	48.25	38.40
Brick masonry:					
Amer. in tr'nch, 300 c. y.	12.50	11.80	11.50	12.50	13.45
Amer. in tun'l, 100 c. y.	14.00	13.30	15.00	14.70	14.40
Port. in trn'ch, 3,500 c.y.	13.50	12.80	12.50	13.50	13.45
Port. in tunnel, 300 c. y.	18.00	14.30	16.00	15.75	14.40
Concrete masonry:					
Amer. in tr'nch, 500 c. y.	5.00	4.50	4.75	4.65	4.55
Amer. in tun'l, 100 c. y.	7.00	5.50	7.00	5.75	5.30
Port. in tr'nch, 3,000 c. y.	6.00	5.50	6.00	5.45	5.10
Port. in tunnel, 300 c. y.	8.00	6.50	8.00	6.70	5.75
Spruce lum., 10 M. ft. B.M.	30.00	35.00	40.00	35.00	24.00
Rock excav. in trench, 15,000 cu. yds.	3.00	2.50	2.50	3.00	3.36

Bids for Section 47 were as follows: Bidders: A, Jones & Meehan, Boston; B, Metropolitan Contracting Co.; C, Bruno Salomone & Petitti, East Boston; D, National Contracting Co.; E, H. P. Nawn; F, Beckwith & Quackenbush; G, Latta & Terry Co., Philadelphia, Pa.; H, C. G. Belden & Co., Quincy, Mass. (awarded).

Bidders.	Earth excav. in tr'ch and emb'k, sewer 135 x 150", 3,162 lin. ft.	Br. mas. in trench & embank.		Con. mas. in trench & embank.		Spruce lumber in tr'ch & emb'k, 10 M. ft. B. M.	Total.
		Amer., 500 cu. yds.	Portl'nd, 3,500 cu. yds.	Amer., 500 cu. yds.	Portl'nd, 5,000 cu. yds.		
A	$21.00	$14.00	$15.00	$5.00	$6.50	$40.00	$161,302
B	14.00	13.25	14.25	5.00	5.80	35.00	132,618
C	12.60	12.50	13.85	5.50	6.50	40.00	130,216
D	13.45	13.92	13.92	4.55	5.10	24.00	126,224
E	10.80	12.00	13.00	4.00	6.50	30.00	120,450
F	11.50	11.80	12.80	4.50	5.50	35.00	117,163
G	7.70	12.85	13.25	4.00	4.60	30.00	102,147
H	7.94	10.67	11.47	3.52	4.63	30.00	95,796

Bids for Section 59 were as follows: Bidders: A, Jones & Meehan; B, National Cont. Co.; C, E. W. Everson & Co., Providence; D, Metropolitan Cont. Co.; E, Bruno, Salomone & Co.; F, H. P. Nawn, Boston (awarded); G, Latta & Terry Co.; H, J. W. Bustin, Syracuse, N. Y.

Bidders.	Earth excav., 127 x 139" sewer, 2,568 lin. ft.	Brick masonry.		Concrete masonry.		Spruce lumber in trench, 10 M. ft. B. M.	Total.
		Amer., 900 cu. yds.	Port., 3,000 cu. yds.	Amer., 300 cu. yds.	Port., 3,000 cu. yds.		
A	$17.00	$14.00	$15.00	$5.00	$6.50	$40.00	$122,656
B	16.32	13.45	13.45	4.55	5.10	24.00	111,270
C	13.50	12.00	14.00	4.50	6.00	30.00	107,118
D	13.35	12.75	13.75	4.85	5.65	35.00	105,763
E	11.50	12.50	13.50	5.50	6.50	40.00	102,832
F	12.00	12.00	13.00	4.00	6.00	30.00	100,116
G	8.90	12.70	13.00	4.10	4.70	30.00	88,915
H	8.00	11.65	12.75	4.10	4.90	25.00	85,459

The contract for Section 50 has been awarded to C. G. Belden & Co., of Quincy, Mass., as follows: Earth excavation and refilling in trench and embankment, 135 x 150 in. sewer, 3,070 lin. ft., $7.34; brick masonry, in trench and embankment—American, 500 cu. yds., $10.67; Portland, 3,500 cu. yds., $11.47; concrete masonry, in trench and embankment—American, 1,000 cu. yds., $3.52; Portland, 4,500 cu. yds., $4.63; boulder concrete masonry, Portland in trench and embankment, 400 cu. yds., $3.75; spruce lumber in trench, 10 M. ft. B. M.,, $30; total, $94,169.

The contract for Section 53 has been awarded to the National Contracting Co., as follows: Earth excavation and refilling 132 x 147 in. sewer, 1,900 lin. ft., $12; brick masonry—American, 750 cu. yds., $13.45; Portland, 2,000 cu. yds., $13.45; concrete masonry—American, 500 cu. yds., $4.55; Portland, 2,000 cu. yds., $5.10; spruce lumber in trench, 10 M. ft. B. M., $24; rock excavation in trench, 7,500 cu. yds., $3.60; total, $99,502.

The contract for Section 54 has been awarded to the National Contracting Co., as follows: Earth excavation and refilling 132 x 147 in. sewer, 1,990 lin. ft., $14.40; brick masonry—American, 800 cu. yds.; $13.45; Portland, 2,200 cu. yds., $13.45; concrete masonry—American, 600 cu. yds., $4.55; Portland, 2,000 cu. yds., $5.10; spruce lumber in trench, 10 M. ft. B. M., $24; rock excavation in trench, 3,500 cu. yds., $3.36; total, $93,936.

The contract for Section 57 has been awarded to J. W. Bustin & Co., of Syracuse, N. Y., as follows: Earth excavation and refilling 127 x 139 in. sewer, 1,870 lin. ft., $7.50; brick masonry—American, 600 cu. yds., $11.65; Portland, 2,100 cu. yds., $12.75; concrete masonry—American, 800 cu. yds., $4; Portland, 1,600 cu. yds., $4.75; spruce lumber in trench, 10 M. ft. B. M., $25; total, $58,840.

The contract for Section 58 has been awarded to Latta & Terry Co., of Philadelphia, as follows: Earth excavation and refilling 127 x 139 in. sewer, 2,560 lin. ft., $6.70; brick masonry—American, 1,000 cu. yds., $12.45; Portland, 2,800 cu. yds., $12.90; concrete masonry—American, 1,000 cu. yds., $4.15; Portland, 2,300 cu. yds., $4.75; spruce lumber in trench, 10 M. ft. B. M., $30; total, $81,097.

The contract for Section 60 has been awarded to J. W. Bustin & Co., of Syracuse, as follows: Earth excavation and refilling 127 x 139 in. sewer, 1,609 lin. ft., $7.50; brick masonry—American, 800 cu. yds., $11.65; Portland, 1,700 cu. yds., $12.75; concrete masonry—American, 600 cu. yds., $4.10; Portland, 1,600 cu. yds., $4.80; spruce lumber in trench, 10 M. ft. B. M., $25; total, $53,452.

Washington, D. C.—Acting Supt. of Sewers O. L. Ingalls writes that the following bids were opened Oct. 5 for the construction of a portion of the Low Area Trunk Sewer: A, E. G. Gummel, Washington, D. C., $42,365; B, John Jacoby, Wilmington, Del., $47,669. Alternate section, A, $46,650; B, $50,126.

The detail bids for above work were as follows:

Bidders.	Excavation, 22,600 c. y.	Masonry. Port. cem. Red brick 150 c. y.	Vit. brick 170 c. y.	Concrete. A 550 c. y.	Concrete. B 415 c. y.	6-in. pipe under-drain, 3,000 ft.
A	$1.20	$16.00	$25.00	$8.50	$8.00	$.20
B	1.50	12.00	22.00	7.75	7.75	.25
Alternate section:	22,600 cu. yds.	710 cu. yds.	170 cu. yds.		415 cu. yds.	3,000 lin. ft.
A	$1.20	$16.00	$25.00	.....	$8.00	$.20
B	1.50	12.00	22.00	.....	7.75	.25

This work includes 3,000 ft. of 3½-ft. brick or concrete sewers and 7 manholes, the trench to average 40 ft. in depth (no rock excavation).

Plainfield, N. J.—City Surveyor Andrew J. Gavett writes that the contract for sewer construction, including 8,647 ft. of 8 to 12-in. pipe sewer, with 12 manholes and 2 flush manholes, has been awarded to Patrick T. Plunkett, of Jersey City, as follows: 44 cts., 50 cts. and 57 cts. for 8, 10 and 12-in. pipe, respectively; $33 for junction manholes; $30 for plain manholes; 50 cts., 60 cts. and 70 cts. for 8, 10 and 12-in. branches, respectively; lampholes, $7; flush manholes, $45; 4-in. house conections, 35 cts.; total, $5,333. The trench is expected to average 7 ft. in depth and be excavated in gravel and hard pan.

Brooklyn, N. Y.—The following bids were opened Oct. 9 by Jas. Kane, Commr. of Sewers, N. Y. City, for the construction of sewers in 72d and 73d Sts., and outlet sewers in 6th, 8th and 7th Aves.:

	Brick Sewer.					Vitrified Pipe.							
	54-in. 590 lin. ft.	45-in. 670 lin. ft.	42-in. 270 lin. ft.	36-in. 560 lin. ft.	30-in. 855 lin. ft	18-in. 250 lin. ft.	15-in. 400 lin. ft.	12-in. 2,300 lin. ft.	Man-holes, 52	Rec. ba-sins, 5	Plkg. 25 M ft.	Sheetg. 150 M ft.	Total.
John J. Creem.....	$6.00	$5.50	$4.00	$3.50	$3.25	$3.00	$2.00	$1.25	$30	$100	$17	$17	$23,254
John Hann.........	4.76	5.50	4.50	3.75	3.50	2.50	1.55	1.30	30	85	17	17	22,071
P. F. Brennan......	7.00	7.00	6.50	5.50	5.00	3.00	1.70	1.70	45	100	..	..	26,180
*J. H. Holmes & Co.	5.50	5.25	4.00	3.25	2.75	2.25	2.50	1.09	27	100	20	19	21,387
N. Y. Sew. Con. Co.	6.00	5.90	5.00	4.25	3.90	2.90	1.65	1.32	55	100	15	14	24,914

*371 No. Sixth St., Brooklyn.

Cleveland, O.—The following bids were opened Oct. 8 by the Board of Public Works for the construction of Taylor St. sewer:

Items and Quantities.	Christ & Burkhardt.	John Polk & Co.	W. J. Townsend.	Boers & Doolittle.	A. F. Helm.	Cook & Ferguson.	Jno. Wagner.	Reaugh Cons. Co.
Excavation, 10,000 cu. yds........................	$.57	$.70	$.60	$.59	$.78	$.45	$.70	$.65
Shale brick masonry, first quality Portland cement mortar, 620 cu. yds....................	8.05	9.35	9.00	7.32	8.50	9.00	8.50	8.50
2d quality Port. cem. mor., 1,150 cu. yds..	7.55	8.70	8.70	6.75	7.65	7.75	8.00	8.00
Clay brick masonry, second quality Portland cement in haunches, 1,000 cu. yds............	6.95	7.50	7.60	5.90	6.48	7.05	7.00	7.50
Oak grillage, 71,000 ft., B. M.....................	18.00	20.00	20.00	18.60	24.00	18.00	15.00	20.00
Cast iron in M. H. caps and covers, 3,800 lbs.	.03	.02	.03	.03	.03	.04	.03	.04
Wrought iron in manhole steps, 900 lbs........	.03	.05	.04	.03	.03½	.10	.04	.04
6-in. standpipe, 300 lin. ft........................	.35	.20	.20	.12	.30	.20	.40	1.00
12-in. catch-basin pipe, laid, 100 lin. ft........	.60	.60	.60	.75	.10	.50	.75	1.00
House sewer connections, 70....................	7.00	5.00	5.00	5.60	8.00	6.00	8.00	8.00
Catch basin connections, 6.......................	10.00	5.00	6.00	9.60	25.00	20.00	10.00	15.00
12-in. junctions, 12................................	.75	.70	.50	.75	.60	.75	.75	1.00
6-in. junctions, 200................................	.25	.25	.25	.30	.25	.20	.30	.50
Plank and timber in trench, 320,000 ft., B. M.	15.00	14.00	14.00	13.25	14.00	15.50	14.00	14.00
Common stone pavement relaid, 2,000 sq. ft..	.05	.10	.04	.04	.12	.05	.03	.05
Com. stone pavt. furn. & relaid, 750 sq. ft....	.15	.28	.13	.09	.30	.10	.10	.15
Block stone pavt. relaid & tar filled, 300 sq. ft.	.20	.30	.10	.13	.16	.25	.05	.30
Total	$33,589	$37,381	$36,005	$30,619	$36,057	$33,472	$35,199	$36,023

BRIDGES.

Borden, N. Y.—The Town Board is considering the construction of an iron bridge.

Lenox, Mass.—The Selectmen have been instructed to secure estimates of the cost of constructing a bridge across Housatonic River, which is to be constructed, jointly, by Berkshire St. Ry. Co. and the Town.

San Juan, Porto Rico.—Press reports state that bids received by the Board of Public Works for constructing a concrete masonry bridge across Marvilla River, at the entrance to Corozal, have been rejected, and that plans will be prepared for a smaller bridge and new bids asked.

Chadds Ford, Pa.—The County Commissioners contemplate repairing the Twin Bridges across the Brandywine, a short distance from Chadds Ford.

Peoria, Ill.—Alderman Jobst, the Mayor and the Finance Committee have been appointed as a committee to construct a bridge at Bridge St., which will replace present structure.

Oskaloosa, Ia.—A committee has been appointed to consider the construction of a viaduct at 7th St.

Buffalo, N. Y.—The construction of a bridge at Stevenson St., probable cost $5,240, is contemplated.

Stockton, Cal.—County Surveyor Quail has been directed to prepare plans for a steel bridge, to cost about $10,000, which will replace McMullin Lake structure.

Altoona, Pa.—The Board of Trade is considering the construction of a bridge or subway at 11th St.

Two Rivers, Wis.—The City Council and the officials of the Chicago & Northwestern R. R. have petitioned the Government to permit the construction of a railroad bridge across West Twin River.

Rhinelander, Wis.—Bonds amounting to $6.000 are to be issued for the purpose of constructing the Davenport bridge.

Wilmerding, Pa.—Permission has been granted to the East McKeesport St. Ry. Co. to construct a viaduct from Middle Ave. to Station St.

South Park, Wash.—It is stated that plans are being prepared for a bridge, to be about 500 ft. long, including approaches, which the Seattle Electric Co. will construct across the Duwamish River, at South Park.

Montpelier, Vt.—The City Council contemplates replacing the Rialto bridge with a steel structure.

San Saba, Tex.—County Clk. L. W. Rector writes that 3 bridges are to be built across Colorado River, by San Saba and Lampasas counties. Cost, $16,000. Bids for construction will probably be asked in November.

Rankin, Pa.—It is stated that plans are being prepared by the Monongahela Traction Co., for a $60,000 steel bridge which will connect Rankin, East Pittsburg and North Braddock. The contract for constructing same will soon be let.

Wellsville, O.—Local press reports state that surveys are being made for the proposed bridge to cross Ohio River.

Jersey City, N. J.—John P. Egan, Clk. of the Bd. of Chosen Freeholders of Hudson County, writes that the following bids were opened Oct. 7 for the reconstruction of Newark Ave. bridge: Berlin Construction Co., New York City, $31,900; American Bridge Co., New York City, $29,817; Joseph H. Cutley, Jersey City, $34,900; F. R. Long Co., Hackensack, N. J., $31,000.

Los Angeles, Cal.—A resolution has been adopted by the City Council instructing the City Engineer to prepare and submit estimates of the cost of building a wagon bridge at 4th St.; bridges at Aliso and Macy Sts., also for one at Pasadena Ave.

Freedom, Pa.—A charter has been asked by the Freedom & South Monaca Bridge Co., which intends to build a bridge across Ohio River, connecting Freedom and Monaca.

St. Paul, Minn.—Bids are wanted Oct. 15 for constructing the north abutment of bridge to cross the tracks of Northern Pacific Ry., at Rice St. Matt Jensen, City Clk.

Albany, N. Y.—Bids are wanted Oct. 16 for constructing a bridge across Cattaraugus Creek, at Versailles, on the Cattaraugus Indian Reservation; also for constructing a bridge across Erie Canal near Rexford Flats. John N. Partridge, Supt. Pub. Wks.

Helena, Mont.—The citizens in the vicinity of Bear Tooth Mountain are about to petition the County Commissioners to construct a bridge across Missouri River, near there.

Clinton, Ia.—Press reports state that the Chicago & Northwestern Ry. Co. is having plans prepared for a double-track railway bridge to cross Mississippi River at Clinton. W. C. Armstrong, Res. Engr., Boone.

Harwith, Ont.—It is stated that bids are wanted Oct. 25 for constructing a 3-span steel pile trestle bridge, 75 ft. long, across McGregor's Creek in Harwith Township. Geo. M. Baird, Township Clk.

Three Rivers, Ont.—It is stated that bids are wanted Oct. 21 for $125,000 bridge bonds. L. T. Desaulniers, Sec'y-Treas.

Topeka, Kan.—The Atchison, Topeka & Santa Fe Ry. Co. is stated to be considering the construction of a viaduct at Branner St.

Spartanburg, S. C.—It is stated that bids are wanted Oct. 24 for building approach spans to Burnt Factory bridge, across Tyger River. J. D. Leonard, Co. Supervisor.

Iron City, Tenn.—F. M. Cannon, Chmn. Bridge Com., Lawrenceburg, Tenn., writes that the contract for constructing a steel highway bridge over Shoal Creek, at Iron City, has been awarded to the Converse Bridge Co., of Chattanooga, for $6,900. The masonry, estimated at 300 cu. yds., has been awarded to W. J. Neely, at $4.50 per cu. yd.

PAVING AND ROADMAKING.

Toledo, O.—Bids are wanted Nov. 4 for paving Waite Ave. with block pavement on a 6-in. concrete or an 8-in. sand foundation, or with asphalt block on a 6-in. broken stone foundation, including grading, curbing, draining, etc. John E. Connell, City Clk.

Plymouth, Pa.—See "Sewerage and Sewage Disposal."

White Plains, N. Y.—Bids are wanted Oct. 15 for macadamizing, paving, grading, curbing and otherwise improving Cromwell Place. Henry B. Sutherland, Village Clk. pro tem.

Columbus, O.—Bids are wanted Oct. 15 for improving 19th St. by grading and paving the gutters, where not done, with brick or block, setting 5-in. curb and for repairing the gutters where paved with boulders. Bids will also be received the same day for improving Gay St., by grading and removing old asphalt surface, dressing up and reconstructing the concrete foundation where necessary, and constructing an asphalt pavement, setting a 5-in. curb and constructing necessary subdrains and catch basins. Clarence M. Addison, Clk. Bd. Pub. Wks.

Stark, N. Y.—Bids will be received by the County Commissioners at Herkimer, until Oct. 16, for constructing a road in Stark. Calvin Wagner, Highway Commr. of Stark, Vanhornesville.

Meadville, Pa.—Paving contracts have been awarded as follows: Walnut St. with Jamestown repressed block, to F. Robinson & Co., of Meadville, at $1.48 per sq. yd., total $5,584; Market St. with Mack brick to Jas. McAfee & Co., of Allegheny, at $1.53 per sq. yd., total $5,467.

Reno, Nev.—County Clk. W. A. Fogg writes that the contract for improving Commercial Row has been awarded to Fairchild & Gilmore, of San Francisco, at 90 cts. per ft. for granite curb and 25 cts. per sq. ft. for asphaltum paving, total amount of contract estimated at $15,000.

Syracuse, N. Y.—Plans and specifications have been adopted for the repair of asphalt pavement in a portion of West Onondaga St.; also for asphalt paving in portions of Lemon and Almond Sts.

Oyster Bay (L. I.), N. Y.—The Town Board and the Highway Commissioners on Oct. 3 adopted resolutions requesting the Board of Supervisors to issue $36,800 bonds for grading and graveling village highways for a distance of about 7 miles.

Pittsburg, Pa.—Allegheny County Commissioners have sold $550,000 road improvement bonds.

San Diego, Cal.—The Municipal Improvement Committee has recommended that steps be taken to issue bonds for the construction of a system of boulevards around the city.

Lowell, Mass.—The Committee on Streets has voted to recommend the paving with macadam of portions of Pleasant St., cost $5,000; Agawam St., cost $4,731, and Stevens St., cost $3,198.

Lyons, N. Y.—A vote will be taken Oct. 15 on the proposition to issue $30,000 bonds for street improvements.

Johnstown, N. Y.—The State Engineer has prepared plans and specifications for about 4 miles of macadam road to be built in Fulton County at an estimated cost of $11,000.

Niagara Falls, N. Y.—City Engineer Very has reported the final estimate of the cost of paving a portion of Cedar Ave., to be, exclusive of intersections, $10,144; intersection, $1,757; the cost of paving a portion of 7th St. is estimated at $7,223.

First St. is to be paved from Falls St. to Buffalo Ave. to a width of 35.84 ft., with first quality asphalt, at a maximum cost not to exceed $9,199.

Newburg, N. Y.—The Board of Public Works has decided to pave Broadway with Telford macadam, using vitrified brick between the trolley tracks and in the gutters.

Independence, Mo.—The contract for building 1½ miles of rock road on the Blue Springs, Woods' Chapel and Lee's Summit road has been awarded to George W. Shaw, of Kansas City, at $1.09½ per cu. ft.

Youngstown, O.—Bids are wanted Oct. 26 for the grading, draining and improving of Augusta St. C. E. Cross, Clk. Bd. City Commrs.

Lima, O.—Bids are wanted Oct. 18 for grading, draining, curbing and 8,000 sq. yds. brick paving on 2d St. W. R. Toy, City Engr.

Birmingham, Ala.—Local press reports state that bids will be received by the Mayor and Board of Aldermen until Oct. 15 for $50,000 street improvement bonds.

Kansas City, Mo.—It is stated that bids are wanted Oct. 17 for asphalt paving in 8 streets, brick paving in 6 streets, and for sidewalks in numerous streets as follows: Granitoid in 2 streets, natural stone in 3, and brick in 5 streets. Robt. W. Waddell, City Engr.

Milwaukee, Wis.—The contract for 4,645 sq. yds. of brick pavement on the gutters and cross-walks of Chestnut St. is stated to have been awarded to R. J. Hickey, at $1.49 per sq. yd.

Philadelphia, Pa.—Bids are wanted Oct. 22 for furnishing a quantity of paving blocks at the League Island Navy Yard. Address A. S. Kenny, Paymaster-Gen., Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.

Richmond, N. Y.—Bids are wanted Oct. 22 for regulating, grading and paving with macadam, in all about 44,470 sq. yds., and for 970 sq. yds. asphalt and 1,975 sq. yds. granite block pavement on numerous streets in the Boro. of Richmond. Jas. P. Keating, Commr. of Highways, N. Y. City.

Wellsville, O.—Bids are wanted Nov. 5 for improving Clark Ave., requiring about 5,000 cu. yds. excavation, 11,000 sq. yds. vitrified brick paving, 6,400 lin. ft. dressed curbing, and 190 lin. ft. curbing, 5 ft. radius; also for 6,632 sq. yds. brick paving on Liverpool St. J. W. McQueen, City Clk.

Louisville, Ky.—Local press reports state that the Board of Public Works will receive bids until Oct. 22 for the reconstruction, with asphalt, of Van Borries Ave. and parts of Beechwood, Hepburn, Castlewood and Lucia Aves. There will be 7,375 ft. of reconstruction, which will cost about $67,000.

Petersburg, Va.—About 4,400 sq. yds. of asphalt pavement is to be laid on W. Washington St.

Weehawken, N. J.—The Uvalde Asphalt Co., N. Y. City, is stated to have submitted the lowest bid for paving Hudson Ave., at $14,515.

Brooklyn, N. Y.—Resolutions have been adopted by the City Council providing for the paving with asphalt of Woodruff Ave., cost $17,000; also portions of Shepherd Ave., cost $12,000; Norwood Ave., cost $22,400, and Essex St., cost $13,000.

Washington, Ind.—Co. Clk. Thomas Harris writes that on Oct. 8 it was voted to construct 33 miles of gravel road in this township, at a cost of $2,350 per mile.

Woonsocket, R. I.—The contract for building a section of Manville Road, 4,000 lin. ft., has been awarded to Wm. L. Lane & Sons, Hingham, Mass., for $8,300.

Albany, N. Y.—The Board of Contract & Supply is reported to have awarded contracts as follows on Oct. 2: Riverside Park improvement to John Dyer, Jr., for $25,822; Sheridan Ave. with Johnsonburg brick, to Ed. F. Dillon, of Albany, for $8,659; and Robin St., with Metropolitan brick, to Wm. F. Doyle, for $6,573.

Columbus, O.—Local press reports state that the following bids (per sq. yd.) were opened Oct. 7 for resurfacing a portion of Town St. with asphalt: A. G. Pugh & Co., Columbus, $1.42; American Asphalt Co., $1.57; Barber Asphalt Paving Co., $1.53; Cleveland Trinidad Co., $1.31.

Buffalo, N. Y.—Local press reports state that the following bids were opened Oct. 4 for paving Marilla St.: Asphalt—Warner-Quinlan Co., $15,305; Henry P. Burgard, $14,750; Barber Asphalt Co., $14,447, and German Rock Asphalt & Cement Co., $14,447. The brick bids were Louis H. Gipp, $14,490, 4 bids to $14,840; Henry P. Burgard, $14,800; John Mumm and George W. Partridge, $14,449 each for Mumm fireclay block brick and Partridge round-edge fireclay.

Henry P. Burgard, of Buffalo, has received the contract to repave the Terrace with block stone and asphalt from Main to Seneca Sts. on both sides of the New York Central Cut, at $15,500.

Conneaut, O.—City Engr. Geo. B. Pike writes that paving contracts for which bids were opened Sept. 21 have been awarded as follows: Sandusky St., to V. D. Eichenlaub, of Erie, Pa., at 30 cts. per ft. for 5,000 ft. of straight curb, 60 cts. for 325 ft. of circular curb, 10 cts. for 200 ft. of curb redressed and reset, 10,320 yds. of Harper Norton block paving at $1.04 per yd. with Murphy grout filler, 1,850 cu. yds. of excavating and grading at 20 cts., pavement relaid at $1.70, new catch-basins, 4 at $28; catch-basins rebuilt, 4 at $22; 3,400 ft. of 10 to 18-in. sewer pipe at 35 to 66 cts. per ft.; manholes, 8 at $25.55; inlet basins, 30, each $11; iron pipe, 2 tons at $70, etc.; total, $15,703. Buffalo St., which calls for 10,770 yds. of paving, was also awarded to V. D. Eichenlaub at the same prices as Sandusky St.; total, $15,298.

Day St., to Frank M. Savage, of Chicago, Ill., at 36 cts. for 2,650 ft. of straight curb, 50 cts. for 76 ft. circular curb, and 8 cts. for 100 ft. of curb redressed and reset; 4,842 yds. of Harper Norton block paving at $1.20 per yd., with Murphy grout filler; excavating and grading, 2,000 cu. yds. at 20 cts.; manholes, 2 at $22 each; inlet catch-basins, 6 at $10, etc.; total, $7,784. Park Ave., which calls for 900 yds. of paving, was also awarded to Frank M. Savage at the same prices as Day St.; total, $1,528.

POWER PLANTS, GAS AND ELECTRICITY.

Fort Adams, R. I.—Bids are wanted Oct. 24 for installing electric lighting here, as advertised in The Engineering Record.

Brazil, Ind.—Bids are wanted Oct. 29 (extension of date) for lighting by electricity the streets, public places, etc., of the city, for a period of years, as advertised in The Engineering Record.

Milwaukee, Wis.—See "Street Cleaning and Garbage Disposal."

Logansport, Ind.—A 50-year franchise has been granted to the Logansport Flat Water Heating Co. Wm. E. H. Elliott, Pres., John C. Nelson, Vice-Pres. and Gen. Mgr.

Primghar, Ia.—See "Water."

Owen Sound, Ont.—The Owen Sound Electric Illuminating & Mfg. Co. is reported to have been authorized to construct and operate the necessary works for the production of heat, light and power.

Oakpark, Ill.—E. A. Cummings, of Chicago, is stated to have received a franchise to furnish light, heat and power at Oakpark, according to the Yaryan system. The company is capitalized at $300,000.

Lena, Ill.—S. S. Garvin, of Austin, Ill., is stated to have received a 25-year franchise for an electric light, heat and power plant.

Coshocton, O.—The Council is stated to have granted the Merchants' Electric Light Co. a franchise for a steam heating plant.

Charlestown, W. Va.—Howell & Taylor, Huyler Bldg., Washington, D. C., are the engineers for the Shenandoah Electric Light & Power Co., which proposes to develop the water power of Shenandoah River near Charlestown.

Berrien Springs, Mich.—Henry Kephart, Dir. of the Berrien Springs Water Power Co., writes that it is proposed to construct a dam at a probable cost of $350,000 to $500,000. Thompson, Tenney & Crawford, 35 Nassau St., N. Y. City, may be addressed for further information.

Washington, D. C.—Bids are wanted Oct. 19 for erecting at the Government Hospital for the Insane an electric unit. E. A. Hitchcock, Sec'y Dept. of Interior.

Portland, Ore.—The following bids were opened Oct. 2 at the Treasury Dept., Washington, D. C., for certain combination gas and electric fixtures, furnished and placed in the U. S. Custom House at Portland: Horn & Brennan Mfg. Co., Philadelphia, Pa., $5,650; W. C. Vosburg Mfg. Co., Brooklyn, N. Y., $7,095; Giese & Goodyear Co., Philadelphia, $4,262; Cassidy & Son Mfg. Co., New York, N. Y., $4,528; Morreau Gas Fixture Mfg. Co., Cleveland, O., $3,536; Mitchell-Vance Co., New York, $4,438; Portland Gas Co., $5,776.

Mansfield, La.—See "Water."

Knoxville, Tenn.—The Knoxville Electric Light & Power Co. is making improvements in its plant to cost about $30,000. C. C. Howell, Gen. Mgr., Knoxville, Tenn.

Poughkeepsie, N. Y.—The Poughkeepsie Light, Heat & Power Co. has been incorporated, with a capital of $500,000, to manufacture gas and electricity for light, heat and power purposes. Directors: Wm. B. Goodwin and others, of New York City, and L. Hollingsworth Wood and G. T. Kirby, of Mt. Kisco, N. Y.

Elmwood, Ill.—It is stated that the power house at Elmwood which furnished the power for the lights at Elmwood and Yates City, was burned Sept. 29.

Warren, O.—The Council is stated to have granted T. H. Gillmer and Wm. Wallace a franchise for a heating plant.

Mt. Gretna, Pa.—A charter is stated to have been granted to the Mt. Gretna Light, Heat & Power Co., of Mt. Gretna, with a capital of $5,000.

Salt Lake City, Utah.—A. L. Woodhouse, Gen. Supt. Utah Division Telluride Power Co., has petitioned the County Commissioners for a franchise to erect poles and wires and engage in the electric light and power business in West Mountain mining district.

Springfield, O.—The Horne Lighting, Power & Heating Co., of Springfield, has been incorporated, with a capital of $100,000. Incorporators: E. S. Kelly, J. E. Bowman and others.

Jasper, Ala.—See "Water."

Augusta, Ga.—Stewart Phinizy writes that he has just received a franchise and will receive estimates from engineers and contractors for gas and electrical apparatus of all kinds.

Wallace, Idaho.—F. J. Johnson, of Wallace, E. J. Dyer, Pres. Exchange Nat'l Bank, of Spokane, Wash., and others are stated to have purchased the plant of the Wallace Light & Water Co. It is reported that they will further develop the water power and extend the pipe lines.

Lockport, N. Y.—Local press reports state that plans have been completed for the new dam to be constructed at Burt, for the Lockport & Newfane Power and Water Co. It will be 50 ft. high and generate 3,000 H.-P. Contracts will probably be let in the early part of next year, and work will begin in the spring.

Versailles, O.—See "Water."

Binghamton, N. Y.—The Water Commissioners are stated to have decided to install an electric plant at the pumping station, to cost about $1,028.

Lodi, Cal.—L. A. Reniff, of Martinez, is reported interested in the construction of an electric light plant.

Spokane, Wash.—It is stated that the Washington State Marble Co. will construct a dam 150 ft. long and develop power to operate the plant.

Florence, Ala.—The Mayor and Board of Aldermen are stated to have granted a franchise to M. C. Buxbaum and associates for an electric light, power and heating plant and an electric street railway.

ELECTRIC RAILWAYS.

Pleasant Ridge, O.—Bids are wanted Oct. 15 for a franchise to construct and operate a street railway on the Montgomery road. J. B. Hayden, Village Clk.

Natchez, Miss.—A press report states that plans have been approved and contracts are about to be let for the construction of an electric railway, for the Natchez Electric St. Ry. Co.

Janesville, Wis.—The Council is stated to have granted a franchise to P. L. Spooner, of Madison.

St. Joseph, Mo.—The Commissioners of Buchanan County are stated to have granted a franchise to the Kansas City, Parkville & St. Joseph Electric Ry. Co.

Upper Sandusky, O.—The Council is stated to have granted two electric railway franchises, one to Otto C. Stutz to construct a line through this city, and the other to a company, headed by M. A. Smalley, for a line from Findlay to Marion.

Whittier, Cal.—Local press reports state that bids will be received by the City Council until Nov. 11 for an electric railway franchise.

New York, N. Y.—The contract for electrical equipment and substation apparatus of the Rapid Transit R. R. has been awarded by John B. McDonald to the Westinghouse Electric & Mfg. Co. The items included in this contract are 6 5,000-Kw. alternators, 3 250-Kw. exciters, 26 1,500-Kw. rotary converters, 78 550-Kw. transformers and 8 motor-generator starting sets.

Westfield, Mass.—The Woronoco St. Ry. Co. contemplates putting in new turnout and about 2,500 ft. of new track, very soon. Robt. P. Lee, Supt., Westfield.

East Sharon, Pa.—A charter is stated to have been granted to the East Sharon St. Ry. Co., to construct a railway 6 miles in length. Incorporators: Geo. Smith, M. E. Lally, and others.

Nacogdoches, Tex.—C. C. Galloway & Co. are stated to have petitioned the City Council for a franchise for an electric railway, which includes a belt line of the principal streets of the city.

Holyoke, Mass.—The Council is stated to have granted the Holyoke St. Ry. Co. a franchise to extend its line. W. S. Loomis, Pres. & Mgr., Holyoke

Perth Amboy, N. J.—Local press reports state that the Freeholders at a meeting in New Brunswick, Oct. 2, granted permission to the Raritan Traction Co. to cross the bridge about to be constructed over Woodbridge Creek, near Perth Amboy. W. G. Rock, Supt., Perth Amboy.

Walhalla, S. C.—A charter is stated to have been granted to the new Blue Ridge Ry. Co. This road at present runs from Anderson to Walhalla, a distance of 34 miles, and this charter gives it the right to build on from Walhalla to the Georgia line, a distance of 17 miles; capital, $100,000. Directors: Fairfax Harrison, of Washington, D. C.; B. L. Abney, of Columbia, S. C., and H. G. Beattie, of Greenville, S. C.

Greensburg, Pa.—It is stated that the Westmoreland Ry. Co. will shortly begin the construction of an auxiliary plant, with a capacity of 600 H.-P., on the site of the old line furnace, south of the town. C. L. Brinser, Supt., Greensburg.

Decorah, Ia.—H. E. Wells, of Preston, Minn., is reported interested in the construction of an electric railway from Decorah, Ia., to Chatfield, Minn.

Monrovia, Cal.—The Council is stated to have granted a franchise to W. A. Holabird, of Los Angeles.

Collinwood, O.—It is stated that the Big Consolidated Ry. will extend its line from Collinwood to Nottingham.

Canastota, N. Y.—The Village Trustees are stated to have granted a franchise to the Canastota & Morrisville Ry. Co.

Alexandria Bay, N. Y.—The State Board of R. R. Commissioners is stated to have granted the St. Lawrence International Electric R. R. & Land Co. permission to construct a road 7½ miles long between Alexandria Bay and Redwood.

Sidney, O.—Bids will be received until Oct. 28 for constructing and operating Street Railway Route No. 1 and Route No. 2. H. S. Ailes, City Clk.

Tiffin, O.—The Central Ohio Traction Co., of Tiffin, was incorporated Oct. 3, with a capital of $100,000, by W. F. Carr, S. H. Tolles, and others, all of Cleveland, to construct and operate an electric railroad between Tiffin and Freemont.

Los Angeles, Cal.—Local press reports state that C. W. Smith, of Los Angeles, Pres. Los Angeles & Pasadena Electric Ry., has applied to the Board of Co. Supervisors for a franchise to extend the line to Alhambra, and that bids for said franchise will be received by the Board until Nov. 5.

Conneaut, O.—The Conneaut St. Ry. Co. was incorporated Oct. 3 with a capital of $10,000, to construct and operate an electric railway in Conneaut and extending easterly along the Ridge Road to the Pennsylvania line. Incorporators: G. W. Brown, Geo. H. Cleveland and others.

Skaneateles, N. Y.—The Auburn Interurban Electric R. R. Co. is stated to have filed with the Secretary of State a certificate of extension of its line from Skaneateles to Marcellus, a distance of about 8 miles. R. A. Dyer, Jr., Supt., Auburn.

Wilmington, N. C.—The Wilmington Sea Coast R. R. Co. is reported to be considering the advisability of converting its line into an electric railway. R. Oscar Grant, Supt., Wilmington.

Pottsville, Pa.—The Pottsville & Suburban St. Ry. Co. is stated to have secured franchises through Yorkville, St. Clair and Norwegian townships.

Van Wert, O.—The County Commissioners are stated to have granted the Ft. Wayne, Van Wert, Delphos & Lima Traction Co. a right of way through Van Wert County.

Quincy, Ill.—Robt. W. Gardner, Geo. Wells and others, of Quincy, Ill., are stated to have applied for a charter to construct an electric railway from Rushville, Ill., through this city to Hardin, a distance of about 130 miles.

Homestead, Pa.—The Burgess is stated to have signed the ordinance granting a franchise to the Homestead & Mifflin St. Ry. Co.

Florence, Ala.—See "Power Plants, Gas and Electricity."

Springfield, O.—The Clark County Commissioners are stated to have granted John P. Martin a franchise from Springfield to the Green County line.

RAILROADS

Okolona, Miss.—A new company is being organized to construct a railroad from Okolona to Houston, Miss., a distance of about 18 miles.

Natchitoches, La.—The Police Jury and Progressive League have pledged the right of way through Rapides Parish, and the right to use the Grand Ecore Bridge over Red River at Natchitoches; also $7,500 and about 12 acres of ground in Natchitoches to J. D. Beardsley, Gen. Mgr. of the Louisiana & Northwestern R. R., now building from McNeil, Ark., to Natchitoches, providing said railroad be completed by Jan., 1903, and that the general offices and shops be established here.

Needles, Cal.—A press report states that a new railroad is to be built from Ibex north a distance of 60 miles, to Eldorado Canyon. The terminals will be Needles, Cal., and Eldorado Canyon, Nevada, with joint track service over the Santa Fe Pacific between Needles and Ibex. The new company will operate under the name of the Eldorado Ry. Co. Construction work will begin about Nov. 1. The yards and shops will be located at Needles.

Ashburn, Ga.—A charter has been granted to the Flint River Gulf R. R. Co., to construct a railroad from Ashburn, Ga., through the counties of Worth, Colquitt, Mitchell and Decatur to Bainbridge; capital, $500,000. Incorporators: J. S. Betts, J. S. Shingler, and others.

Chester, Pa.—The Council is stated to have adopted, finally, the ordinance and agreement with the Pennsylvania R. R. Co. for the elevation of its tracks through the city. W. H. Brown, Ch. Engr., Philadelphia.

Milwaukee, Wis.—A press report states that in the spring the Chicago, Milwaukee & St. Paul Ry. Co. will expend about $1,000,000 in rebuilding the northern division of its road in Wisconsin. In addition to this, it is proposed to construct a roundhouse at Wells, Mich., together with shops and accessories. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Summit, N. J.—Plans are stated to have been completed by the Lackawanna R. R. Co. for depressing its tracks from a point ½ mile east of Summit Station to the city limits, a distance of about 2 miles; estimated cost of construction, $546,140, including a $40,000 stone and brick depot. W. K. McFarlin, Ch. Engr., Hoboken.

Jefferson, City, Mo.—The Miller County R. R. Co., of Jefferson City, has been incorporated; capital, $50,000. Incorporators: Walter W. Taberner, Geo. H. Monahan and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Charlotte, N. C.—Bids are wanted by Wheeler, McMichael & Co., Archts., Charlotte, until Nov. 1, for erecting the Carnegie Library.

Akron, O.—Bids are wanted Nov. 7 for erecting a jail. Address, County Commissioners.

Ft. Wayne, Ind.—Bids are wanted Oct. 31 for erecting a public library. Allen Hamilton, Chmn. Bd. School Trus.

New Roads, La.—Bids are wanted Oct. 20 for erecting a Catholic church; cost not to exceed $10,000. F. Laroche, Pastor, St. Mary's.

Belview, Minn.—Bids are wanted Oct. 19 for erecting a village hall. Otto Goetze, Village Recorder.

Baltimore, Md.—Butler & Rodman, 16 E. 23d St., New York, N. Y., are stated to have completed plans for the Babcock Memorial Presbyterian Church to be erected on Madison and North Aves., to cost $50,000. Rev. John T. Stone, Pastor of Brown Memorial Church, is Chmn. Bldg. Com.

Springfield, Mass.—B. Hammett Seabury, 21 Besse Pl., has prepared plans for a $25,000 brick church to be built on No. Main St. by the St. James M. E. Society.

Ozark, Ala.—F. M. Dobson, of Jasper, is stated to have secured the contract to construct the Dale County court house, for $21,440.

Kansas City, Mo.—It is stated that plans have been prepared by J. G. Braecklein, Junction Bldg., for a synagogue for Keneseth Israel; estimated cost, $20,000.

Wabash, Ind.—John Hipskind & Son, of Wabash, are stated to have secured the contract for erecting the Carnegie Library, for $18,433.

Boston, Mass.—The Board of Aldermen is stated to have passed an ordinance providing for a loan of $50,000 for a bathhouse on Cabot St.

Chauncey, N. Y.—The Trustees of the N. Y. Juvenile Asylum, Amsterdam Ave. and 175th St., are stated to have purchased a site on Echo Hills, near Chauncey, and will erect an asylum there to accommodate 1,500.

Chicago, Ill.—Jas. Gamble Rogers, 1314 Ashland Blk., is stated to have prepared plans for a stone edifice for the Hyde Park Baptist Church, to be erected on Woodlawn Ave. and 56th St.; cost, $65,000.

Johnson City, Tenn.—Bids are wanted at the office of the National Home for Disabled Volunteer Soldiers, N. Y. Life Bldg., New York City, until Nov. 11., for constructing hospital buildings at the Mountain Branch of the Nat. Home for D. V. S., near Johnson City, Tenn., as advertised in The Engineering Record.

Austin, Tex.—O. J. Lorehn, Binz Bldg., Houston, is stated to have been selected to prepare plans for a $40,000 building for the Deaf and Dumb Institute.

Akron Pa.—Local press reports state that the County Commissioners, at Lancaster, will receive bids until Oct. 28 for $72,000 bonds; said bonds to be used to erect a stone jail in Akron.

Boston, Mass.—Kendall, Taylor & Stevens, 87 Milk St., are stated to have prepared plans for the Faulkner Hospital to be erected in Jamaica Plain, to cost about $100,000.

Nashua, N. H.—The contract for the foundations for Hillsboro County Court House has been awarded to C. W. Stevens, of Nashua. Contract for the superstructure will not be let until spring.

Atlanta, Ga.—The plans of J. H. Dinwiddie, Equitable Bldg., are stated to have been selected for the proposed $50,000 Central Congregational Church.

Greenville, Ga.—It is stated that bids are wanted Nov. 22 for erecting a court house. L. A. Allen, Chmn. Co. Commrs.

Covington, Ky.—Bids are wanted Oct. 16 for erecting a public library. Joseph L. Rhinock, Chmn. Library Trus.; M. Abele, Sec'y.

York, Pa.—Bids are wanted Oct. 22 for improving, enlarging and repairing the county jail. Chas. M. Motter, Clk. Co. Commrs.; J. A. Dempwolf, Archt., York.

St. Paul, Minn.—The contract for roofing and skylights for the State Capitol has been awarded to the Butler-Ryan Co., of St. Paul, for $87,300; the contract for complete mechanical equipment of said building has been awarded to W. I. Gray Co., of Minneapolis, for $321,664.

Contracts will soon be let for the fireproof floor construction of the Capitol.

BUSINESS BUILDINGS.

Kansas City, Mo.—A $20,000 brick warehouse is about to be built at 1317-1319 St. Louis Ave. Owner, Lucy H. F. Douglass.

W. W. Sylvester and A. E. Stillwell are reported to be making arrangements to erect a 16-story office building, estimated to cost $500,000.

Rochester, N. Y.—J. Mills Platt and Leon Stearn, Chamber of Commerce Bldg., have prepared plans for a $150,000 Masonic Temple, fireproof construction, to be erected at Clinton Ave. and Mortimer St. Contractors, H. H. Edgerton and F. L. Hughes.

Grand Rapids, Mich.—It is stated that Voigt, Herpolsheimer & Co., dry goods merchants, will erect an 8-story building on Monroe and Ottawa Sts.

Richmond, Ind.—John A. Hasecoster, 805 Main St., is stated to be preparing plans for a 2-story building 44 x 114 ft., for Robinson & Co. He is also preparing plans for a 2-story building 50 x 208 ft., for the Richmond Mfg. Co.

Homestead, Pa.—Leopold Vilsack is reported to have purchased a site for the erection of a $75,000 office building.

Boise, Idaho.—It is stated that the Western Trust & Guarantee Co. has purchased a site at 9th and Main Sts. for the erection of a 6-story building. B. F. Ogden and H. N. Coffin are reported to be members of the company.

Benton Harbor, Mich.—Plans are stated to have been accepted by the Pere-Marquette R. R., S. T. Crapo, Gen. Mgr., Detroit, and Big Four R. R., C. E. Schaff, Gen. Mgr., Cincinnati, O., for a union depot to be erected on the site of the present Pere-Marquette depot, to cost $40,000.

Richmond, Va.—The plans of Hodges & Leach, of Baltimore, Md., are stated to have been accepted for the $200,000 hotel to be erected here by Mrs. A. D. Atkinson, of the Lexington Hotel.

W. H. Zimmermann is stated to have under consideration plans for a hotel which he proposes erecting on the n. e. cor. 7th and Broad Sts.

St. Louis, Mo.—It is stated that Isaac S. Taylor, 318 N. 8th St., is about to prepare plans for a hotel, to cost about $1,500,000, to be erected near the World's Fair grounds by a Chicago Syndicate, of which W. S. Eden, of Chicago, is a member.

Springfield, O.—The Trustees of the Pythian Home are stated to have approved plans for a $45,000 administration building. Robert Love, Pres. Bd. Trus., Steubenville, O. W. C. Kershner, Sec'y, Dayton, O.

Birmingham, Ala.—The Title Guarantee Loan & Trust Co., of Birmingham, of which E. J. Smyer is Pres., is to erect a 7-story fireproof building on 3d Ave. and 21st St.

Los Angeles, Cal.—John Parkinson, Laughlin Bldg., has prepared plans for a 3-story brick business building, to be erected on Los Angeles St., between 2d and 3d Sts. Owner, E. S. Youmans, of Winona, Minn, C. B. Booth his attorney. Cost, $35,950.

Boston, Mass.—Plans prepared by Winslow & Bigelow, 3 Hamilton Pl., have been filed for an 11-story fireproof building, to be located on State, India, Central and Broad Sts., and to be occupied by the Board of Trade. Contractors, The Geo. A. Fuller Co., 27 State St.

New Haven, Conn.—L. W. Robinson, Exchange Bldg., has prepared plans for a $40,000 brick building for the City Missionary Association.

Ottawa, Kan.—It is stated that Wm. Stranchon, of the Indiana State Life Insurance Co., contemplates the erection of a $20,000 hotel.

Spokane, Wash.—A Masonic temple will be erected on Riverside Ave. and Jefferson St., to cost about $30,000.

Rock Island, Ill.—It is stated that the Tri-City Ry. Co. is planning the erection of a brick car barn, 150 x 300 ft.

Philadelphia, Pa.—The Frankford Real Estate, Trust & Safe Deposit Co. is stated to have commissioned Stearns & Castor, Stephen Girard Bldg., to prepare plans for its new home, to be erected on Frankford Ave. and Unity St. It will be granite, 25 ft. high, and measure 135 x 35 ft. John Crankshaw, Sec'y.

Denison, Tex.—It is stated that the Denison Hotel Co. will erect a $150,000 hotel. Frank E. Miller will be manager.

Philadelphia, Pa.—J. F. Stuckert & Son, 1421 Chestnut St., are reported to be preparing plans for a 4 or 6-story business building, to be erected on 9th and Filbert Sts., for Frank Hardart. They are also preparing plans for a 7-story factory 20 x 175 ft., to be erected in the rear of this structure.

The storage warehouses at 15th St. and Columbia Ave., owned by A. S. Leach & Co., are reported to have been destroyed by fire Oct. 3.

Denver, Colo.—F. E. Edbrooke, Opera House Blk., is stated to have prepared plans for a building to be used as a theater and business block. The new structure will be composed almost entirely of steel, iron and glass, brick being used only in the upper stories.

Chicago, Ill.—Treat & Adler are stated to have prepared plans for the first section of a clubhouse for the Ravisloe County Club at Homewood. The structure when completed will cost $50,000.

Holabird & Roche, 1618 Monadnock Bldg., have prepared plans for an 8-story pressed brick and stone front building to be erected at 191-197 S. Jefferson St., for W. L. De Wolf.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

114 to 122 Greenwich St, br office bldg; c, $200,000; o, Louis M. Bailey; a, Jardine, Kent & Jardine.

65th St & B'way, br office bldg; c, $65,000; o, John L Miller; a, Julius Munckwitz.

Brooklyn, N. Y.

Pennsylvania Ave & Fulton St, br store, offices and lodge room; c, $20,000; o, Tyrian lodge; a, Harde & Short.

De Kalk Ave & Steuben St, br factory; c, $32,000; o, Morris Bldg Co; a, W B Tubby & Bro.

DWELLINGS.

Kansas City, Mo.—Dr. O. P. Coats is about to build a $20,000 stone dwelling at Thompson St. and Gladstone Boulevard.

Winnipeg, Man.—Ernest Kennedy, of Minneapolis, Minn., is reported to have prepared plans for a 7-story apartment house which a Chicago syndicate, of which H. Burkholder, of Chicago, Ill., is a member, is reported to be considering erecting on Smith and Ellice Sts., to cost about $200,000. J. H. Anderson, of Winnipeg, is also reported interested.

Jersey City, N. J.—Wm. H. Wolfe, 247 Ocean Ave., has prepared plans for an $18,000 apartment house, to be built on Crescent and Clinton Aves. Owner, L. T. Morrin.

Chicago, Ill.—Howard Shaw, 115 Dearborn St., is stated to have prepared plans for a residence to be built on Calumet Ave., near 21st St., for John B. Drake, Jr.; cost, $30,000.

J. F. & J. P. Doerr, 138 Washington St., have prepared plans for a 3-story apartment house, to be erected at 6030-6036 Greenwood Ave. for John Zulewski; cost, $30,000.

Frank Schoenfeldt, 1755 W. 12th St., is stated to have prepared plans for an apartment house to be erected on Oakley Boulevard and W. Adams St., to cost $20,000.

Albert Hecht, 163 Randolph St., has prepared plans for an apartment house which he will build on Michigan Ave. near 51st St.; cost, $26,000.

Another apartment house is stated to have been designed by Wm. F. Gubbins, 685 Ogden Ave., for D. Clohesy, to be erected on Ogden Ave. near Ridgeway; cost, $30,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

6 E 62d St, br dwellg; c, $75,000; o, Wm Halls Sons; a, Welch, Smith & Provot.

62 W 92d St, br and stone dwellg; c, $50,000; o, Benj E Jones; a, Brower & Gayle.

SCHOOLS.

Norton, Kan.—Bids are wanted Oct. 21 for erecting a brick and stone high school; also bids for steam heating and plumbing same. H. J. Milz, Clk.

South Salem, O.—Bids are wanted Oct. 15 for erecting the Salem Academy. W. J. Parrett, Chmn. Bldg. Com., Lyndon, Ross Co., O.

Stanwood, Ia.—Bids are wanted Oct. 18 for erecting a school. C. H. Haesemeyer, Sec'y.

Champaign, Ill.—V. Jobst & Sons, 517 N. Adams St., Peoria, are stated to have secured the contract to erect the new chemical laboratory for the University of Illinois, for $98,000.

Quincy, Mass.—An order has been introduced in the City Council for $55,000 with which to build and furnish a 12-room brick school in Ward 2. Albert H. Wright, Studio Bldg., Boston, is the architect.

Watertown, N. Y.—John Hardiman, of Watertown, is stated to have secured the contract to erect the high school, for $67,839.

St. Louis, Mo.—Mrs. Eliza A. How is reported to have given $100,000 to Washington University, St. Louis, to be used for the erection of a memorial to her father, the late Capt. Jas. B. Eads.

Princeton, N. J.—The Thompson-Starret Co., 51 Wall St., New York, N. Y., is stated to have secured the contract to erect a dormitory for Princeton University, for about $100,000.

Macon, Ga.—Alexander Blair, of Macon, is preparing plans for a $15,000 school.

Columbia, Mo.—The Executive Committee of the Curators of the Missouri State University, composed of Campbell Wells, of Platte City, Walter Williams, of Columbia, and others, are stated to have adopted plans for buildings at the University, which will cost about $195,000.

Cleveland, O.—Bids are wanted Oct. 28 for erecting a school on Willson Ave. Thos. H. Bell, School Dir.

Waxahachie, Tex.—The Building Committee appointed by the late Texas Synod of the Cumberland Presbyterian Church to arrange for the erection of the new Trinity University buildings here met in the office of Judge M. B. Templeton in this city on Oct. 2 and prepared an advertisement for plans, etc. About $50,000 will be expended on the main building.

Merrill, Wis.—Bids are wanted Oct. 18 for installing a ventilating, heating, plumbing, sewerage and electric lighting systems in the high school. B. J. Lambert, City Clk.; Van Ryn & De Gellcke, Archts., Milwaukee.

New York, N. Y.—Bids are wanted Oct. 21 for sanitary work at school No. 186, Boro. of Manhattan, and for sanitary work and gas fitting in school No. 129, Boro. of Brooklyn. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ.

West Newton, Mass.—It is stated that bids are wanted Oct. 15 for erecting a 16-room brick school at Newton Center. Geo. H. Elder, Commr. Pub. Bldgs.

Des Moines, Ia.—Chas. Weitz & Sons, 713 Mulberry St., are stated to have secured the contract to erect the west side high school, for $24,460.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids are wanted Oct. 18 for the removal of the snow and ice from the streets of the Bronx Boro., during the coming winter. P. E. Nagle, Commr. of Street Cleaning.

Boston, Mass.—The Committee on Public Improvements has passed the order for a loan of $140,000 for the removal of the garbage plant from Cow Pasture to one of the islands in the harbor, as recommended by Mayor Hart.

St. Louis, Mo.—The contract for reducing city garbage for a period of 3 years has been awarded to the St. Louis Sanitary Co. at $130,000 per year.

Lowell, Mass.—The Garbage Committee has voted to report in favor of purchasing a Smith cremator and appropriating $25,000 for same.

Milwaukee, Wis.—Bids are wanted Oct. 19 for furnishing and installing necessary machinery and appurtenances to operate the garbage crematory plant, and to light said plant by electricity. Chas. J. Poetsch, Commr. Pub. Wks.

Allentown, Pa.—The Mayor will reeceive bids until Oct. 16 for a lot of ½ to 10 acres in or near the city for a garbage crematory site.

Newark, N. J.—Bids will be received by the Committee on Public Markets of the Common Council until Oct. 14 for the removal of garbage, offal, refuse and waste matter, which shall accumulate in and about the grounds of the Centre Market and streets adjoining same; also removal of snow and ice therefrom, for a period of one year from Oct. 15, 1901. Wm. R. Swan, Clk. of Centre Market.

GOVERNMENT WORK.

Ft. Banks, Mass.—Bids are wanted Nov. 2 for erecting a guard house at Ft. Banks. Address, A. B. Putnam, Asst. Q. M., Winthrop, Mass.

Ft. Strong, Mass.—Bids are wanted Oct. 14 for furnishing material and constructing a water and sewer system at Ft. Strong. A. M. Palmer, Depot Q. M., 170 Summer St., Boston.

Philadelphia, Pa.—Bids are wanted Oct. 18 for erecting a 4-story brick fireproof storehouse at Schuylkill Arsenal, Philadelphia. Address, Col. John V. Furey, Asst. Q. M. Gen., U. S. A.

Creston, Ia.—The following bids were opened Oct. 3 at the Treasury Dept., Washington, D. C. for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post-Office at Creston: Geo. W. Corbett, Washington, D. C., $87,500; Angus & Grindele Co., Chicago, Ill., $101,000.

Portland, Ore.—See "Power Plants, Gas & Electricity."

Louisville, Ky.—The following bids were opened Sept. 30 at the office of the U. S. Engineer for building warehouse and power house: C. L. Cornwell, $18,330; Jacob Bornstein, $15,245; Jacob F. Meriwether, $15,699; J. P. Will Co., $15,853. Bidders all of Louisville.

Washington, D. C.—The Secretary of War has made an allotment of $100,000 for the purpose of preparing the military post at Washington Barracks for the use and occupation of the Army War College, the School of National Defence, and the Engineer School of Application.

Ft. Dade, Fla.—Bids are wanted Oct. 25 for a water system at Ft. Dade, to consist of 1 pump and boiler house, pumping machinery, wooden tank and trestle, distributing system and well system and suction pipes. C. L. J. Frohwitter, A. Q. M.

Altoona, Pa.—Bids are wanted Oct. 28 at the Treasury Dept., Washington, D. C., for the installation of a conduit and wiring system for the U. S. Court House and Post Office, Altoona, as advertised in The Engineering Record.

Ft. Adams, R. I.—See "Power Plants, Gas and Electricity."

Chicago, Ill.—The following bids were opened Oct. 7 at the Treasury Dept., Washington, D. C., for smoke preventing devices at the U. S. Temporary Post Office, Chicago: Hawley Down-Draft Furnace Co., Chicago, $4,650; Water Arch Furnace Co., Chicago, $3,000.

Inverness, Ga.—Bids are wanted Oct. 20 for a steam pump, boiler, pipe, etc., for the South Atlantic Quarantine Station, via Inverness. Address G. M. Corput, Asst. Surgeon, M. H. S., in command of station.

Altoona, Pa.—Bids are wanted Nov. 8 for furnishing the heating apparatus complete in place, for the U. S. Court House and Post Office building at Altoona. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

Ft. Mason, Cal.—Bids are wanted Oct. 17 for constructing (including plumbing, heating and electric wiring) of hospital at Ft. Mason. Address Capt. H. P. Howard, 14th Cav., Acting Ch. Q. M., San Francisco, Cal.

Ft. Washington, Md.—Bids are wanted Oct. 17 for installing plumbing in one double set of old officers' quarters at Ft. Washington. Abe S. Bickham, Capt. and Q. M., Alexandria, Va.

Ft. Greble, R. I.—Bids are wanted Oct. 18 for constructing, plumbing and electric wiring one double set non-commissioned officers' quarters at Ft. Greble. H. P. Young, Q. M., Newport, R. I.

Ft. Lincoln, N. Dak.—Bids are wanted Oct. 25 for constructing extensions to the water and sewer systems at Ft. Lincoln. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

Washington, D. C.—Bids are wanted Nov. 2 for constructing a basin and slips for housing torpedo vessels at the naval coal depot, Narragansett Bay, R. I. Estimated cost, $100,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept.

Ft. Monroe, Va.—Bids are wanted Nov. 4 for erecting a double barracks and guard house at Ft. Monroe. Address C. P. Townsley, Q. M.

San Francisco, Cal.—Bids are wanted Nov. 30 for constructing 2 brick and steel buildings at the Navy Yard, Mare Island, Cal. Appropriation, $146,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Mansfield, R. I.—Capt. E. F. Ladd, Constructing Quartermaster, New London, writes that the following bids for sinking a tubular well were opened Oct. 7: Prices per lin. ft., *a*, 1 to 200 ft.; *b*, 200 to 400 ft.; *c*, 400 to 600 ft.; *d*, 600 to 800 ft.: P. H. & J. Conlan, Newark, N. J., *a* $7, *b* $7.25, *c* $7.50, *d* $7.75; Nassau Construction Co., 367 Fulton St., Brooklyn, N. Y., *a* $20, *b* $5, *c* $5, *d* $5; Elisha Gregory, 60 Liberty St., New York, *a* $6.50, *b* $6.50, *c* $7, *d* $7.50; Artesian Well Supply Co., Providence, R. I., *a* $10, *b* $10, *c* $10, *d* $10.

MISCELLANEOUS.

Newman, Ill.—Bids are wanted Oct. 26 for the construction of 24,768 ft. of main open ditch, as advertised in The Engineering Record.

Jersey City, N. J.—Bids are wanted Oct. 22 for the partial improvement of city property known as the South Cove Grant. Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

St. Nicholas, Que.—It is stated that bids are wanted Oct. 21 for reconstructing part of a wharf at this place. Fred. Gelinas, Sec'y Dept. Pub. Wks., Ottawa, Ont.

Father Point, Que.—Bids are wanted Oct. 25 for constructing a pier at Father Point. Fred Gelinas, Secy. Dept. Pub. Wks., Ottawa, Ont.

New York, N. Y.—Bids are wanted for the removal of 70,000 cu. yds. of earth and rock from the block bounded by 134th and 135th Sts.; also the block between 135th and 136th Sts., and from the lots on the south side of 134th St., lying between Amsterdam Ave. and what was formerly known as Bloomingdale Road. Address James R. Hay, 71 B'way, City.

Watkins, N. Y.—Marson & Ryan, of Rochester, are stated to have received the contract for repairing the channel of Glen Creek, in the village of Watkins, for $4,913.

New York, N. Y.—The Department of Docks & Ferries has awarded contracts, for which bids were opened Oct. 4, as follows: Dredging North River, between the Battery and W. 159th St., to W. H. Beard Dredging Co., 13 William St., at 18.9 cts. per cu. yd.; preparing for and building a wooden pier, with appurtenances, at the foot of E. 5th St., East River, to Wm. H. Jenks, 130 Pearl St., for $29,823; furnishing granite stones for bulkhead or river wall, to Booth Bros. Hurricane Isle Granite Co., 207 B'way, at 74½ cts. Class I and 94½ cts. Class II per cu. ft.

NEW INDUSTRIAL PLANTS.

Bids will be received by the Crescent Brewing Co., Washington, Pa., until Oct. 20, for alterations, additions and new buildings, including a complete 35-ton ice machine and plant for the company. James Lyle, Mgr.

The Pittsburg, Pa., Stove & Range Co. will build an extensive plant at Beaver Falls, Pa. Plans have not been completed.

The Ohio Valley Clay Co., Steubenville, O., has let the contract for a 5-story, 145 x 66-ft. addition, to be equipped with a freight elevator, clay-conveying machinery, and a 50 to 75-H.-P. gas engine.

R. H. Blakely & Co., 17-19 S. Warren St., Trenton, N. J., will erect a 3-story, 40 x 165-ft. laundry building and install a 60-H.-P. return tubular boiler, a 50-H.-P. engine, and a lighting dynamo.

The Battle Creek, Mich., Flaked Food Co., Ltd., is erecting 60 x 120-ft. and 52 x 75-ft., 4-story buildings, and a 48 x 60-ft. power house. The power plant will probably include a 150-H.-P. engine and a boiler capacity of 200 to 300 H.-P.

The Kalamazoo, Mich., Stove Co. is building a 120 x 350-ft. plant. All machines, elevators and cupola blower will be run by electricity.

The Eaton, Cole & Burnham Co., Bridgeport, Conn., has purchased a large tract of land with dock property, and will erect at once a steel and brick foundry building, 400 x 150 ft., together with power plant and minor buildings. Contracts for the entire work have been let to Berlin Construction Company, of Berlin, Conn.

The Coatesville, Pa., Boiler Works have contracted for a 110 x 206-ft. addition to their plant, to be equipped with electric traveling cranes, hydraulic riveting machinery, flanging presses, etc.

F. E. Reed, Worcester, Mass., is putting in the foundation of a foundry to be built next year. Provision has been made for the power plant, excepting dynamo and motors.

The Warren Fdy. & Mch. Co., Phillipsburg, N. J., will erect a 208 x 52-ft. steel and brick machine shop, with a 130 x 21-ft. lean-to. A 10-ton electric traveling crane and several small swing cranes will be installed. The power plant is already provided for.

The Walker Engineering Co., Youngstown, O., will erect a new plant, to include a 150 x 80-ft. machine shop equipped with a 20-ton electric crane; an 80 x 120-ft. foundry equipped with an electric crane, and two 10-ton cupolas; a 60 x 80-ft. forge building equipped with two large steam hammers, and an office building 40 ft. square.

The Arion, Ia., Milling & Cereal Co. will erect a 250-bbl. mill and there will be an electric light plant in connection with it. Wilbur C. Clarke, secretary of the company, also writes that a steam brick plant will be started by a company now being organized.

Gilbert & Canfield, Walker, Minn., expect to erect a 90 x 40-ft. sawmill, having a daily capacity of about 100,000 ft., a 50 x 30-ft. engine and boiler house; also a 30 x 60-ft. planing mill with a 20 x 30-ft. boiler and engine room. A 500-light electric plant will be installed.

The Colvin Fdy. Co., 191 Globe St., Providence, R. I., has contracted for the erection of an extension to the foundry, a new office building and a pattern shop. The pattern shop will be equipped with an elevator and all the buildings will be lighted by electricity.

BUSINESS NOTES.

The Hocking Valley Railway Co. has recently placed in operation in its shops at Columbus a 135-H.-P. engine built by the Ball Engine Co., Erie, Pa., who have also recently shipped engines for electric lighting for beet-sugar factories at Saginaw and Bay City, Mich., and Loveland, Colo.

The Charles Millar & Son Co., Utica., has recently fitted up large show rooms at 127-9 Genesee St., in that city, in order to display to the best advantage and in a practical manner the plumbing goods which it handles. These range from a tooth-brush holder to a porcelain bathtub, and the exhibition is on a large scale, which makes it educational rather than directly commercial.

Nearly two years ago the Buffalo Forge Co. shipped an important mechanical induced draft plant to Japan for the Osaka Water-Works in that country. A recent letter has been sent to the company expressing the highest approval of the system, with a statement that the coal bills have been reduced 15 per cent. With some proposed improvement in handling the firing, the engineers predict that there will be a still further saving in the amount of fuel burned.

The Sprague Co. recently held its annual meeting and re-elected the following officers: John Markle, president; Edward C. Platt and Allan C. Bakewell, vice-presidents; Harry R. Swartz, secretary and treasurer.

The Robins Conveying Belt Co., 21 Park Row, New York, has been awarded a gold medal for its exhibit at the Pan-American Exposition. It included two full-size 20-in. conveyors with automatic self-reversing tripper in operation, and two quarter-scale operating belt conveyors with similar tripper.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Oct. 15.	Deer River, Minn	Oct. 12
Oct. 15.	Columbus, O	Oct. 12
Oct. 15.	Engine, Elysian, Minn	Oct. 12
Oct. 16.	Well, Winthrop, Minn	Oct. 12
Oct. 16.	Springfield, O	Oct. 5
	Adv., Eng. Record, Oct. 12.	
Oct. 17.	Tunnel, Newark N. J.	Oct. 5
	Adv., Eng. Record, Oct. 5, 12.	
Oct. 19.	Pipe, Washington, D. C	Oct. 12
Oct. 22.	Well, Farmington, Mo	Oct. 12
Oct. 22.	Merrillan, Wis	Oct. 5
	Adv., Eng. Record, Oct. 12.	
Oct. 24.	Chimney Cleveland, O	Oct. 5
Oct. 26.	Pumps, Washington, D. C	Oct. 5
	Adv., Eng Record, Oct. 5.	
Oct. 28.	Pipe, Atlantic City, N. J	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Oct. 28.	Fayette, Miss	Oct. 12
	Adv., Eng Record, Oct. 12.	
Oct. 30.	Pumping plant, Savannah, Ga	Oct. 12
	Adv. Eng. Record, Oct. 12.	
Nov. 1	Hazlehurst, Miss	Oct. 5
Nov. 1.	Greenwood, Miss	Sept. 21
	Adv., Eng. Record, Sept. 21 to Oct. 5.	
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
Nov. 12.	Grand Rapids, Mich	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Nov. —.	Farmersville, Tex	Oct. 12
Dec. 4.	Sale of pumping works, Chicago, Ill	Oct. 12
	Adv., Eng. Record, Oct. 12.	
	SEWERAGE AND SEWAGE DISPOSAL.	
Oct. 14.	St. Paul, Minn	Oct. 12
Oct. 14.	Montclair, N. J	Oct. 12
Oct. 15.	Owatonna, Minn	Oct. 12
Oct. 15.	Cincinnati, O	Oct. 5
Oct. 15.	Trenton, N. J	Oct. 12
Oct. 15.	Brazil, Ind	Oct. 12
Oct. 16.	Cleveland, O	Oct. 12
Oct. 16.	Logansport, Ind	Sept 14
Oct. 16.	Ridgefield, Conn	Oct. 5
	Adv., Eng. Record, Oct. 5.	
Oct. 16.	New York, N. Y	Oct. 5
Oct. 16.	Ottawa, Ont	Oct. 12
Oct. 17.	Xenia, O	Sept. 21
Oct. 21.	Santiago, Cuba	Sept. 14
	Adv., Eng. Record, Sept. 14 to Oct. 12.	
Oct. 21.	Niles, O	Oct. 12
Oct. 22.	Merrillan, Wis	Oct. 5
Oct. 23.	Havana, Cuba	June 29
	Adv., Eng. Record, June 29 to July 20, Oct. 12.	
Oct 23.	Long Island City, N. Y	Oct. 12
Oct. 24.	Rochester, Ind	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Oct. 26.	Youngstown, O	Oct. 12
Oct. 31.	New Philadelphia, O	Oct. 12
Nov. 1.	Greenwood, Miss	Sept. 21
	Adv., Eng. Record, Sept. 21 to Oct. 5.	
Nov. 4.	Burlington, Ia	Oct. 5
Nov. 8.	Hudson, N. Y	Oct. 12
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
———	Canon City, Colo	Sept. 28
	Adv., Eng. Record, Sept. 28 to Oct 12.	
	BRIDGES.	
Oct. 15.	St. Paul, Minn	Oct. 12
Oct. 16.	Albany, N. Y	Oct. 12
Oct. 18.	Cedar Rapids, Ia	Oct. 5
Oct. 21.	Victoria, B. C	Sept. 28
Oct. 22.	Michigan City, Ind	Oct 5
Oct. 23.	Kansas City, Mo	Oct. 5
Oct. 24.	Zanesville, O	Oct. 5
Oct. 24.	Spartanburg, S. C	Oct. 12
Oct. 25.	Harwith, Ont	Oct. 12
Nov. 1	Milwaukee, Wis	Sept. 5
Nov. 4	Kentland, Ind	Oct. 5
Nov. 5.	Princeton, Ind	Oct. 5
Feb 28.	Sidney, N. S. W	June 22
	Adv., Eng. Record, June 22 to July 13.	
Sept. '02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Oct. 15.	White Plains, N. Y	Oct. 12
Oct. 15.	Columbus, O	Oct. 12
Oct. 16.	Cleveland, O	Sept. 21
Oct. 16.	Stark, N. Y	Oct. 12
Oct. 17.	Kansas City, Mo	Oct. 12
Oct. 18.	Lima, O	Oct. 12
Oct. 18.	Williamsport, Ind	Oct. 5
Oct. 19.	Zanesville, O	Oct. 5
Oct. 21.	Cincinnati, O	Sept. 28
Oct. 22.	Philadelphia, Pa	Oct. 12
Oct. 22.	Huntington, Ind	Oct. 5
Oct. 22.	Richmond, N. Y	Oct. 12
Oct. 22.	Louisville, Ky.	Oct. 12
Oct. 23.	Havana, Cuba	June 29
	Adv., Eng. Record, June 29 to July 20. Oct. 12.	
Oct. 26.	Youngstown, O	Oct. 12
Nov. 4.	Toledo, O	Oct. 12
Nov. 4.	Roseburg, Ore	Sept. 21
Nov. 4.	Bloomfield, Ind	Oct. 5
Nov. 5.	Wellsville, O	Oct. 12
	POWER, GAS AND ELECTRICITY.	
Oct. 15.	Wilkesbarre, Pa	Oct. 5
Oct. 15.	Frankfort, N. Y	Oct. 5
Oct. 19.	Milwaukee, Wis	Oct. 12
Oct. 19.	Washington, D. C	Oct. 12
Oct. 22.	Merrillan, Wis	Oct. 5
	Adv., Eng. Record, Oct. 12.	
Oct. 24.	Newport, R. I	Oct. 5
Oct. 24.	Ft. Adams, R. I	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Oct. 26.	Power house on hospital grounds, Washington, D. C	Oct. 5
	Adv., Eng. Record, Oct. 5.	
Oct. 29.	Brazil, Ind	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Nov. 1.	Hazelhurst, Miss	Sept. 28
Nov. 1.	Burlington, Ia	Sept. 28
	Adv., Eng. Record, Sept. 28 to Oct. 12.	
Nov. 11.	El. light plant franchise, Yazoo, Miss	Sept. 14
	GOVERNMENT WORK.	
Oct. 14.	Ft. Strong, Mass	Oct. 12
Oct. 15.	Ft. Du Pont, Del	Sept. 28
Oct. 15.	Building, Washington, D. C	Sept. 28
Oct. 15.	Buildings, Indian Head, Md	Oct. 5
Oct. 16.	Electric elevator, Washington, D. C	Sept. 21
	Adv., Eng. Record, Sept. 21 to Oct 12.	
Oct. 16.	Bldg additions, etc., Jeffersonville, Ind.	Sept. 28
Oct. 17.	Ft. Washington, Md	Oct. 12
Oct. 17.	Ft. Mason, Cal	Oct. 12
Oct. 18.	Ft. Greble R. I	Oct. 12
Oct. 18.	Bldg., Philadelphia, Pa	Oct. 12
Oct 20.	Inverness, Ga	Oct. 12
Oct. 21.	Stockton, Cal	Sept. 14
	Adv., Eng. Record, Sept. 14, 21.	
Oct. 21.	Santiago, Cuba	Sept. 14
	Adv., Eng. Record, Sept. 14 to Oct. 12.	
Oct. 22.	Stockton, Cal	Sept. 21
	Adv., Eng. Record, Sept. 21, 28.	
Oct. 22.	Hospital, Morris, Minn	Sept. 28
Oct. 23.	Newport, R. I	Oct. 5
	Adv., Eng. Record, Oct. 5, 12.	
Oct. 24.	Governors Island, N. Y	Oct. 5
	Adv., Eng. Record, Oct. 5, 12.	
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	Adv., Eng. Record, Oct. 12.	
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Analysis of Stresses in the Brooklyn Bridge.

In the last issue of The Engineering Record some comments were made on the general features of the report of Messrs. Duryea and Mayer on the New York and Brooklyn bridge and on the administration and care of that structure, as revealed by the examination of those engineers. In the present article it is proposed to notice some of the more technical features of the report, the publication of which is finished in this issue.

Even a superficial examination of Appendices B, C and D, particularly the last, cannot fail to show that the examination of such plans and data as exist, and of the structure itself, was as thorough and accurate as the time and facilities at the command of the investigating engineers made possible. In considering the results of their scrutiny it is to be borne in mind that no complete and correct plans of this great structure are to be found in the bridge office, and furthermore, that portions of its structure as actually built are not in accordance with some partial plans found in that office. Under such circumstances, obviously, no such thing as a stress sheet was available to indicate just what sort of analytic treatment was originally given to the structure in its main portions. It is a remarkable fact that there has never been published any satisfactory paper or book on this subject. The work of the examiners was, therefore, to a large extent one of analytical and structural exploration.

Appendix D contains the great mass of computations which show the actual state of the structure with reference to its capacity, or incapacity, to perform its present duties. The analytical work in that appendix is very complete and searching for the main or river span of the bridge. Indeed, so far as known to this journal, this analysis is actually the first one of a complete and satisfactory character, in the light of present engineering knowledge, ever applied to the structure. The Brooklyn bridge does not belong to a pure type of stiffened suspension bridge. It is a suspension bridge with the cables stiffened by trusses throughout the central portion of the main span, but with the stiffening truss in its turn stiffened by stay cables throughout the remaining portions of the span. Even the most modern systems of stiffened suspension bridge analysis do not alone suffice for this case. Although these observations find their most important applications in the main span they apply equally to the two short spans.

Again, it was one of the prominent features of the original design that the large saddles on which the cables rest at the tops of the towers should move over the sets of rollers under them under variations of temperature and of moving loads. Through neglect of gross and inexcusable kind these rollers have been so blocked by rust and dirt and other debris that they have become fixed in position. This fixedness of the saddles radically changes the conditions under which the steel superstructure and cables are supposed to act, and subjects them, as well as the masonry towers, to stresses never contemplated in the design. Under high temperatures and with full moving load on the river span, and half the full moving load on the shore spans, this condition of things subjects the top of each tower to a heavy pull toward the river, and thus imposes a large bending movement, increasing downward, on the masonry. The greatest resulting compression from this bending is about 79,000 pounds per square foot, whereas if the bending resulting from the fixedness of the saddles were absent, the greatest compression would amount to less than 41,000 pounds per square foot. The higher of these values is much greater than would be used in any first-class design, but it is to be observed that it exists only on an indefinitely small area, even if the computations be accepted as accurate in their results, and that the intensity of pressure decreases at a rather rapid rate as the line of highest pressure is departed from. Under these circumstances this high pressure in the masonry need not be considered as proving immediate danger, although it is very undesirable.

The report presents a very reasonable treatment of the combined action of the stays and cable over the 430 feet of length adjacent to each tower in the main or river span. The stays are no necessary portion of a stiffened suspension system, and they are omitted in the best modern design, as they cannot act in harmony with the remainder of the structure. The investigating engineers have undoubtedly taken the best practicable treatment in their analysis, based on the fact that the deflection of the stiffening trusses at the lower ends of the stays must be essentially equal to that of the cables above them. The results of their computations are undoubtedly as nearly correct as any that can reasonably be desired, and they show no overstressing of the metal which need be a source of apprehension. The details at the lower extremities of the stays, however, are wretchedly faulty, in consequence of eccentric connections with the lower chords of the stiffening trusses. If the computed stresses should be realized in these details there would be most dangerous overstressing of metal. Fortunately in such cases there is frequently a distributed distortion of adjoining parts which reduces materially those computed stresses. How much that reduction would be in the present case cannot be predicted, but it is certainly not nearly enough to insure a safe condition. These eccentric details are sources of dangerous stresses, and no time should be lost in replacing them by others in every way satisfactory, which is neither difficult nor very expensive.

The central portion of the river span, 740 feet long, which the stays do not reach, forms a purely stiffened suspension system composed of the cables and stiffening trusses and it is so treated in the report. The assumption of points of contraflexture not far from the end of the longest stay, in addition to the sliding joint at the center of the span, is reasonable and is probably as close an assumption as could be made. No point of material criticism is found in this portion of the span, outside of the floor system, except the trunnion detail constituting the suspender connection with the lower chord of the truss. This has already been discussed in these pages, and, as previously stated, is too faulty and too much neglected to be permitted to remain in the structure.

The sliding joint in the stiffening trusses in the center of the span, which constitutes practically a pin joint as far as the computations are concerned, imposes a substantial approach to an angular bend in the cables, creating a computed maximum stress of 69,000 pounds per square inch in some of the wires of the cables. The authors of the report regard this as very serious, but it is probably involved in more uncertainty than any other part of the computations. It depends upon the tension in the wrapping wire of the cables and upon other rather uncertain elements. This value is certainly higher than it should be. It cannot be regarded as very dangerous, but some considerations indicate that the computed value is too low, and the studies made by Messrs. Duryea and Mayer since the report was written show that in other details, also, more elaborate analyses indicate the stresses are exceeding those mentioned in the report. This is an important matter, which would be a fruitful subject of discussion before an engineering society.

It seems from the language of the report that its authors do not, on the whole, regard the fixedness of the cables a very serious matter; indeed, that it has in some respects at least been an advantage under existing conditions. This is probably a fair and reasonable view of this feature of the case. The effect upon the cables at and in the vicinity of the saddles should not, however, be neglected. There is a very heavy friction between the cables and the saddles on which they rest, and the existing condition of fixedness cannot fail to bring upon those wires nearest the saddles heavy overstresses of tension, which may be approximately but not exactly computed. This is a point which should receive careful attention, for it would not be a matter of surprise to find the heaviest overstresses in the cables at those locations.

The chief remedies proposed, besides displacing bad details and strengthening the floor systems, are the substitution of thin steel sleeves for the wrapping wire at the center of the main span and the insertion of anchored bents at the ends of the stayed portions of the shore spans. In the main these latter propositions are well adapted to accomplish the desired purposes, but much further detail study, for which no opportunity has yet been available, is required before the exact statement of these proposed remedies can be made. Doubtless when the study of the subject is completed along the lines set forth in the report, some features of the proposed relief measures may need modification, while new ones may suggest themselves.

The investigating engineers have approached the work set before them with a far more complete recognition of the relation of the bridge to its duties and of the inspection and care required in its maintenance than has ever been exhibited by the officials in whose charge it has remained since its completion. The simple facts brought out by the report constitute what is probably the worst indictment for ignorance and neglect ever prepared against the authorized wards of a great engineering work.

The Steam Plant of the Fall Mountain Electric Light and Power Company.

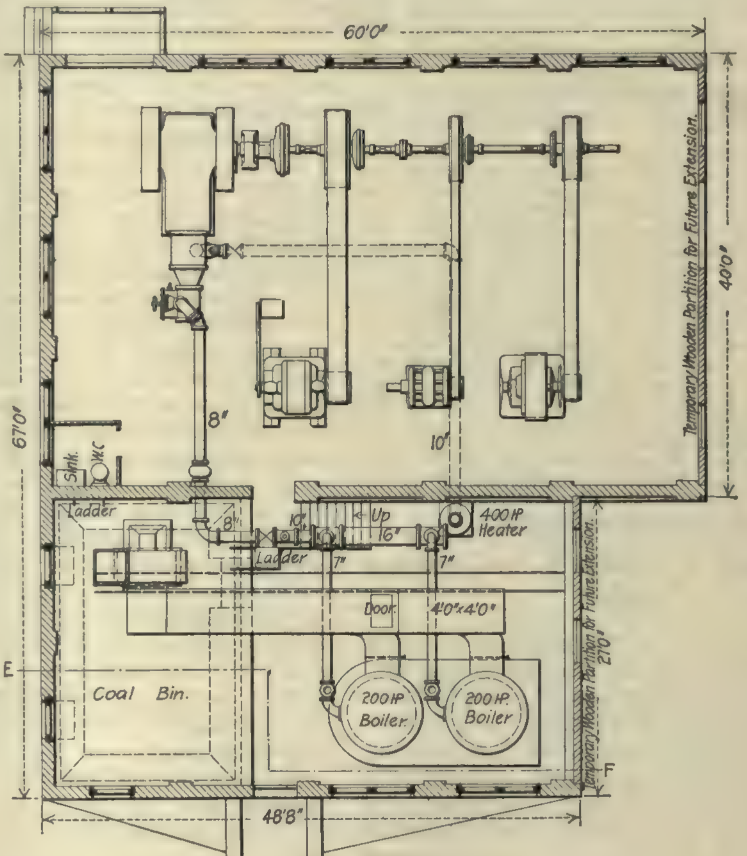
The plant of the Fall Mountain Electric Light & Power Company is situated at Bellows Falls, Vt., a town of about 4,000 inhabitants, located on the Connecticut River, which here forms the boundary between Vermont and New Hampshire. The original plant, which was established about 1890, was operated by water power, and furnished single-phase alternating current for incandescent lighting and motor service, and direct current for railway and arc lighting purposes. Under the increasing demands upon it, it became overloaded and it was decided to install a steam-driven auxiliary plant to act as a reserve except in case of low water, and to carry the extra load. The design of this plant was placed in the hands of Messrs. Hollis French and Allen Hubbard, consulting engineers, of Boston, Mass. Under their advice the existing single-phase plant was changed over to give three-phase current, the newly installed direct-current arc machines were retained, and the auxiliary plant was constructed. The latter is of 500 electrical horse-power capacity, and is capable of supplying power to any or all of the three systems. The boilers are of the vertical type, using induced draft. The arrangement, as shown by the ground plan, is very compact, and is capable of convenient extension.

The buildings comprise a 40 x 60-foot one-story brick structure, serving as an engine room, and a two-story brick ell measuring 27 x 48 feet, in which are the boilers and the coal bin. Both buildings have trussed wooden girders supporting flat roofs covered with tar and gravel, and the boiler room has in addition two galvanized iron monitors, one over each boiler.

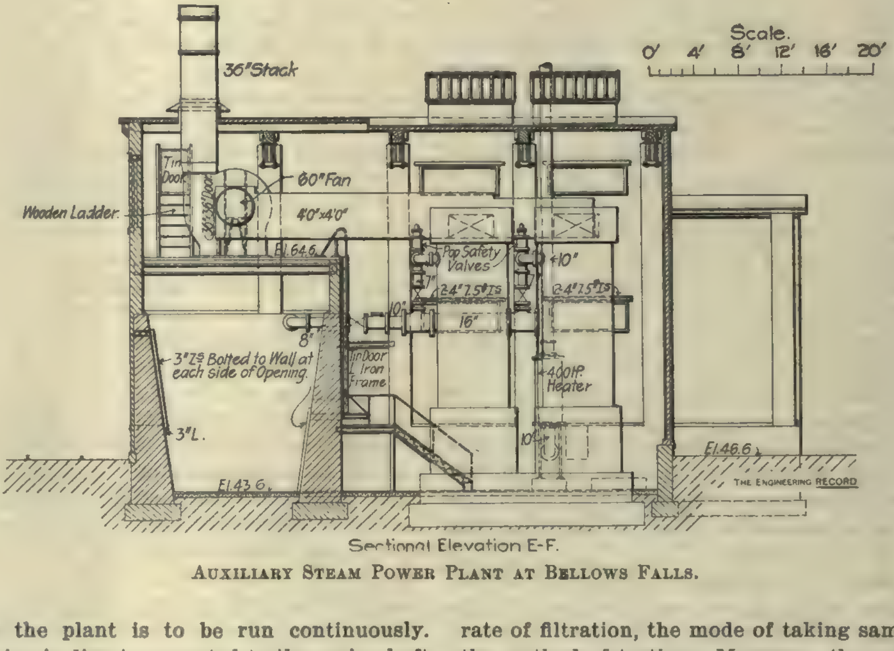
The coal comes in on a branch of the Boston & Maine Railroad, which passes near the power house, and it is stored in a rectangular coal bin of unusual construction. It measures about 16 x 24 feet inside and has concrete retaining walls 16 feet high. The coal is shovelled into the bin through two openings 3½ feet wide and 8 feet high in the longer side of the bin, which are closed by movable boards held in place by Z-bars built into the wall. The coal is brought into the fire room on a Hunt car which runs on a narrow-gauge track over weighing scales past the furnace doors. There are two Manning vertical boilers, of 200 rated horse-power each, generating steam at 125 pounds pressure and hand fired with soft coal. These boilers were made by Messrs. Bigelow & Company, of New Haven. Induced draft is used, the smoke flue from the boilers being connected to a 60-inch Sturtevant fan, driven by a separate engine. The fan discharges through a short stack leading up through the roof. In the boiler room there is also a 7½ x 4½ x 10-inch Knowles single acting feed pump, a 400-horse-power United States feed water heater, and a Hancock inspirator. The feed water is drawn from a tank over the coal bin, which is supplied with city water through a ball and cock valve. Provision has been made for the extension of the building to accommodate additional boilers, as may be seen on the right of the ground plan, this side of the building being of temporary frame construction. The same provision has been made for the extension of the engine room.

The main steam header is 16 inches in diameter, a 7-inch feeder from each boiler entering it from above. The branch to the engine is 8 inches in diameter, the 16-inch tee on the other end of the main header being blanked off to allow for future extension. The piping is all of steel, with screwed flanges, and the fittings are of extra-heavy cast iron. The steam passes through a Cochrane separator on its way to the throttle valve. The engine is of the tandem cross-compound type, built by Ball & Wood, and is designed to run either condensing or non-condensing. It is of 425 indicated horse-power at 225 revolutions per minute, and has cylinders 19 and 31 inches in diameter, and 18-inch stroke. The exhaust from the engine passes directly to the feed-water heater and thence to the atmosphere, but provision has been made for installing a condenser in case the plant is to be run continuously. The engine is direct-connected to the main shaft by a friction clutch, and the generators, of which there are three, are belted direct from the shaft, there being a quill and friction clutch for each one. The alternator is of 200 kilowatts capacity, at 2,300 volts, the railway generator of 75 kilowatts, and the arc light machine, which is of the Brush type, is of 120 lights capacity. All three were made by the General Electric Company.

The officers of the Fall Mountain Electric Light & Power Company are Mr. W. A. Russell, of Boston, president, and Mr. H. Bottomly, general manager.



Plan.



Sectional Elevation E-F.

Auxiliary Steam Power Plant at Bellows Falls.

The Bacterial Quality of the London Water Supply deteriorated in a marked manner between July 6 and 15, although the best water furnished by the various companies is generally delivered in the summer months. Professors William Crookes and James Dewar ascribe this abnormal development of microbes in the filtered water to some exceptional climatic conditions, for there was nothing unusual in the general rate of filtration, the mode of taking samples or the method of testing. Moreover, the raw river water was exceptionally good. The plants of all companies were affected, which makes it improbable that every one was simultaneously using defective filters or filtering at an excessive rate. No pathogenic bacteria or bacilli coli communis were discovered, but undoubtedly liquefying organisms were occasionally present, and minute bacteria such as do not usually occur among ordinary river microbes. The last time a similar unexplained bacterial outbreak occurred was during the severe winter of 1894-5.

The Northport Bridge.

The Northport bridge is a single-track combination Pratt-truss structure carrying the Columbia & Red Mountain Railway across the Columbia River at Northport, Wash. It has a total length of 2,100 feet, including three channel spans of 250 feet each, three side spans of 150 feet each, and a timber trestle approach. It crosses the Columbia in a flat valley where at low-water stage the river has a width of less than 700 feet and a depth of about 13 feet, high water being 25 feet deeper.

All of the piers have pile foundations. Those of the long spans are surmounted with timber grillages and had their submerged masonry built on them in timber coffer dams which were left in place for permanent protections after construction. These piers have a height of about 64 feet above low water, and for this portion of their height are of concrete cased with a riveted steel shell. Those for the short spans each consist of two separate steel-sheathed concrete cylinders about 6 feet in diameter, braced together above the surface of the ground with solid stiffened web plates and united at the top by a plate girder floorbeam. This intersects the steel cylinder plates and projects inside the pier to take bearing on the masonry without depending on any connections with the shell.

The steel shells of the large piers are 5 x 23 feet on top and 10 x 32 feet 8 inches on the bottom, with rounded ends. The upstream end is battered 7 feet 2 inches and is reinforced by a 48 x ¼-inch cutwater-plate riveted on the whole height of the center line. The shell has a height of 61 feet and is battered 1:24 on the other three sides. It is built of 5-foot courses of ¼-inch steel plates, 4 feet wide on the upstream end and 5 feet wide elsewhere, with staggered vertical joints. The upper edge of each course is stiffened by an inside 3 x 3 x ¼-inch belt angle with its horizontal flange up, which is secured to the lapped joint of both courses of plates by ⅝-inch button-head bolts 6 inches apart. There are five ¾-inch transverse tie rods through the pier at each course, which pass through the belt angles and have nut bearings on the outside of the shell.

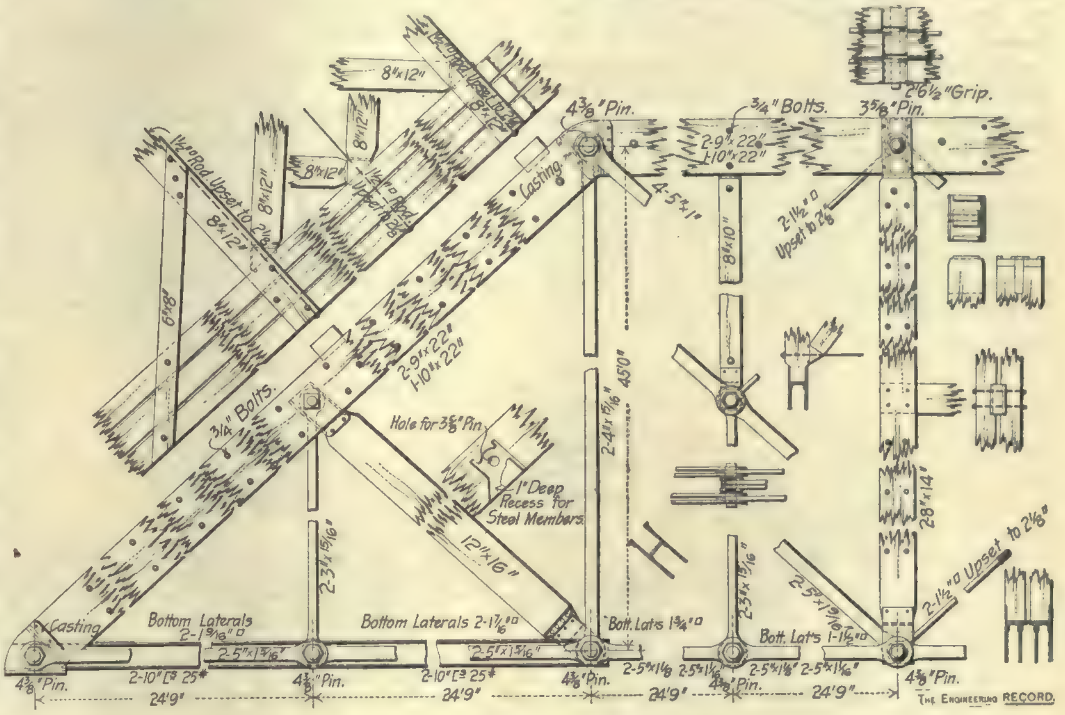
The piles in the trestle approaches and in the pier foundations were driven by an overhanging machine which consisted substantially of standard 40-foot leads mounted on a horizontal timber bed-frame 50 feet long, which was trussed in the form of an inverted king-post by a pair of vertical posts and inclined tension rods. The vertical posts were braced together with a horizontal sill, cap and knee-braces, and were secured to the bottom pieces by small tenons so that they could be shifted readily to correspond to different panel lengths. The hoisting engine was set at the rear extremity of the base and served as a counterweight, enabling the leads to be projected as much as 20 feet beyond the last finished bent. The machine was thus capable of use as a traveling derrick, and with it the trestle timber was handled and the steel lifted for the small piers.

The bridge was erected on fixed trestle falsework about 60 feet high from the low-water level to the top of the caps. In each bent there was a transverse row of six vertical piles, capped 19 feet above low water by a 12 x 12-inch timber 40 feet long, spliced on the center of one of the middle piles. The three piles on each side of the center line were X-braced above the water level with single 4 x 12-inch planks bolted on. A framed trestle with two vertical and two outside battered 10 x 12-inch posts was set on top of the pile cap, X-braced in two vertical panels with single 4 x 12-inch planks, and capped with a 12 x 12-inch timber 24 feet long.

Neither piles nor trestle posts were mortised or scabbed to the caps, but their joints were secured by ¾-inch bolts and by 10-inch ship spikes through overlapping ends of the diagonal bracing planks at these points. At each end of the trestle cap, directly above the top of the inclined post, there was a pair of 10 x 24-inch stringers separated 1 inch and having a 4 x 12-inch plank laid on top in the center to receive the traveler rail. The tops of the trestle bents were also connected by two lines of 12 x 12-inch longitudinal timbers and by a material track on pony bents in the center line. The panel points of the trusses were supported directly from the trestle caps and were wedged up to camber heights of 2 inches and 3½ inches for the 150-foot and the 250-foot spans, respectively.

After the first 250-foot span was swung three bents of the falsework were washed out, but the stringers and track rails remained connected together by their splices, forming a kind of suspension bridge across the gap. Afterward several more bents were washed out in this and the next span, but they were replaced and the erection completed without damage to the permanent structure.

The erection traveler was of the ordinary striding type and was composed entirely of timber except bolts, spikes and wheels. It had a 20 x 52-foot clearance, and was 40 feet wide, 62 feet high and 76 feet long over all. The outside posts battered upward 8 feet and the overhead transverse trusses were 9¼ feet deep. It differed from ordinary travelers in having four transverse bents connected together by the double sills with single 12-inch double-flange wheels under each post, by two lines of 7 x 9-inch and four lines of 8 x 12-inch timbers on top, and by two lines of double 4 x 12-inch planks at intermediate points of each of the four posts. The latter braces divided the sides of the traveler into three panels vertically, and each of these panels was X-braced with single 3 x 12-

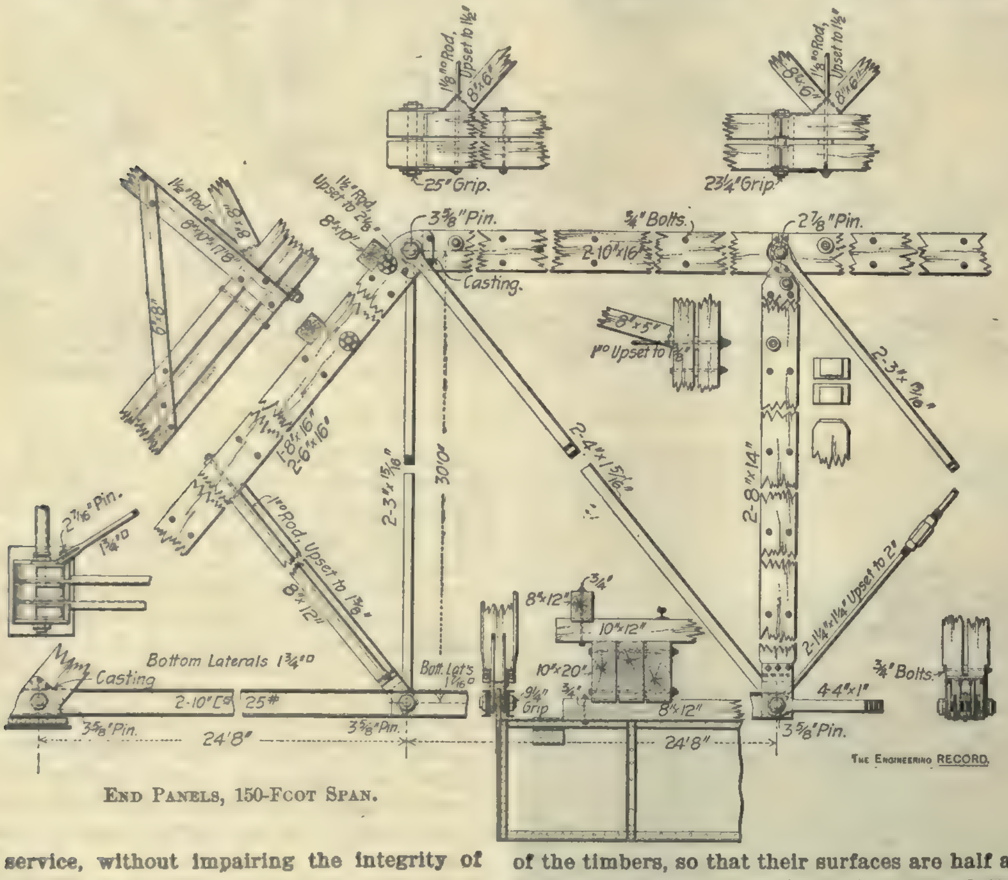


Details of the End Panels of the 250-Foot Span.

Combination Bridge at Northport.

inch planks in the panels between the end bents and the bents adjacent to them. The traveler thus virtually consisted of two towers and an unbraced center panel connected together by the longitudinal struts, a feature which enabled it to be easily separated in halves and each part used independently as a complete lighter traveler.

The main spans are built with steel tension members and floorbeams and wooden compression members and stringers; the top-chord connections are made with castings and pins and the top lateral systems are horizontal Howe trusses. The bottom lateral system is composed of the floorbeams and steel diagonal rods, and, in the long spans, the portals and sway-brace frames have crossed timber diagonal struts in the vertical transverse planes. Cast iron is used for the compression connections only, the lower ends of all the vertical posts being provided with riveted steel-pin bearings. Most of the wooden main truss members are bolted at both ends to the pin connections, and are made in two or more pieces for easy renewal while in service, without impairing the integrity of the bridge.



END PANELS, 150-FOOT SPAN.

The top-chord and end-post timbers are all fitted at each end to enter shallow sockets in the connection castings and take full end bearings on their webs, while they are secured transversely by short flanges 1 inch thick, which are let in flush with their surfaces and are extended on the outsides so as to make room for through bolts. The lower end of the end post engages a pedestal having its pin extended on the inside to receive a wing plate for the lateral diagonal attachment, and screwing into a 5-inch heavy pipe which serves as an end lateral strut. The end post is over 38 feet long, and is supported against undue flexure by an inclined strut in the middle, which bears at the upper end on a cast plate with ribs gained into the side of the end post. The lower end of this strut bears on a steel yoke connecting it to the lower-chord pin and having side flanges through which a pair of tension rods are put. These extend each side of the strut parallel with it and through the end post, and terminate on the upper side of it, where they take bearings on beveled washers; they have nuts at each end and are adjusted to bring initial pressure on the strut.

The portal consists of horizontal transverse struts, bolted across the face of the end posts, and diagonal X-brace timbers bearing against angle blocks on their inner faces. There are also two rods parallel to the horizontal struts which pass through the end posts and angle blocks and take bearing with nuts and washers on the outside, and two knee-braces bolted across the upper surfaces of the end posts and horizontal struts. The end-post timbers are spaced 1 inch apart, with cast-iron fillers, and are carefully recessed to receive the steel bars packed between them. The top-chord casting at each intermediate panel point consists virtually of a vertical transverse web ¾ inch thick, with side flanges to engage the chord ends, and a horizontal bottom web to receive the end of the vertical post. There is a vertical longitudinal flange on each end of these webs to receive the connection bolts, so that a horizontal section of the casting at any point is I-shaped and a vertical section is an inverted T. At each panel point there are two castings, one for each line of timbers, and they are let into the sides of the timbers, so that their surfaces are half an inch inside those of the chord pieces; the latter are recessed that amount so as to receive the diagonal bars snug against the surface of the castings.

There are twice as many panels in the top lateral system as there are in the main top-chord system connections, therefore one lateral truss panel point comes at each main connection and one midway between. The bearings of the vertical posts are not equal to their cross-sections and they are not bolted to the connection pieces at the top. At the bottom they are bolted to a riveted steel saddle-piece made of angles and plates with intermediate diaphragms and reinforcement angles. The floorbeams are suspended from the lower chord pins by end plates, and have timber cushions on their top flanges to receive the track stringers, each of which consists of three lines of 10 x 24-inch beams, each 24¾ feet long.

The 250-foot spans correspond in general construction to the 150-foot spans, but differ chiefly in having the trusses divided into sub-panels; in having double-web pin castings like rectangular tubes in the top chords, and in having deeper portals and sway-brace frames.

Mr. E. J. Roberts is the chief engineer of the Columbia & Red Mountain Railway, and the bridge was built and erected by the San Francisco Bridge Company, of which Mr. J. McMullen is president, Mr. H. Krusi chief engineer, and Mr. J. B. C. Lockwood, Seattle, Wash., assistant engineer.

The Septic Tank System at Glencoe, Ill.

About eighteen months ago Mr. Frank Winds, of Winnetka, Ill., was retained by the village of Glencoe to design a system of sewerage and sewage disposal. The plans he submitted for the treatment of the sewage provided for a septic tank, followed by filtration through eight primary and secondary beds. The bids on the work, as designed, exceeded the available funds of the village. The Cameron Septic Tank Company, of Chicago, of which Mr. H. D. Wyllie is general manager, then offered to put in a disposal plant on its own designs at a somewhat lower figure than the bids on the plant originally described, and its offer was accepted. The sewerage and sewage disposal systems are now in operation, and the following details of the latter are made public with the company's consent.

The works were designed to serve a population of 600, the maximum flow of sewage and storm water provided for being 25,000 gallons per day. They consist of one grit chamber, one septic tank and four high and four low-level aerating bacterial filters, all of which are built in concrete. They are located at the foot of a steep bluff on the shore of Lake Michigan.

The main outfall sewer discharges into the grit chamber, which is 6 feet long, 3 feet wide and 4 feet 9 inches deep. From this chamber two channels lead off to the tank, into which the sewage is delivered by two special inlet pipes about 3 feet below the springing.

The tank is 56 feet long, 10 feet wide and 6 feet 9 inches deep below the springing, and is covered with a concrete arch, over which a layer of soil is spread. Access to the tank is provided by two manholes, with sealing covers, but these are not intended to be opened except for the purpose of inspection.

In the tank the solids present in the sewage are separated and retained, and the organic matter is acted upon by the liquefying organisms present, by which it is broken down into simpler substances, capable of being dealt with by filtration. The effluent, thus largely freed from solids in suspension, passes off through a slotted cast-iron pipe, laid horizontally across the end of the tank 2 feet 3 inches below the springing, into the effluent collecting channel.

Any mineral detritus which may escape from the grit chamber, together with the insoluble residue from the sewage solids, accumulate slowly in the tank. A similar tank has been in use in Exeter, England, for over five years without such an accumulation of deposit as to require removal. It is therefore not expected that the deposit in the tank at Glencoe will need to be removed except at very long intervals. In order that this may be done when necessary without draining off the liquid contents, a slotted pipe is constructed across the end, at the bottom of the tank, from which a 6-inch pipe is led off to the cleansing well. By opening a valve in the latter, the deposit from the end of the tank may be drawn off. The deposit, which is banked against the end of the tank being thus removed, the remainder should be left until it in turn drifts forward.

The effluent chamber, 2 feet wide and 4 feet long, is constructed as shown in the illustrations, and the tank effluent passes therefrom by the main effluent carrier to the admission valve chambers of the filters.

The four high-level filters are each 17 feet

10½ inches long and 14 feet wide, the dimensions of the low-level filters being slightly greater to compensate for the area taken from them by the gear chamber. They are filled to a depth of 4 feet with furnace clinker, broken to pass through a half-inch screen and freed from dust.

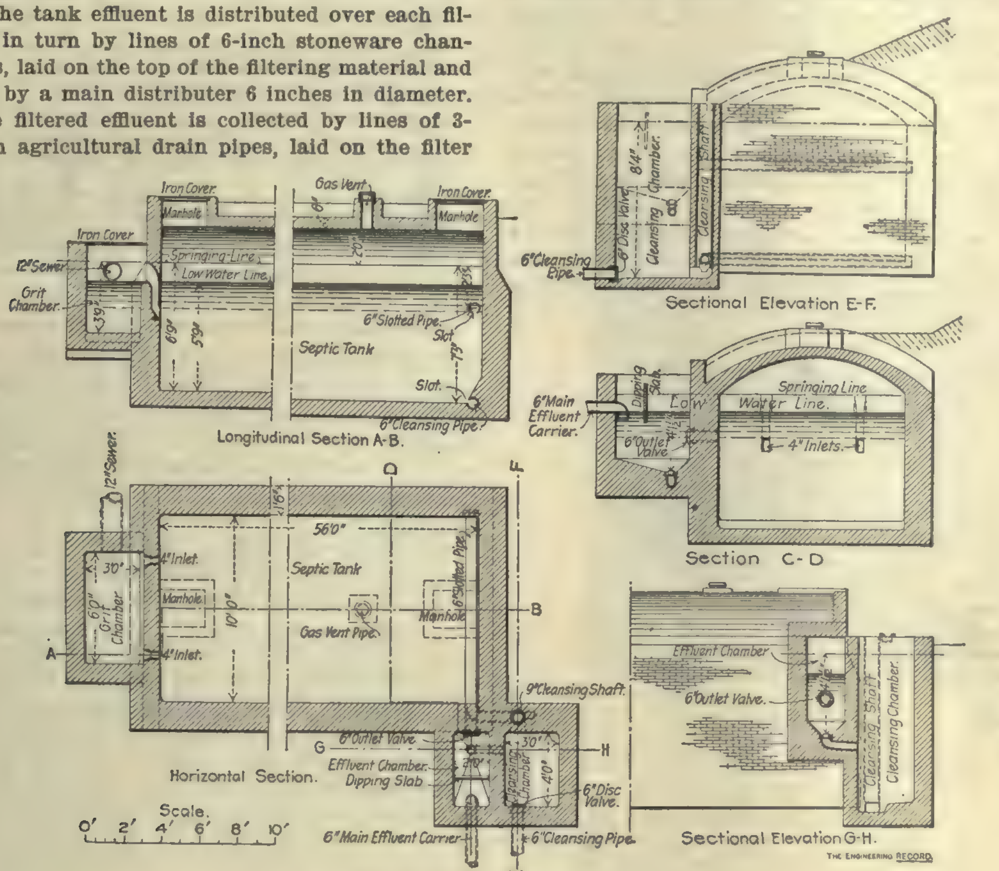
The tank effluent is distributed over each filter in turn by lines of 6-inch stoneware channels, laid on the top of the filtering material and fed by a main distributer 6 inches in diameter. The filtered effluent is collected by lines of 3-inch agricultural drain pipes, laid on the filter floor and discharging into a stoneware main collector 6 inches in diameter. The latter runs into a cast-iron discharge well, in the bottom of which the discharge valve is placed.

The high-level filters are filled one after the other, each in turn being kept full while the next is filling. The effluent discharged from each upper filter goes on to the lower filter immediately adjoining it, and the low-level discharge valves are connected to the shaft of the upper gear, so that all parts work together.

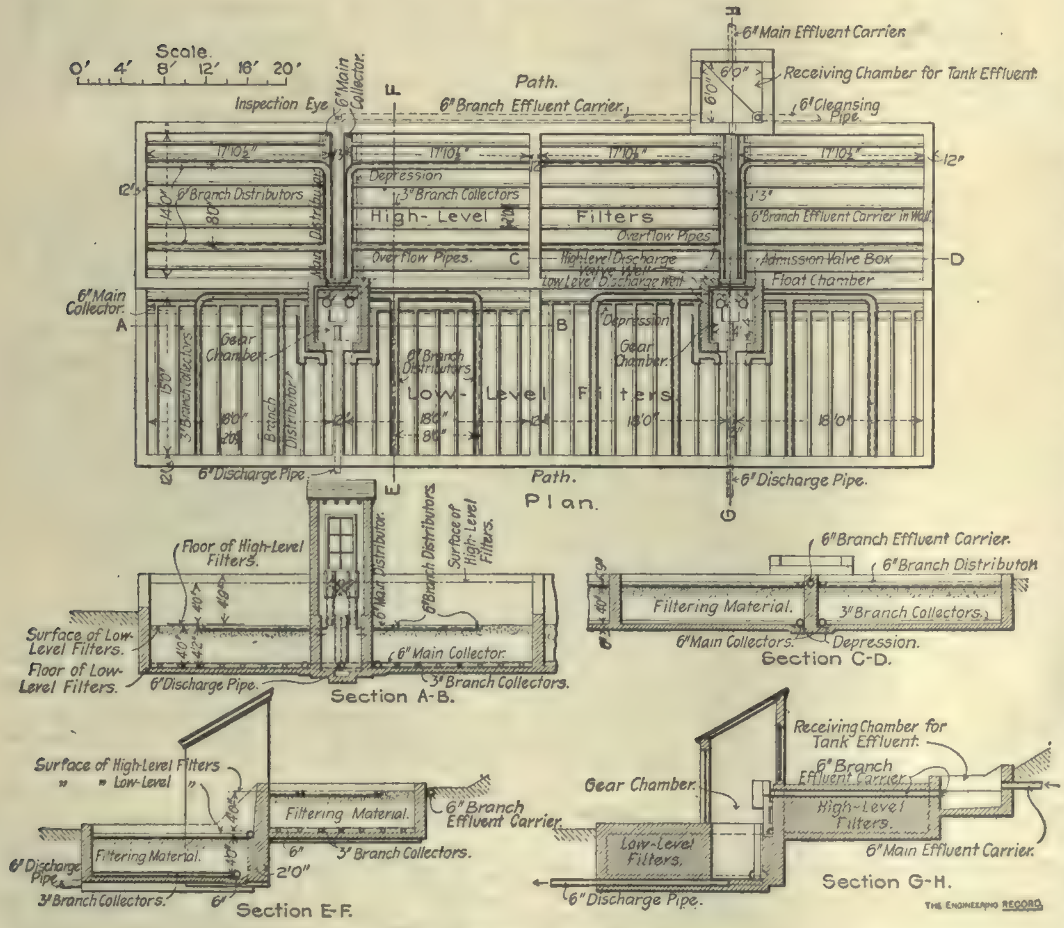
The effluent remains in the filter for a period of two to four hours. The discharge valve is then opened, and the filtered effluent escapes, drawing down after it a supply of air into the crevices of the filter. The latter drains and aerates while the remaining filters of the set are filling, after which it is again filled.

The filling and emptying of the filters is effected automatically by means of the alternating gear. As soon as a filter is filled, a small quantity of filtered effluent overflows from its discharge well into its actuating bucket, thereby causing the closing of its admission valve, and, after the proper interval has elapsed, the opening of its discharge valve, and the release of the contents of the filter.

An installation on similar lines has been at work at Exeter, England, for nearly five years, the only attention it has required having been to oil the bearings every few weeks and loosen the surface of the filters at long intervals, when these have become compacted.



The Glencoe Septic Tank.



The Glencoe Filter Beds.

The Tremont Church Roof, New York.

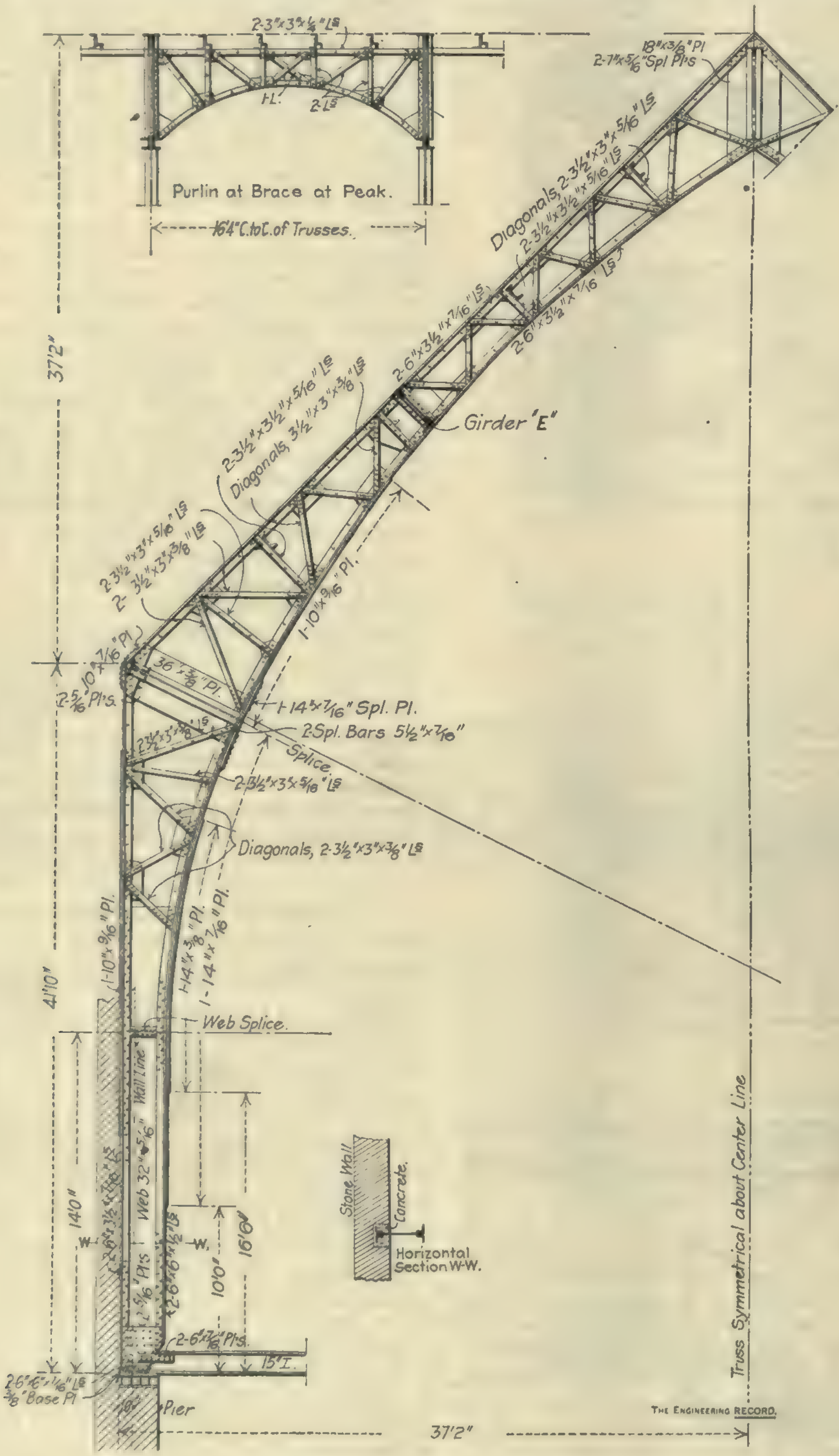
The 73 x 95-foot auditorium of the Roman Catholic church at Tremont, New York City, is over 80 feet high above the ground and is about 70 feet high from the floor to the center of the ceiling. It is unobstructed by columns and the slate roof has four main arch trusses of 74 feet 4 inches span from out to out, which are spaced 16 feet 4 inches apart on centers. The trusses themselves serve as rafters, having straight top chords with a rise of 37 feet 2 inches from eaves to peak. The curved bottom chords have a rise of about 50 feet above the springing line and are continued 20 feet below it in vertical tangents parallel to the vertical end posts; these are nearly 41 feet long and intersect the top chords at the eaves. The lower end of the vertical portion of the truss has an I-shape cross section and resembles a plate girder on end with its web in the transverse plane of the truss. The 32 x 5/16-inch web plate is 27½ feet long, is reinforced at the foot with double cover plates and has a pair of wide flange angles which are bolted to a planed cast-iron pedestal anchored to the masonry wall pier.

The truss is a hingeless arch, with the top and bottom chords spliced at the eaves by flange cover plates, and the web spliced with double cover plates and two vertical rows of rivets, at the crown. All of these splices are strengthened by the connections there of the longitudinal purlin-girders which are made with vertical angles riveted to the truss webs both sides of the splices. The trusses are about 7 feet deep at the crown, 7½ feet deep at the eaves and 2½ feet deep midway between these points. The lower chords support the furring and metal lath for the plaster ceiling which forms a Gothic arch and conceals the trusses. All the trusses are alike except one end truss which supports part of the transept roof and is a little heavier than the others, with materials as shown in the elevation. This truss carries on one side the ends of the longitudinal lattice girders, E-E, which are 31½ feet long and have two 6 x 3½ x 7/16-inch angles in each flange.

The other main trusses support 12-inch channel purlins in the lines of girders, E-E, and have their chord angles 1/16 inch thinner. All their diagonal members are made of pairs of 2 x 3½ x 5/16 and ⅜-inch angles, and they have 5/16-inch connection plates and ⅞-inch rivets throughout. The corners of the vertical ends of the trusses are cut off on the inside to clear the beveled ends of the 15-inch I-beam floor joists which rest with bearings 7½ inches long on the cast pedestals there, and are riveted at the opposite ends to the ½-inch web plates of a longitudinal floor girder in the center line of the building. The top flanges of these joists are spliced over the top chords of the longitudinal girder with which they are flush, by 7 x ½-inch plates with six rivets in each end, and thus are designed to serve as tension members connecting the ends of the arch trusses under the floor.

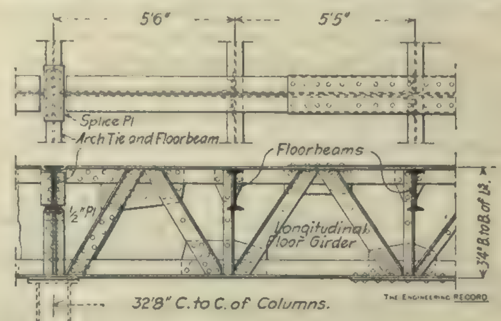
The longitudinal girder has a length of 96 feet 8 inches over all and is supported on the end walls and on two intermediate basement columns, over which it is continuous except that the top flange angles are cut there to clear the arch ties. The flanges are each composed of two 6 x 6 x ½-inch angles and a 13 x ⅜-inch cover plate, and the diagonal members are pairs of 6 x 3½ x ⅜-inch and 3 x 3½ x 5/16-inch angles. In each panel between the planes of the arch trusses there are two intermediate floor joists which are supported on the masonry at the walls and are riveted at the opposite ends to the outstanding flanges of pairs of 3½ x 3½ x 5/16-inch vertical angles in the longitudinal girder, but not spliced together across its top chord.

The trusses are united longitudinally by purlins 10 feet apart. At the peak and at the eaves these purlins are lattice girders with horizontal top chords and curved bottom chords, both made of pairs of 3 x 3 x ¼-inch angles, united by pairs of 3 x 2½ x ¼-inch diagonal and vertical angles, with 5/16-inch connection plates and ¾-inch rivets. At the peak the purlin trusses are in a vertical plane and at the eaves they are in the plane of the radius of the bottom chord. The intermediate purlins are 12-inch channels riveted to web angles of the trusses in planes normal to the top chords. The purlins support four 3 x 3 x ¼-inch Z-bar jack rafters in each panel between roof trusses. The top flanges of the jack rafters are in the planes of the flanges of the top chords of the arch trusses and their vertical webs are riveted to the webs of connection angles with their horizontal flanges riveted across the top flanges of the purlins. The vertical end sections of the arch trusses are set in chases about 12 inches wide and 10 inches deep in the wall masonry, which were filled solid with concrete after the trusses were set, thus reinforcing the thin plate webs of the slender column-like vertical sections of the trusses and bonding them in with the wall so that there is no need of transverse bracing there.



Half Sectional Elevation of Steel Roof.

The transept at one end of the building is 31½ feet wide and extends a little beyond the main side wall at one end. About 40 feet of the middle part of its roof is continuous with that of the rest of the auditorium and is supported by the gable wall, by a main arch truss and by a special parallel truss midway between them. This special truss corresponds exactly to the upper part of the main arch truss above and between girders E-E, and is supported at each end on the centers of girders E-E, which are riveted at one end to the main truss as shown in the elevation, and rest at the other end on the gable wall. The girders E-E also support at the center the ridge and valley rafters of the transept roof which intersects the main roof like a dormer.



Connection of Floor Beams to Center Girder.

The roof is proportioned for a dead load of 60 pounds and a live load of 50 pounds per square foot, and to resist a horizontal wind pressure of 30 pounds per square foot. The main arch trusses were received from the bridge shop in four sections each, with field splices at the peak and eaves. The vertical end sections were set up in place in the wall chases by boom derricks and lashed to the heavy stone walls. The middle sections were simultaneously raised in pairs by two gin poles which supported them until the splice joints were made and the purlins and longitudinal girders were connected to them.

Mr. John E. Kerby was the architect of the building and Mr. Bernt Berger was the consulting engineer and designed the roof trusses. Mr. W. C. W. Childs was the contractor for the structural iron work, which was built by the Passaic Rolling Mill Company.

Condensing Water for the Moulineaux power station in Paris, of the Western Railroad, is taken from the Seine through a conduit 6.07 feet in height and 4.92 feet in width, lifted by six centrifugal pumps directly coupled to 50-horse-power continuous-current motors into a tank of 10,600 cubic feet contents, and led to the condensers in conduits partly of concrete and partly of metal. The water is returned to the Seine in a pipe 3.93 feet in diameter. The total power of the works, according to a description in a recent issue of "Le Genie Civil," is 7,200 kilowatts, under normal conditions, supplied from nine direct-connected engines, six of the triple-expansion four-cylinder type and the rest cross-compound.

A Very Unsatisfactory Reservoir seems to be owned by the city of Reading, Pa. It ought to hold a little over 1,000,000 gallons, but it does not, for reasons stated as follows in the last report of Supt. E. A. Nuebling: "The numerous cracks in the concrete lining of the reservoir were repaired by cutting out the concrete on each side of the cracks for a distance of several inches and refilling the spaces with fresh concrete made of Portland cement, washed sand and gravel. The repairs were made as well as skilled mechanics could make them with first-class material. Most of the concrete cut out was very porous and could not be expected to hold water. After the completion of the repairs to the cracks, water was turned into the reservoir, but it all leaked out through the concrete as rapidly as when the reservoir was first completed."

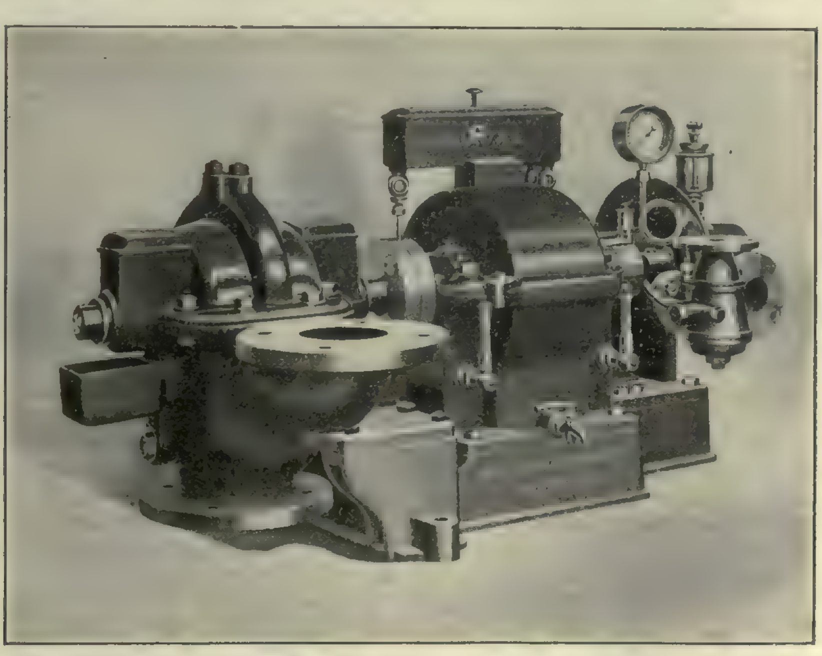
The De Laval Steam Turbine.

In 1883 De Laval made his first successful steam turbine, using it in direct connection with the shaft of the cream separator manufactured in this country by The De Laval Separator Company. It was then limited in its application and comparatively wasteful of steam, and to compete successfully with the reciprocating steam engine, it was necessary to introduce means for the complete expansion of the steam. By use of the diverging nozzle, which he patented, De Laval provided a means for the adiabatic expansion of the steam and the conversion of its static energy into kinetic; and to overcome the impossibility of producing a wheel accurately enough balanced to revolve about its center of gravity at a velocity sometimes as high as 1,350 feet per second, without causing a side pressure destructive to plain bearings and a rigid shaft, he produced a flexible shaft, which he also patented. These features of his motor were fully explained in The Engineering Record of October 28, 1893, in an article on the turbines exhibited at the Columbian Exposition. In the eight years since that date, the turbine has been modified in all the details where improvement seemed possible, and arrangements have been made to manufacture the engine on a large scale in this country.

In a properly constructed nozzle, considering that every element of the nozzle assumes a temperature constant and equal to that of the passing steam, a volume of steam of maximum pressure adiabatically expands to minimum pressure. The energy of a jet of steam per unit weight is: $E = V^2 \div 2g$, where V is the velocity of the effluent steam. Assuming this velocity to be 4,000 feet per second, $E = 4{,}000^2 \div 2g = 248{,}500$ foot-pounds.

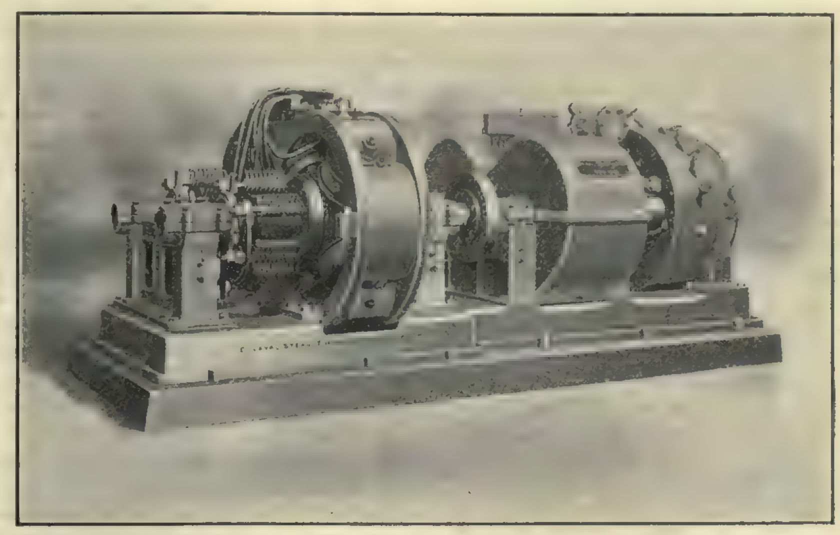
With the nozzle at an angle of 20 degrees to the plane of motion of the buckets, the velocity of the turbine wheel for the maximum of efficiency should be 47 per cent. of the velocity of the steam. The absolute velocity of the steam leaving the buckets is then 34 per cent. of the initial, and the energy absorbed by the turbine wheel is 88 per cent. of that expended. With $V = 4{,}000$ feet per second, the horse-power per hour per pound of steam is 0.11 and the steam consumption per theoretical horse-power per hour, 9.1 pounds.

The speed of the turbine wheel for $V = 4{,}000$ feet and for the maximum efficiency should be about 1,880 feet per second, or about 21 miles per minute; this, however, is much lower in the actual case, as it has been found difficult to produce a material for the wheels that with ample margin of safety would withstand the strains produced by the centrifugal force at this high speed. At the present time the speed does not actually exceed 1,350 feet per second, which in the above case, would give a steam consumption of 9.8 pounds per theoretic horse-power.



A 15-Horse-Power Turbine Pump for 150 Feet Head.

A characteristic feature of the De Laval steam turbine is that none of its running parts are subject to the full pressure of the steam, as the latter is expanded in the nozzles before it reaches the turbine wheel. This feature is of promise in the direction of using high pressures with resultant increase in economy of fuel. As far as the steam turbine itself is concerned, the makers state that it has been operated successfully with a pressure as high as 3,000 pounds per square inch.



A 300-Horse-Power De Laval Steam-Turbine Dynamo Unit.

The modifications which have been made to the turbine since its last extended description in these columns, as referred to, may best be indicated by a description of the motor as it is to-day. The turbine wheel is mounted on a slender flexible shaft, in such position relative to the wheel case as to revolve entirely free, liberal space being allowed on each side. The wheel case and its cover are shaped to form safety bearings around the hub of the wheel for the purpose of catching and checking its speed in case of an accident to the shaft. The steam after passing through the governor valve enters a steam chamber where it is distributed to the various nozzles. These, according to the size of machine, range in number from 1 to 12. They are generally fitted with shutting-off valves by which one or more nozzles can be cut out when the turbine is not loaded to its full capacity. This allows steam of boiler pressure to be used almost always and adds to the economy on light loads. After passing through the nozzles, where it is expanded, the steam blows through the buckets, its kinetic energy being transferred to the turbine wheel. After performing its work the steam passes into another chamber and out through the exhaust opening.

The speed of the turbine wheel and shaft, in most cases too great for practical utilization, is reduced by means of a spiral gear, usually made 10 to 1. The gear is mounted and enclosed in a gear case. The pinion is made solid with the flexible shaft and engages a gear wheel which, with couplings, connects to the dynamo or is extended for a pulley.

The flexible shaft is supported in three bearings. Two are the pinion bearings and the third is the main shaft bearing, carrying the greater part of the weight of the wheel. The latter bearing is self-aligning and is held to its seat by a spring and cap. Besides these there is a flexible bearing free to oscillate with the shaft, to prevent escape of steam when running non-condensing, or air from entering the wheel case when the turbine is running condensing. All the bearings are self-oiling.

The gear wheels are made of solid cast steel, or of cast iron with steel rims pressed on. The teeth in two rows are set at an angle of 90 degrees to each other, to avoid the necessity of a troublesome thrust. Gears, which have been examined after a continuous operation of seven or eight years, show no appreciable wear.

The turbine wheel is made of forged nickel-steel, and it is designed to withstand more than double the normal speed. In the smaller sizes the wheels have a hole through the center and are forced upon a taper sleeve shrunk on the shaft. The larger wheels are made solid, with the shaft in two pieces screwed to the flanges of the wheel. The buckets are drop forged and made with a bulb shank fitted in slots milled in the rim of the wheel. By this method the buckets can easily be taken out and new ones inserted, should occasion require, without damage to the wheel.

An interesting new feature is a vacuum valve used in connection with the governor when the turbine is operated condensing. In this case, when a large part of the load is suddenly thrown off, the governor pushes a bell-crank toward the vacuum valve. Thus when the steam is shut off and the speed is even then not sufficiently checked, the vacuum valve is opened and the vacuum broken.

The American De Laval Steam Turbine Company, 74 Cortlandt Street, New York, is the owner of all patents and designs of the parent European company, and the details of construction are under the supervision of engineers who have been connected with the European works for some years. The new shops, at Trenton, N. J., are built with saw-tooth roof, side and center nave construction, and are fitted with electric traveling cranes and a modern equipment of electrically driven machine tools.

Some recent tests of a 300-horse-power De Laval turbine, directly connected to a Ganz dynamo, were reported in these columns on August 17. Since then some interesting figures of the performance of a turbine-driven centrifugal pump operating under a head of 588 feet have been received. The pumping unit was a steam turbine fire engine, of 50 effective horse-power, run at a speed of 20,000 revolutions per minute. It consisted of a high-pressure centrifugal pump coupled directly to the turbine shaft and of a low-pressure centrifugal pump mounted on the secondary shaft, which is connected by a 10 to 1 reducing gear. The low-pressure suction was 4.92 inches in diameter and the pump delivered to the high-pressure pump which discharged through a 3.94-inch pipe. The head in the test was varied by a throttle valve. The results are as follows, steam, about 117 pounds pressure:

Total head, ft..............	165.6	279	326	489	588
Gals. of water per sec....	7.28	7.09	6.73	5.07	3.4
H.-P. in water pumped..	18.6	30.	33.8	38.2	30.7
Steam per Water H.-P. per hr., lbs..............	96.8	67.2	61.6	57.3	67.

The Value of an Exclusive Franchise which has not expired must hereafter be taken into account in all condemnation proceedings against public-utility corporations in Rhode Island. The State Supreme Court has recently ruled directly on this point in Town of Bristol v. Bristol & Warren Water-Works, 49 Atl. Rep. 974. The town granted the company's assignor the exclusive use of the public streets for water pipes for fifty years and the use of all the town's water pipes for the same period, or until the town should avail itself of the privilege reserved to buy the entire plant at a fair and reasonable price. The court holds that in estimating the value of the plant, on the exercise of the option by the town, the franchise for the unexpired term must be considered as an asset.

A Portable Storage Battery, of a capacity of 1,000 amperes for one hour, 750 amperes for two hours, or 500 amperes for three hours, forms part of the storage-battery equipment of the Brooklyn Heights Railroad Company, of Brooklyn, N. Y. As described by Mr. Franklin E. Morse, superintendent of power of the company, in a paper before the recent Rochester convention of the New York State Street Railway Association, it is installed in seven discarded open passenger cars once in use on a steam road. The cross seats were removed and the cells set up in two rows along the sides, with an aisle 2.5 feet wide through the center. Six of the cars contain 36 cells each, and the seventh 32 cells, with a switchboard at one end. The load on each car is about 40,000 pounds. The car bodies and parts liable to be attacked by the acid fumes are painted with asphaltum and the sides left open. Each car is supplied with electric heaters to prevent freezing the acid, but it has not been found necessary to use them. The seven cars are coupled into a continuous train and side-tracked in a shed close to the line. It is used at two different points of the city, to take heavy loads, at one point for three months during the summer, and at another point for the rest of the year where the service is heaviest in winter. The end cells in each car are connected by rubber-covered wire, the negative to the tracks and the positive to the feed wires. Each cell contains 27 plates, 15.5 inches square.

The New Sewage Disposal Plant at Madison, Wis.

A paper presented to the American Society of Municipal Improvements by Prof. F. E. Turneaure.

The city of Madison has now been struggling with the problem of sewage disposal for nearly ten years. The natural outlet for the city drainage is into one or the other of the two small lakes which are adjacent to the town; and in the construction of the older sewers these lakes were freely used for sewer outfalls. The lakes are, however, very shallow near the shores, and during the summer are stagnant for many days at a time, so that sewage discharged into them is diffused very slowly and a nuisance is likely to be created. Many complaints of such nuisance along the shores, from time to time, caused the question of purification to be agitated, and, after much discussion, the city adopted a plan whereby all the sewage would be collected and brought to one point and there treated by a system of combined chemical precipitation and sand filtration. The effluent from such works would be discharged into a small sluggish water-course leading from one lake to the other. Under these circumstances it was considered desirable to secure a fairly high degree of purification, although it should be said that neither lake is used as a source of water supply.

Before the above-mentioned plan was adopted the feasibility of sand filtration alone had been quite thoroughly discussed, and ultimately rejected, on account of the high first cost and scarcity of suitable land, although not all those competent to judge were agreed upon this decision.

Shortly after the adoption of the combination plan the American Sanitary Engineering Company, of Detroit, Mich., presented to the city a proposition for the construction of a plant involving the use of ferozone as a chemical precipitant, and polarite as a filter, these being patented materials which this company controlled. They offered very high guarantees as to the purification which their scheme would effect and also guarantees as to cost. The proposition was accepted and the company put under bonds to carry out the terms of their contract. The plant was duly constructed, and put into operation about June, 1899.

It will be unnecessary to enter into a detailed description of these works. It is sufficient to say that they consisted of a series of four chemical precipitation tanks of a combined capacity of about 200,000 gallons, and three polarite filters of a combined area of about 5,500 square feet, or about ⅛ acre, designed to filter the effluent from the precipitation tanks. The machinery connected with the plant consists of three gasoline engines of 12-horse-power rated capacity each, two centrifugal sewage pumps, a sludge pump, sludge press, chemical mixer, small centrifugal pump for pumping chemical, small rotary pump for pumping water for washing filter beds, and a dynamo. The precipitation tanks and filter-beds were constructed by the Sanitary Engineering Company; the pumps and other machinery were built by the city.

The results of operation which the plant was guaranteed to accomplish were briefly: That the effluent should be as good as would be produced if treated in the way previously adopted; that it should equal in purity the waters of Lake Mendota as shown by a certain analysis; that the cost of operation should not exceed $3,600 per year for 600,000 gallons of sewage per day, and that the effluent should not contaminate the waters of the lake, and that the plant and effluent in general should be satisfactory. The capacity of the plant was to be 1,200,000 gallons per day.

The failure of the plant to meet the terms of the guarantee is probably well known. The chemical tanks did quite satisfactory work, although the amount of chemical required was very high. The filters accomplished relatively little. They clogged up rapidly, and even though cleaned about once in three days their capacity was not more than 300,000 or 400,000 gallons per day. The cost of operation, including the necessary pumping, was at a rate of about $10,000 per year. The plant was not accepted by the city and litigation is now pending with reference to it.

As the city could not continue to operate this plant, and as the discharge of crude sewage into the lake could not long be permitted, it was necessary to construct a new plant of some sort without delay.

Professor J. B. Johnson, Dean of the Engineering College of the University, proposed, as the best solution of the problem, the construction of a plant involving the use of a septic tank and rapid filter, his opinion being based largely upon the experimental work at Manchester, which had just then been made public. With this opinion the writer fully concurred, and, after considerable public discussion, he was called upon to recommend detailed plans. In deciding upon the general arrangement it was considered that some kind of filters would be required in addition to the septic tank, but that the purification need not be so great as would be obtained from the ordinary sand filter. The plans therefore contemplated septic tanks and coarse filters. The tanks were authorized first and construction began upon them in March last. They were completed and put into operation about August 1. The filters were not authorized until some months later and construction of this part of the plant is now progressing. It is expected that sufficient filter area will be completed by November 15 so that the dry weather sewage can all be filtered.

Madison has a population of about 20,000, about half of which is tributary to the sewers. This proportion is, however, rapidly increasing. About 160 roofs are connected with the sewers, and 340 cistern over-flows. The consumption of water is about 45 gallons per capita, and the ordinary dry-weather flow of sewage is about 450,000 gallons per day. In wet weather the flow is increased to about 600,000 or 800,000, due to inflow of ground water; and after heavy rains the discharge rises to 1,000,000 gallons or more for a short time. As would be expected from the low water consumption the sewage is of a fairly strong character. The albuminoid ammonia usually ranges from about 0.8 part to nearly 2 parts per 100,000, and free ammonia from 1.2 to 3.6 parts. Ordinarily about three-fourths of the albuminoid ammonia is in suspension, a condition which may be considered favorable. The sewage is, however, not readily cleared by sedimentation, owing to the fact that in passing through the pumps the suspended matter is thoroughly stirred up and is left in a state of very fine subdivision.

In fixing upon the design, the matter of economy of construction had to be kept prominently in mind, as the city had already paid out about $25,000 toward a disposal works, in addition to the amount expended for the pumping station.

The pumping station and disposal works are located on low marsh land in the eastern end of the city. The main outfall sewer carries the entire sewage of the city by gravity to this point, discharging it into a well at a depth of about 15 feet below the surface. From this well the sewage is raised by centrifugal pumps. In the design of the tanks it was necessary to build them practically on the surface of the ground, in order to permit the sewage effluent to pass by gravity onto the filter bed. It was

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danger of septic poisoning
too long period of rest can
y the use of long and comparatively narrow settling tanks. It would appear, for example, that a tank might be indefinitely long, provided the velocity of flow is such that the cleared sewage will pass beyond the area of excessive bacterial action in the sludge, before objectionable products of decomposition have had time to form. It certainly seems reasonable to suppose that the effluent from an efficient tank might be passed on through a great length of similar tank, or a series of tanks, without detriment. If this theory is correct the critical point to be determined in a design of long rectangular tanks is the proper velocity of flow, so that the sewage will not remain in the region of excessive bacterial action too long a time. From these considerations it was thought that a long tank was the safer form of construction. The depth of a tank, within quite wide limits, would not seem to be very material, as many experiments on sedimentation have shown that the effect of depth is not great. In this case the depth was determined largely by considerations pertaining to convenience of construction. The tanks as finally constructed consist of two simple rectangular reservoirs, each 30 x 120 feet inside dimensions. The depth of sewage varies from 6 feet at the outlet end to 8 feet at the inlet end. The walls are built of Portland cement concrete founded on a layer of clean sand about 3 feet below the surface. They reach to a height of about 9 feet above the original surface, and are backed by earth embankments which reach within one foot of the top of the walls. The level of the sewage inside is the same as that of the earth embankment. The tanks are covered with an ordinary tar-and-gravel roof placed close to the surface of the sewage. Numerous openings covered by simple board covers permit access to the tank for cleaning and inspection, and for the adjustment of certain baffle boards used for holding back the surface scum. The floor of the tank consists of 4 inches of concrete resting upon compacted clay. Sewage is pumped into the tanks at one end through a cast-iron force main which is divided into eight branches where it enters the tank at an elevation of 4 feet below the surface of the sewage. Each branch ends in a bell mouth where it passes through the concrete wall. By this arrangement the sewage is well distributed along the end of the tank and enters at a low velocity, so that sedimentation can begin promptly. The effluent passes out at the opposite end of the tank over a weir extending the entire width of the tank. To prevent the scum from passing off, a number of baffle boards are used, and three of these are placed quite close to the outlet weir. After passing over the weir the sewage flows along a channel in the wall to an outlet pipe and thence either to the filter beds or directly to the outfall. Provision is made for cleaning out the accumulated sludge by depressing one end of the tank and providing there a sump connecting with a sludge pipe which leads to the old sludge well at the pumping station. The sludge can then be pressed, or, if desired, pumped into tanks and carted off, all the necessary machinery being already installed. The two tanks are arranged side by side and both are in continuous operation, the object of making two tanks instead of one being merely to permit cleaning without interrupting the operation. The contract price for the tank and piping was

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXVIII, DRESDEN, ALBERT BRIDGE.

Of later date than the Augustus bridge. While a fine structure, it misses the high character of the former example. It was built in 1877 from the plans of Manck. The four large river arches have spans of about 102 feet

$7,020. This was higher than it would have been had the contract been let in the summer, as the specifications provided for winter work, involving considerable extra expense.

In the design of the filters there was a choice of many different schemes and combinations. It was at first contemplated to use the ordinary contact beds with possibly double contact. Such an arrangement, however, would have required the construction of water-tight reservoirs and would have been quite expensive. With further study it was concluded that the coarse filter, operated intermittently like an ordinary sand filter, would possess considerable advantage; that is to say, a filter in which the sewage is applied intermittently by sprinkling or some like method, and where the pores are never entirely filled with the liquid. Available data, including the results of certain experiments carried out at this place, indicated that such filters would be likely to effect a better nitrification; and, furthermore, they would not need to be water-tight nor have any division walls whatever. The only difficulty with this system is in the design of an effective method of distribution.

After considering several schemes the following arrangement was adopted: A bed of an area of one acre was fixed upon as the desirable size. This bed is arranged in two stories or two beds, each about 2 feet thick, to be composed of screened locomotive cinders. The lower bed is placed upon a floor of inch boards laid upon the ground, and having wooden drains constructed therein 16 feet apart. The boards are used on account of the soft character of the soil on which the filters are built. This bed is composed mainly of cinders from 3/16 to ⅝ inch in diameter. At the bottom is a thin layer of coarser material. The upper bed is supported 12 inches above the lower bed on a floor of 1 x 4-inch hemlock boards, laid with a ¼-inch space between; 2 x 6-inch joists, resting on 2 x 4-inch posts, support this floor. The upper bed is composed mainly of cinders from ⅝ to 1 inch in diameter. The sewage is distributed over the upper bed by means of 3-inch perforated vitrified pipe, laid 2 feet apart. The entire bed is rectangular in shape, 140 x 300 feet in size. There are no division walls or embankments, but exterior embankments of earth and rejected cinders are constructed to retain the filter cinders and furnish room for a drive or foot-way. The distributing system is divided into seven sections, each covering a space of 140 x 40 feet, and supplied with sewage by an independent pipe. In each section the main distributing pipe runs through the center, and from it branch the lines of 3-inch pipe, each 20 feet long. These are perforated along the top with 5/16-inch holes spaced one foot apart, for the escape of sewage. These 3-inch pipes are laid on 3 x 6-inch plank, embedded in the cinders, and are surrounded with cinders up nearly to the holes at the top. The lines of pipe are then covered with 1 x 8-inch boards, placed an inch or so above the pipe. The whole is then covered with fine cinders or other cheap covering to a sufficient depth to prevent freezing. The sewage will escape under a head of from 2 to 6 inches, and by striking against the board covering will be somewhat scattered thereby. Immediately around and under the distributing pipes the cinders will be finer than underneath, in order to aid in distributing the sewage. While this arrangement will not, of course, give a perfect distribution of sewage on the upper bed, it will be fairly good, and it is believed will be all that can be desired on the lower bed. There will also be good aeration between the beds.

The method of operating the distribution system remains to be described. Between the septic tanks and filter beds is placed a receiving chamber of a capacity of about 500 gallons, or about five minutes' flow from the tanks. From this chamber pass the separate pipes to the seven sections of the distributing system, each having a separate valve. Assuming the chamber full, one of the valves is opened and the contents, together with the sewage which enters in the meantime, are discharged quickly and with considerable head upon the one section of the bed. The valve is then closed and the tank allowed to again refill, when another section is closed, etc. By varying the operation of the valves the sewage can be applied as often as desired. By this means, concentration of discharge is assured, which permits the use of good-size holes in the distributing pipes, and at the same time gives considerable pressure head, so that small irregularities in construction will not materially affect the distribution. Split pipe, or troughs, would obviously be of no use for distributers in this form of filter. The covering of cinders above the pipe will, it is believed, obviate any trouble from odors due to gases liberated from the sewage as it is applied to the bed. The valves of the distributing pipes will be of the butterfly pattern, and will be operated from the pump house by means of wire cables. Automatic operation will be secured by a mechanical device attached to the pumping engines. Provision will be made for flushing the 3-inch distributers by connecting them in groups of seven to a 6-inch cross pipe provided with a simple wooden gate valve. Ventilators reaching down to the interior air space will be so arranged as to cause some circulation of air in the bed; and manholes, placed over the drains, will permit of taking samples from any section.

The cost of the filter bed is about $7,500, the city to furnish the cinders f. o. b. at Madison. The estimated capacity is about 1,000,000 gallons per day, or at least 50 per cent. more than the present volume.

The tanks have now been in operation about six weeks, and appear to be in good working order. A good scum formed within two weeks. The effluent appears to be of about the same character as the sewage, but with much less suspended matter.

Some notes regarding the experiments already referred to, which were made here last winter, may be of interest. These were conducted by University students as a thesis study. A septic tank was used which consisted of an ordinary barrel, into which sewage was introduced at hourly intervals. Two styles of filters were used, a single contact bed operated on the fill-and-draw principle, and a double intermittent filter arranged in the same way as that adopted for the large plant. The cinders used were from ⅛ to ¼ inch in diameter. All filters were 2½ feet deep, and were operated at a rate of 500,000 gallons per acre per day. The septic tank was started in July, 1900, and the filters in November. Analyses were made at frequent intervals from December, 1900, to April 26, 1901, with the following results for the months of March and April, the last months of the experiments: The average improvement by the septic tank, based on the albuminoid ammonia, was 62 per cent. That by the tank and the upper one of the double filter was 76 per cent. and practically the same by the single contact bed; and by the tank and both of the double filters, a total of 87 per cent. There was practically no nitrification established in the contact bed by the end of the experiment, although in the effluent from the other filters the nitrates reached 0.6 part per 100,000.

The average analysis of the sewage was: Free ammonia, 0.98 parts per 100,000; albuminoid ammonia, .0.51 parts; oxygen consumed, 14 parts. The effluent from the double filter was very clear and odorless, and would not undergo any putrefaction by standing six weeks in a room at a temperature of 70 degrees Fahr. A bacterial analysis showed that with 5,000,000 bacteria per cubic centimeter in the sewage the septic tank effluent had but 3.5 per cent. of this number and the filter effluent only 0.6 per cent. The depth of sludge remaining in the septic barrel after ten months of operation was only 1.3 inches. The weight of the solid matter in this was estimated at 0.7 pound, while about 15 pounds had been delievered to the barrel.

It is thought that the large tanks will do fully as well, being of a better form for sedimentation. Whether we have adopted the very best form for a filter is, of course, an open question. The working of the entire plant will be carefully followed, and in addition it is planned to conduct experiments on several different forms of filters for a number of years, applying to them the effluent from the septic tank. In this way the maximum capacity of the present plant can be experimentally determined without endangering the life of the plant itself, and much valuable data accumulated for use when extensions are needed.

Hot-Water Heating in a Chicago Residence.

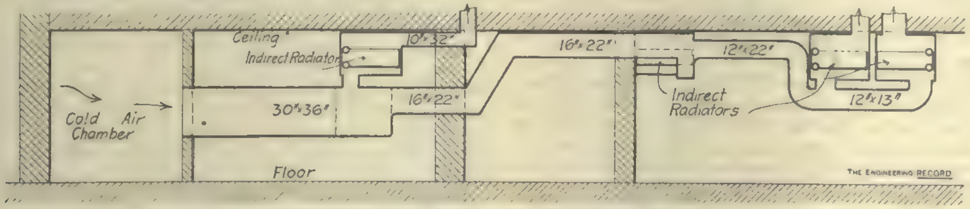
A complete hot-water system of warming is now being installed in a large residence at Woodlawn Avenue and Forty-ninth Street, in Chicago. It is of the open-gravity type and includes direct and indirect radiation. The main rooms of the first two floors are supplied with the fresh warm air from the indirect radiators, and throughout means for ventilating have been provided, in open fireplaces and by vent registers opening into vent flues for rooms not furnished with the fireplace. The plant was designed under a guarantee that it would "heat each room and also all rooms at the same time to 70 degrees Fahrenheit in coolest corner, when thermometer is 20 degrees below zero outside."

The residence is a three-story and basement building. The first floor and the basement are shown in accompanying plans. Of the rooms on the first floor, a library about 20 x 35 feet in inside dimensions extends across one end. From this room through the center of the building extends a hall, entered from the outside through a vestibule immediately back of the library. The main staircase faces the vestibule. A reception room, which may be shut off from the hall, is at one side of the vestibule. Back of the reception room and at the end of the hall is the dining room. The rest of the floor, as shown, is taken up with the kitchen and pantries and the servants' dining room and stairs.

The second floor contains four large sleeping chambers, one with a dressing room and bathroom occupying the space over the library. There are besides these two other sleeping rooms, a sewing room and altogether four bathrooms. The four principal rooms are heated from the indirect system and three of them have open fireplaces; the fourth is provided with a vent register and flue, the vent register being 6 x 10 inches in area, corresponding to a fresh-air register 12 x 14 inches in size. The rest of the rooms have direct radiation only, and are without special ventilation. The third floor has two large chambers with one bathroom for the two, two storage rooms, one for trunks, and a gymnasium, the latter taking up the end over the library. Besides the air vent for one of the chambers of the second floor, as mentioned, the reception room has a similar vent, as shown; in the attic over the third story the flues from these openings are connected together and led in a duct to a chimney flue built for the purpose.

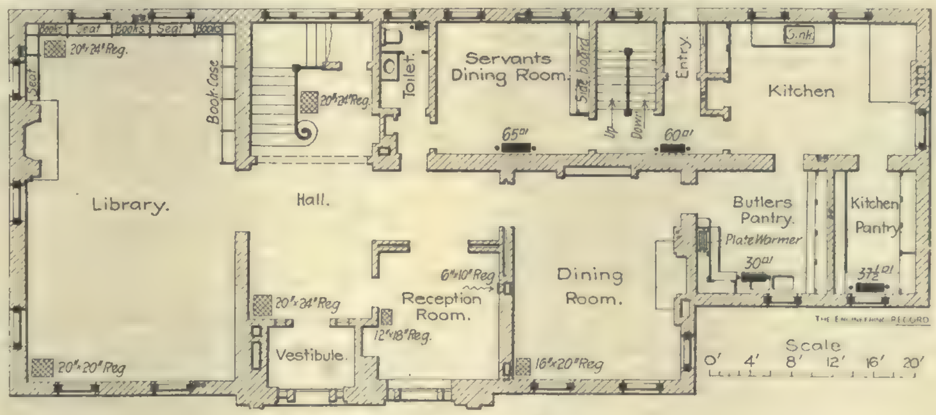
The air distribution is of the type in which the fresh air is received at one inlet and carried to the different indirect radiators by means of a ramifying system of ducts, in contradistinction to the less common type in which the indirect radiators have independent fresh-air connections. The air inlet in the present installation is located at one corner of the basement and is provided with a window in each outside wall, so that the plant is doubly sure to obtain a requisite amount of air, which, of course, is always apt to be diminished when a wind is blowing against the opposite side to that containing the air inlet. It is, of course, good practice to locate the inlet facing the direction of the prevailing winds of the cold season.

In the present plant, a room has been set apart into which the air is admitted, and from this two ducts are taken and a short connection to an indirect radiator enclosed off in the upper part of the chamber. Before passing into the ducts, however, the air is to be filtered in the chamber. The filter consists of a perforated metal framework fixed parallel with the ceiling, and of detachable cheese cloth bags suspended from the holes in this frame. The cloth bags are 12 inches in diameter and are distended at the bottom with metal rings. Through these cloth bags all the air has to pass before entering the ducts, and the area of the cloth is taken as large as possible, so as to offer as little friction to the air flow as possible.

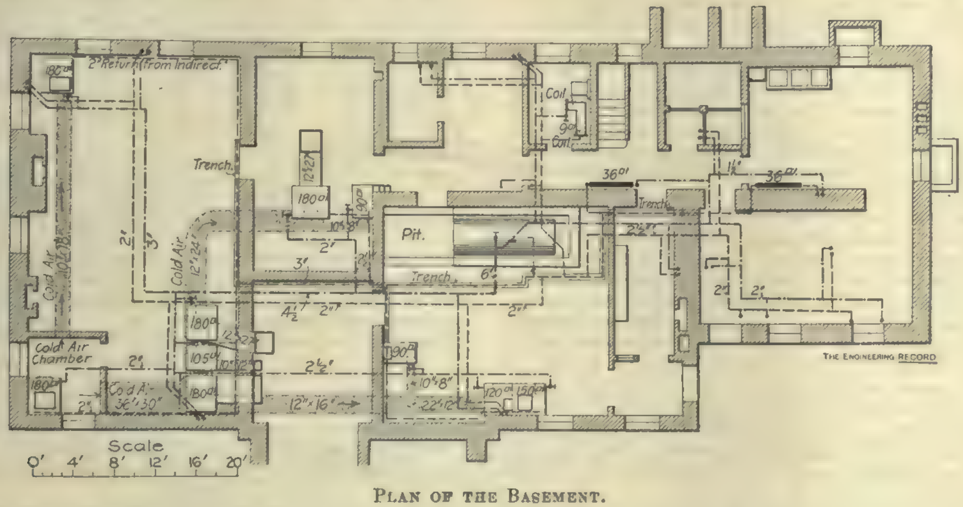


Longitudinal Section through Main Duct.

All but two indirect stacks, which warm the library, are supplied from the cold-air chamber by a duct 2.5 x 3 feet in cross-section. Altogether, including the library radiators, there are 1,455 square feet of indirect surface in the whole plant. Extra large sections of 15 square feet per section are used, and as usual the different groups are enclosed in galvanized iron, with a connection from the cold-air duct system entering at one end into the bottom and a connection at the other end from the top into the flue leading to the room supplied. Remembering that the air becoming heated increases about one-fifth in volume, it will be found that the velocity of the warm air from the indirect casings is, on the average, about 25 per cent. less than that of the cold air. The fresh-air registers in the rooms are in general in the floor.



Plan of the First Floor.



Plan of the Basement.

It will be interesting to discuss in this connection the performance of the indirect radiators, tracing in the opposite direction to that which would be taken up in the calculation of the apparatus a method for determining proportions. The whole plant was installed under a guarantee to warm the building when the outside temperature drops as low as 20 degrees below zero. If it is assumed that the temperature of the air on leaving the indirect radiators is 130 degrees, a temperature not at all uncommon, the incoming air is heated through a total range of 150 degrees, making the mean temperature to which the warm iron surfaces of the indirect radiator are subjected 75 degrees. It would probably be safe to figure that the temperature of the water entering the radiator is 210 degrees Fahrenheit and that it is lowered in passage through it a total of 20 degrees—that is, the radiator has an average mean temperature of 200 degrees. The average difference in temperature between the air and the radiator is therefore 125 degrees. If it is assumed, further, that each square foot of indirect radiator surface gives off for this range about 2¼ British thermal units per hour for every degree difference in temperature between the air and the radiator, each square foot has a heating capacity of 125 × 2.25 = 281 thermal units per hour.

On this basis it will be found that each of the two 180-square-foot indirect radiators which supply the library gives off 281 × 180 = 50,600 thermal units per hour. For a range of temperature of 150 degrees, this will warm 50,600 × 50 ÷ 150 = 16,900 cubic feet per hour, or 280 cubic feet per minute. The library having cubic contents of about 8,750 cubic feet, the two radiators under the conditions assumed will furnish a total air change about four times an hour. As the 50,600 thermal units are given off at the expense of a reduction in 20 degrees in the water supplied, 2,530 pounds of water must be furnished per hour, or about 5.2 gallons per minute. The radiator is connected to the hot-water mains by a 2-inch pipe, so that, referring to G. A. Ellis' table of friction losses of head in iron pipes of different sizes discharging a given quantity of water, as published in Baldwin's "Hot-Water Heating and Fitting," it will be seen the piping is installed to circulate naturally under a friction loss of about 0.075 inch of water per 10 feet of length. Looking at it in another way, it will be found that the quantity of water necessary will pass through the 2-inch pipe at a velocity of 0.53 foot per second. Calculating for air velocities on the basis of the assumptions made, which are held by some as quite conservative, it will be found that the average velocity of air through cold-air connection to the radiator casing is 190 feet per minute, and that of the hot-air connection from the casings is 150 feet per minute. The velocity through the registers is less than the latter figure.

The boiler is of the locomotive firebox type, enclosed in a setting in which the walls are arched over the top of the boiler, leaving a space of 4 inches entirely around the shell for conveying the products of combustion, the idea being to utilize the entire surface of the boiler for heating surface. The boiler is provided with a 6-inch flow connection which subdivides into a 5-inch and a 3-inch main, the former feeding all the indirect surface, and such direct radiators as are located in the front part of the house. The other main supplies the rest of the apparatus. Altogether there are 2 300 square feet of surface, not counting a plate warmer in the butler's pantry, which is available as heating surface for that room, if desired. Of this, 1,455 square feet is comprised in the indirect radiation, and the rest, 845 square feet, in direct. Sixty-six per cent. of the indirect surface belongs to the heating apparatus of the first floor and the rest to the second floor. The direct radiation in the basement, first, second and third stories is 92, 204.5, 277.5 and 271 square feet respectively. The indirect apparatus is under thermostatic control, using Powers' thermostats, and all radiators are provided with Van Auken Suplex automatic air valves. All pipes, whether concealed or not, are covered with asbestos moulded sectional covering.

The house is being erected for Mr. M. D. Hull from the plans of Mr. W. A. Otis, of Chicago. The heating apparatus was designed by the Davis Construction Company, of Chicago.

The Sand Blast was recently used in cleaning the metalwork of the Pont de l'Europe near the St. Lazare station of the Western Railway in Paris. This bridge was last cleaned ten years ago, according to "Engineering," the work being done with scratch brushes and the like, and fifteen months were occupied on the task. With the sand blast, the total time required for the work was but three months and the cleaning was more thorough.

The Condition of the Brooklyn Bridge.

The conclusion of a report to E. A. Philbin, District Attorney, New York, by Edwin Duryea, Jr., and Joseph Mayer. The first part of the report was printed on October 12.

Appendix D.—Calculations of the Stiffening Systems and Floors.

The superstructure consists of three systems; the cables, the stiffening trusses, and the stays acting with the towers and bottom chords of stiffening trusses.

Each system deflects under loads, and the cables deflect considerably by changes of temperature. Each point of bridge is at one elevation with given loads and temperature. The deflections of all the three systems at any point where they are connected are therefore equal. This fact must serve for determining the loads carried by each system.

For arriving at these loads there must first be known the load carried by each system at some one temperature and with some one kind of loading. This could be determined if the curve of cables were known, and also the deviation in curve of stiffening trusses from their curve when they are unloaded. As no such data are available, an accurate calculation of the stresses in the three systems is impossible without measurements on the bridge, which cannot be made without more time and means than are at our disposal.

Approximate results will, however, be sufficient to form a sufficiently reliable opinion on the safety of the bridge.

Relations Between Temperatures, Loads and Deflections in Unstiffened Cables—We will assume a blueprint furnished by the Bridge Department, giving the dip of cables and lengths of spans under dead load at high temperature, to be correct. It is certainly near enough so for our purpose. According to this we have:

	Feet.
Length of main span centers of saddles....	1,598.8
Length of approach spans to face of anchorage	928.3
Dip of cables of main span....................	128.52
Cables at face of anchorage below point of intersection at saddles.........................	187.6

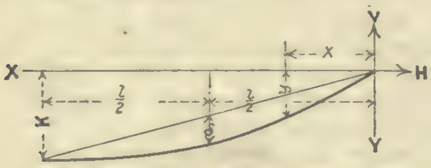
We will, for this investigation, consider the dead load to be uniform, and 4 tons per lineal foot of bridge, and the moving load 1.3 tons per lineal foot of bridge.

The length of cables in shore spans is approximately 952.7 ft., that of cables in main span 1,625.92 ft. Under these conditions the cables in main span are parabolas of the equation

$$y = (128.58 \div 799.4^2)\ x^2,$$

the axis of x being tangent to cables at center and the vertex of parabola being the origin of coordinates.

For the purpose of obtaining a general equation for the curve of cables of shore spans, we call the total load per lineal foot of bridge p, the horizontal component of stress in cables H, and the vertical component of stress in rear cables at saddle V. Then we obtain the equation of curve of rear cables in regard to saddle as origin, with horizontal and vertical axis of coordinates, by taking moments of all the forces acting on cables to the right of a point, the coordinates of which are x and y, around this point.



$$Hy - Vx + \tfrac{1}{2} px^2 = 0.$$

If the length of shore span is l, and if k is the dip of cables from saddle to end of shore spans, we have, by introducing $x = l$ and $y = k$,

$$Hk - Vl + \tfrac{1}{2} pl^2 = 0$$
$$V = (Hk \div l) + \tfrac{1}{2} pl.$$

Introducing this V in above equation, we obtain

$$Hy + \tfrac{1}{2} px^2 - x\,[(Hk \div l) + \tfrac{1}{2} pl] = 0.$$

If we introduce in this equation $x = \tfrac{1}{2} l$, we obtain $y = (pl^2 \div 8H) + \tfrac{1}{2} k$.

The deflection δ of cable below the chord connecting saddle with cable at face of anchorage is therefore $\delta = pl^2 \div 8H$.

Deformation of Cables by Changes of Temperature.—If the temperature falls 120 degs. Fahr. the cables will shorten 1/1,200 of their length; or in each of two shore spans they will shorten 9.53 ins., and in the main span 16.26 ins. If s is the length of back cable, and c the length of chord connecting ends of back cable, then we have approximately, from the formula for the rectification of the parabola, $s - c = 8\ \delta^2 \div 3l$. If we differentiate this equation we obtain $d(s - c) = (16\,\delta \div 3l)\, d\delta$; and from this $d\delta = (3l \div 16\ \delta)\, d(s - c)$.

For main span we similarly obtain, if L is length of span, S length of cables, and h their dip, $dh = (3L \div 16h)\, d(S - L)$.

From these equations we obtain the decreases in deflection in main and shore spans as long as the saddles remain stationary. If we introduce the numerical values for the general expressions, we obtain, by letting $d(s - c) = ds = -0.793$ ft., and $d(S - L) = dS = -1.355$ ft., the values below.

For equilibrium at saddle, we obtain from shore span $H = pL^2 \div 8\delta$ where H is the horizontal component of stress in cable. From river span we obtain $H = pL^2 \div 8h$, hence $\delta = (l^2 \div L^2)\, h = 0.33715\, h$. Then, by substitution, we obtain $d\delta = -3.185$ ft., and $dh = -3.162$ ft.

Before the change in temperature δ and h had above ratio; after the change of both by about equal amounts, δ is too small for equilibrium, and the H in shore span is more than that in river span. If the saddles are movable, they will move toward shore spans; if they are fixed we will call the H in shore span H_s and the H in river span H_r, and we have, for $p = 4$ tons:

$$H = \frac{pl^2}{8\,\delta} = \frac{4 \times 928.3^2}{8 \times 40.145} = 10{,}735 \text{ tons.}$$

For river spans we have

$$H_r = \frac{pL^2}{8\,h} = \frac{4 \times 1{,}598.8^2}{8 \times 125.358} = 10{,}193 \text{ tons,}$$

and $H_s - H_r = 542$ tons.

If the horizontal forces in cables of shore spans and river spans should balance at highest temperature, the horizontal pull toward shore would be 542 tons at lowest temperature, with bridge unloaded. If the horizontal forces in cables of shore and river spans balance at mean temperature, the pull at each of the two extremes will be 271 tons in opposite directions, with bridge unloaded.

With bridge loaded with 1.3 tons per foot, the pull on tower at extremes of temperature will be approximately either $542 \times 5.3 \div 4 = 718$ tons in one direction, or 359 tons in opposite directions.

If the saddles are movable without friction, they will move by an amount x. Then we have for

$$\text{main span } dh = \frac{3L}{16h}\, d(S - L) = -\frac{3L}{16h}\, dL = -\frac{3 \times 1598.8}{16 \times 125.36}\, 2x = -4.782x; \text{ and since } d(s - c) =$$

$$0.98x \text{ for side span, } d\delta = 0.98x\, \frac{3 \times 928.3}{16 \times 40.15} = 4.248x.$$

The total change in deflection by change of temperature must be 0.33715 times as large in shore span as in main span. We have therefore: $3.185 - 4.248x = 0.33715\,(3.162 + 4.782x)$. From this we obtain $x = 0.3615$ ft. Therefore $dh = 4.782 \times 0.3615 = 1.729$ ft.; $d\delta = 4.248 \times 0.3615 = 1.536$ ft. The total decrease of deflection of shore span is therefore $3.185 - 1.536 = 1.649$ ft., and that of main span $3.162 + 1.729 = 4.891$ ft.

The average stress in cables is increased thereby in the ratio of 128.5/123.5, or 5/123.5 of the stress at high temperature. The average stress is $4 \times 1{,}599^2 \times 1.02 \div (8 \times 128.5) = 10{,}150$ tons; or, per square inch, is $10{,}150 \div 580 = 17.5$ tons. The increase in stress per square inch by decrease in deflection is $(5 \div 123.5) \times 17.5 = 0.709$ tons.

The stretch of cables is $(0.709 \div 14{,}000)\ 3{,}531.3$ ft. $= 0.1788$ ft.; and the reductions in decrease of deflections are: Main span $(0.1788 \div 2.942)\ 4.891 = 0.297$ ft; side spans $(0.1788 \div 2.942)\ 1.649 = 0.100$ ft. The corrected decreases of deflections due to fall of temperature of 120 degs. Fahr. are, therefore, 4.594 ft. in main span and 1.549 ft. in side spans, if saddles move without friction. The corrected motion of each saddle is $0.3615\ (2.76 \div 2.94) = 0.3396$ ft. $= 4.08$ ins. toward shore.

Deformation of Unstiffened Cables by Moving Load.—Four distributions of moving load, and the deformations produced by them, will here be primarily considered.

First.—Uniform moving load extending over whole bridge.

Second.—Uniform moving load on main span only, the shore spans being unloaded.

Third.—Uniform moving load on shore spans only, the main span being unloaded.

Fourth.—Uniform moving load on main span extending from one tower to center, the saddles being fixed.

The effects of other kinds of loading may be estimated after the results of these are known.

First.—We take 1 ton uniform moving load extending over whole bridge, with the dead load assumed at 4 tons per lineal foot of bridge.

The deflection of both main and shore spans, below their chords, will be increased, their ratio remaining: Deflection of shore span = deflection of main span × 0.33715.

The cables will receive more stress in the ratio of $5h_0 \div 4h_1$, where h_0 and h_1 are deflections of main span when bridge is respectively empty and when it is loaded with 1 ton moving load per foot.

We assume the increase of deflection due to this moving load to be 1.7 ft., then we have $h_0 = 128.5$ ft., and $h_1 = 130.2$ ft. Then we have the average stress S_1 in cables $= S_0 \times 1.25 \times 128.5 \div 130.2 = 1.234\ S_0$.

$S_0 = 17.5$ tons per square inch; the increase in stress per square inch is therefore $17.5 \times 0.234 = 4.095$ tons.

The stretch of cable in main span is $4.095 \times 1625.9 \div 14{,}000 = 0.4755$ ft., and in each side span is $4.095 \times 952.7 \div 14{,}000 = 0.2787$ ft.

The increase in deflection in main span is $dh = 0.4755\ (3 \times 1{,}599) \div (16 \times 129) = 1.105$ ft., and in shore span is $d\delta = 0.2787\ (3 \times 928.3) \div (16 \times 43.3) = 1.120$ ft.

The saddles will move toward main span by an amount x; then h will be increased by $x \times 4.65$, and δ will be increased by $4.02x$, the values of 129.6 and 43.3, respectively, being used in formulas for dh and $d\delta$. The change in deflection in shore span must be 0.33715 times that in the main span. We have, therefore, $1.120 - 4.02x = 0.33715\ (1.105 + 4.65x)$ and $x = 0.1338$ ft. $dh = 0.1338 \times 4.65 = 0.622$ ft. $d\delta = 0.1338 \times 4.02 = 0.538$ ft.

The increase in deflection of main span is therefore 1.727 ft., and that of shore span is 0.582 ft. The motion of saddle is 0.134 ft. toward river if there is no friction. If the saddle is stationary there will be a slight surplus pull on river side of tower.

Second.—Uniform moving load of 1 ton per foot on main span only, the shore span being unloaded.

This case is obtained from the previous one by removing the load on shore span. The total deflections in previous case were, at high temperature, 130.25 ft. in main span and 43.91 ft. in shore span, the ratio being 0.33715. In this case the ratio must be $0.33715 \times 4/5 = 0.26972$, if the saddles move without friction.

If the saddles move a distance x toward main span this ratio is not quite correct, since l and L are changed. To avoid a future correction, we will anticipate, and assume the motion of each saddle to be 1.7 ft. in comparison with no moving load. We have then $L = 1{,}595.4$ and $l = 930$. We would have for uniform load $\delta \div h = l^2 \div L^2 = 930^2 \div 1{,}595.4^2 = 0.3398$. The ratio for main span only, loaded, becomes $0.3398 \times 4/5 = 0.27184$.

The effect of motion x of saddles toward main span will be to decrease deflection in shore spans by $d\delta = [(3 \times 928.43) \div (16 \times 43.91)] \times 0.98x = 3.884x$.

The change in deflection of main span is $dh = 2x\ (3 \times 1{,}598.5) \div (16 \times 130.25) = 4.602x$. We have then the equation: $43.91 - 3.884x = 0.27184 \times (130.25 + 4.602x)$ and $x = 1.657$ ft.

$$d\delta = 1.657 \times 3.884 = 6.436 \text{ ft.}$$
$$dh = 1.657 \times 4.602 = 7.626 \text{ ft.}$$
$$\delta = 43.91 - 6.436 = 37.474 \text{ ft.}$$
$$h = 130.25 + 7.626 = 137.876 \text{ ft.}$$

The above formulas are only correct for small values of x. The results will be more accurate if the average values of h, l, L and δ are introduced instead of those at beginning of motion of saddles. We obtain then:

$$d\delta = 0.98x\ (3 \times 929.13) \div (16 \times 40.69) = 4.196x.$$
$$dh = 2x\ (3 \times 1{,}597.14) \div (16 \times 134.06) = 4.468x.$$

$43.91 - 4.196x = 0.27184\ (130.25 + 4.468x)$ and $x = 1.571$ ft.

$$d\delta = 4.196 \times 1.571 = 6.592 \text{ ft.}$$
$$dh = 4.468 \times 1.571 = 7.020 \text{ ft.}$$
$$\delta_1 = 43.91 - 6.592 = 37.32 \text{ ft.}$$
$$h_1 = 130.25 + 7.02 = 137.27 \text{ ft.}$$

The increase in deflection of main span will produce a reduction of stress in cables which will shorten them and reduce the deflections in both center and shore spans.

The average stress in cables at deflection of 130.25 ft. is $1.02\ (5 \times 1{,}599^2) \div (8 \times 130.25) = 12{,}510$ tons, or $12{,}510 \div 580 = 21.57$ tons per square inch.

The reduction in stress by increased deflection is $(7.02 \div 137.27)\ 21.57 = 1.103$ tons per square inch.

The shortening of cables in main span is $1{,}626 \times (1.103 \div 14{,}000) = 0.1281$ ft., and that in each shore span is $953\ (1.103 \div 14{,}000) = 0.0751$ ft.

The decrease in deflection in main span produced thereby is $0.1281 \times 2.234 = 0.286$ ft., and that in shore span is $0.0751 \times 4.196 = 0.315$ ft. There will take place a slight motion of saddles toward shore so as to bring these changes into proper proportion and make the reduction of deflection in shore span 0.13 and in main span 0.48 ft.

The actual deflection of main span will therefore be 136.76 ft., that of shore span 37.19 ft. The changes of deflection in comparison with deflections of empty bridge at same temperature will be $136.76 - 128.52 = 8.24$ ft. in main span and $43.33 - 37.19 = 6.14$ ft. in shore spans.

If the saddles are immovable, the tension in shore span cables remains the same as with no load, and $H_s = pl^2 \div 8\ \delta = (4 \times 928.3^2) \div (8 \times 43.33) = 9{,}945$ tons. The H_r would be $9{,}945 \times (5 \div 4) = 12{,}431$ tons, if the deflection remained the same.

The increase in average stress per square inch in cables is $1.02\ (2{,}486 \div 580) = 4.372$ tons. This produces a lengthening of main cables of $1{,}626\,(4.372 \div 14{,}000) = 0.5078$ feet, which increases the deflection by $dh = 0.5078\ (3 \times 1{,}598.8) \div (16 \times 128.52) = 1.185$ feet, and the dip of cables in main span will then be 129.70 ft.

The H_r will then be $12{,}431 \times 128.52 \div 129.70 = 12{,}320$ tons, and $H_s - H_r = 2{,}375$ tons.

The pull on each tower will therefore be 2,375 tons toward river if with dead load alone there was balance at the same temperature. A moving load of 1.3 tons per foot on main span only would give approximately a pull of $1.3 \times 2{,}375 = 3{,}087$ tons toward river at each tower.

Third, Uniform moving load of 1 ton per foot on each shore span; main span being unloaded.

We will anticipate a correction by assuming each saddle to move 1.9 ft. toward its shore span; then the main span becomes $1{,}598.8 + 3.8 = 1{,}602.6$ ft., and the shore spans each $928.3 - 1.9 = 926.4$ ft. Then $\delta \div h$ will become $(5 \times 926.4^2) \div (4 \times 1{,}602.6^2) = 0.4177$ and saddles will move toward shore until this ratio is established. To avoid another correction, we will assume that the result will be an increase of deflection of 7 ft. in shore span; and a decrease of deflection of 8.5 ft. in river span.

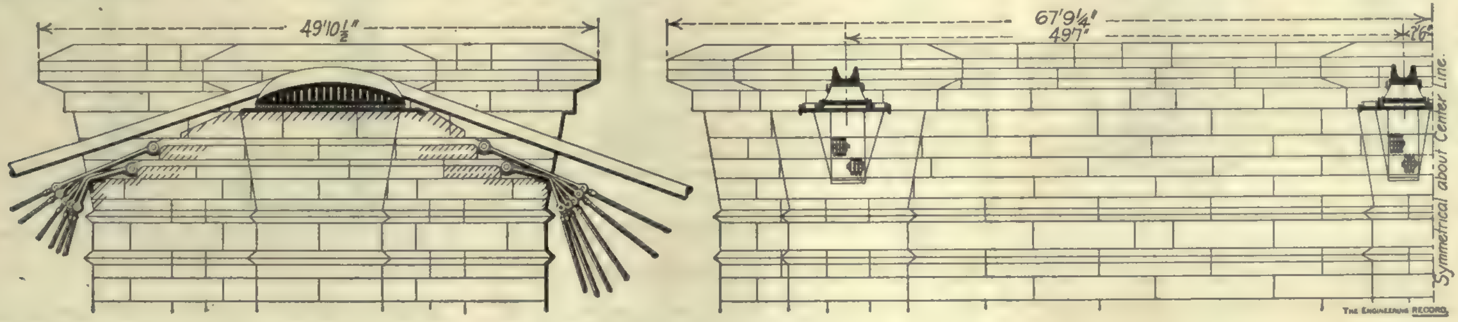
The average values for δ, h, l and L will be $\delta = 46.8$; $h = 124.3$; $l = 927.35$; $L = 1{,}600.7$.

If the motion of saddles is x we have: $d\delta = 0.98x\,(3 \times 927.35) \div (16 \times 46.8) = 3.642\,x$, and $dh = -2x\,(3 \times 1{,}600.7) \div (16 \times 124.3) = -4.829\,x$. We have then $43.33 + 3.642\,x = 0.4177\,(128.52 - 4.829\,x)$, and $x = 1.829$ ft.; $d\delta = 1.829 \times 3.642 = 6.66$ ft; $dh = -1.829 \times 4.829 = -8.33$ ft.

The effect of this decrease in h is an increase in stress in cables. The average stress per square inch was 17.5 tons for bridge unloaded. The increase will be $17.5 \times 8.83 \div 119.69 = 1.291$ tons, which will produce a stretch in cables of main span of $1.291 \times 1{,}626 \div 14{,}000 = 0.1499$ ft., and in cables of each shore span of $1.291 \times 953 \div 14{,}000 = 0.0879$ ft. The increases in deflections of spans produced thereby will be $dh = 0.1499 \times 2.41 = 0.361$ ft.; $d\delta = 0.0879 \times 3.64 = 0.320$ ft. The motion of saddles will bring these two changes into proper proportion and will make $dh = 0.50$ and $d\delta = 0.21$. The corrected changes of deflection due to loading of shore span will therefore be a rise of main span of 8.33 ft., and a drop of shore span of 6.87 ft. The corrected motion of each saddle is 1.80 ft. toward its shore span.

If the saddles are immovable the H_r remains as for empty bridge $H_r = 9{,}945$ tons, and the H_s would be 12,431 tons if deflection δ were unchanged. We found under the first kind of loading that $d\delta = 1.12$ ft. with whole bridge loaded with 1 ton per foot; H_s becomes, therefore, $H_s = 12{,}431 \times 43.33 \div 44.45 = 12{,}119$ tons, and $H_s - H_r = 2{,}174$ tons. If moving load is 1.3 tons, the pull on tower shoreward will be approximately $2{,}174 \times 1.3 = 2{,}826$ tons.

If we assume that the worst actual distribution of moving load is twice or half as much load per lineal foot on main span as on shore spans, that the largest moving load is 1.3 tons per foot, and that saddles are immovable; then the greatest pull on tower toward river is $3{,}087 - 1{,}413 = 1{,}674$ tons, and that toward shore is $2{,}826 - 1{,}543 = 1{,}283$ tons due to moving loads if, when the bridge is unloaded and the saddles immovable, cables exert no horizontal pull on towers. The pull on a tower in either direction due to changes of temperature is 337 tons if, with saddles immovable, the cables exert no horizontal pull on towers at mean temperature. The total pull due to changes of temperature and load would, therefore, be 2,011 tons toward river, or 1,620 tons toward shore. If cables exert a pull on towers shoreward of 195.5 tons when bridge is empty at mean temperature, then the maximum pulls exerted by cables on towers with the loads assumed, at extremes of temperature, will be alike in both directions and equal to 1,815.5 tons. The actual maximum pull in each direction will be near the latter value. It will probably be larger than this value in one direction, and smaller in the other.



TOP OF BROOKLYN TOWER.

The deflection of towers under the influence of the horizontal pulls exerted by cables was calculated, but was found to be so small that it can be neglected. The moment of resistance of the smaller tower (Brooklyn) at its weakest section, which is at an elevation of 148 ft. 11 ins. above mean high water, and 121 ft. below cables at saddles, is 11,360 (ft.) The unit stress per square foot on outer fibre due to bending is therefore at least $1{,}815.5 \times 121 \div 11{,}360 = 19.34$ tons per square foot.

There is at the same place a pressure of 20.3 tons per square foot due to vertical loads, 7.5 tons of this being from superstructure and moving loads and 12.8 tons from the masonry. This gives a total pressure of 39.64 tons per square foot under the circumstances mentioned above; this 39.64 tons per square foot may be regarded as the minimum probable value.

The presence of the stiffening trusses and stay system will not materially reduce the horizontal force acting at top of towers. This force was calculated for the high temperature deflection. For the low temperature deflection the force is increased more on account of diminished deflection than it is reduced by the presence of the stay system and stiffening trusses.

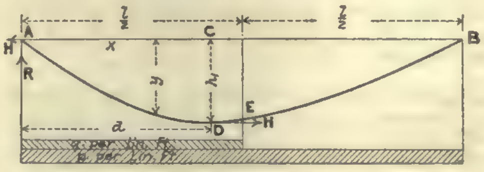
Fourth, Uniform moving load of 1 ton per foot on main span extending from one tower to center, the saddles being immovable.

To obtain first general formulas, we will assume that p is the dead load, and q the moving load per lineal foot, l the span between centers of saddles, and R the vertical reaction at loaded end. We have

$$(1)\quad R = \frac{pl}{2} + \frac{3}{8}\,ql = \frac{l}{8}\,(4p + 3q).$$

If lowest point of cables is at distance d from loaded end, we have

$$(2)\quad R = (p + q) \times d.$$



$$(3)\quad \text{Therefore } d = l\,(4p + 3q) \div 8\,(p + q).$$

Denoting by H the horizontal component of stress in cables and taking moments of forces acting on cable AD, about C we obtain:

$$Hh_1 = \frac{l^2\,(4p + 3q)^2}{64\,(p + q)} - \frac{(p + q)\,(4p + 3q)^2}{128\,(p + q)^2}\,l^2$$

$$(4)\quad \text{Whence } H = \frac{l^2\,(4p + 3q)^2}{h_1\,128\,(p + q)}.$$

The equation of parabola AE referred to A as origin is $Rx - Hy - \frac{1}{2}x^2\,(p + q) = 0$.

Substituting values for R and H from equations (1) and (4) and reducing, we obtain:

$$y = \frac{8\,h_1\,x\,(p + q)}{l\,(4p + 3q)} \left\{ 2 - \frac{8\,(p + q)\,x}{l\,(4p + 3q)} \right\};$$

$$y = \frac{16\,h_1\,x\,(p + q)\,[4p\,(l - x) + q\,(3l - 4x)]}{l^2\,(4p + 3q)^2}$$

For

$$x = \frac{l}{4};\quad y = \frac{4\,h_1\,(3p + 2q)\,(p + q)}{(4p + 3q)^2}.$$

If we introduce $h_1 = 128$ ft., $p = 4$ tons, and $q = 1$ ton, we obtain $y = 99.29$ ft. If the same load is uniformly distributed over whole span, the largest deflection h is at center. If the length of the cable in the first case is calculated and in the second case with $h = h_1$, it is found that they are very nearly alike, so that h can be taken $= h_1$. In this case the deflection at quarter of span is 96 ft. The increase of deflection at quarter by the above one-sided load is, therefore, 3.29 ft.

In the above case of one-sided loading, the equation of cables of unloaded half span is $R_1x - Hy - \frac{1}{2}\,p\,x^2 = 0$, where R_1 is reaction at unloaded ends,

$$R_1 = l\,(4p + q) \div 8.$$

Substituting values for H and R_1, we obtain:

$$\frac{1}{8}\,(4p + q)\,x - \frac{l^2}{h_1}\,\frac{(4p + 3q)^2}{128\,(p + q)}\,y - \frac{p}{2}\,x^2 = 0;$$

$$y = \frac{16\,h_1\,(p + q)\,x\,[4p\,(l - x) + q\,l]}{l^2\,(4p + 3q)^2}$$

If $x = l \div 4$; $y = 4\,h_1\,(p + q)\,(3p + q) \div (4p + 3q)^2$.

If $p = 4$, $q = 1$ and $h_1 = 128$; $y = 92.18$.

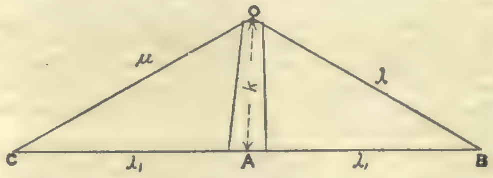
The change in deflection in comparison with that with uniform load is 3.82 ft. If q is taken $= 0.65$ tons and $p = 4$ tons, the deflection in center of loaded half span, below that with uniform load, is 2.26 ft.; and the deflection in center of unloaded half span is 2.54 ft. less than with uniform load of the same total amount. At center of span the deflection is 2⅛ ins. less with the 0.65 ton per foot one-sided load than with the same load uniformly distributed.

The largest changes in deflections of cables are therefore produced by changes of temperature and by loading either the center span or the shore spans much more than the rest of the bridge. The variations in height in center of main span due to a surplus of moving load of 1 ton per lineal foot placed either on main span or on shore spans are 8.24 ft. down + 8.33 ft. up = 16.57 ft. The variation in height due to changes of temperature is 4.6 ft. The total variation by loads and temperature is 21.17 ft. The variation in height 400 ft. from center of tower would be ¾ of 21.17 = 15.88 ft. The variation in height at center of shore spans due to a moving load of 1 ton per foot placed either on main span or on shore spans, and to temperature changes, would be 6.14 up + 6.87 down + 1.55 temp. = 14.56 ft. The corresponding motion of each saddle would be 1.54 to river + 1.80 to shore + 0.34 temp. = 3.68 ft.

If the saddles are immovable and the moving load taken = 1.3 tons per lineal foot, these changes in deflection are reduced to 3.16 temp. + 1.44 m. l. = 4.60 ft. in center of main span and to 3.18 temp. + 1.46 m. l. = 4.64 ft. in center of shore span. But there are produced horizontal forces acting at top of tower amounting to 2,011 tons toward river and 1,620 tons toward shore, if balance exists at mean temperature with bridge empty.

THE STAY SYSTEM.

The stay system, by taking a variable amount of load in shore and river spans, greatly reduces the motion of saddles and the consequent deflections, but just in the proportion that it accomplishes this purpose it will produce bending stresses on the towers; these bending stresses, however, are not objectionable as long as they are within safe limits. For the purpose of ascertaining the loads coming on stay system, and its adequacy to carry them, it is necessary to ascertain the amount of deflection produced in it by the permissible unit stresses.



The steep stays near the towers are immovably fastened at the tops of towers to the masonry. The flat stays near the ends of the stay systems are some of them fastened to the bed plates under saddles and some of them rest on saddles. The latter, unless they slide on saddles, will move with them. With the present fixed position of saddles all the stays may be considered as fixed at tops of towers The bottom chord to which stays are attached is at a grade of about 3¼%.

If the unit stress per square inch in stays is a lbs., the unit stress per square inch in bottom chords b lbs., and if we consider the stay B O C to be movable at tower; if $BO = \lambda$, $OC = \mu$; $AB = AC = \lambda_1$; E_0 = modulus of elasticity of wire ropes, and E_1 = modulus of elasticity of bottom chords; then the expansion of stay under its unit stress is $a\,(\lambda + \mu) \div E_0$, and the contraction of bottom chord under its unit stress is $b\,2\,\lambda_1 \div E_1$. The deflection at B produced by load giving, the permissible unit stresses in stay and bottom chord is

$$\delta = \frac{a}{E_0}\,(\lambda + \mu)\,\frac{\lambda}{K} + \frac{b\,2}{E_1}\,\frac{\lambda_1^2}{K},$$

K being the height A O.

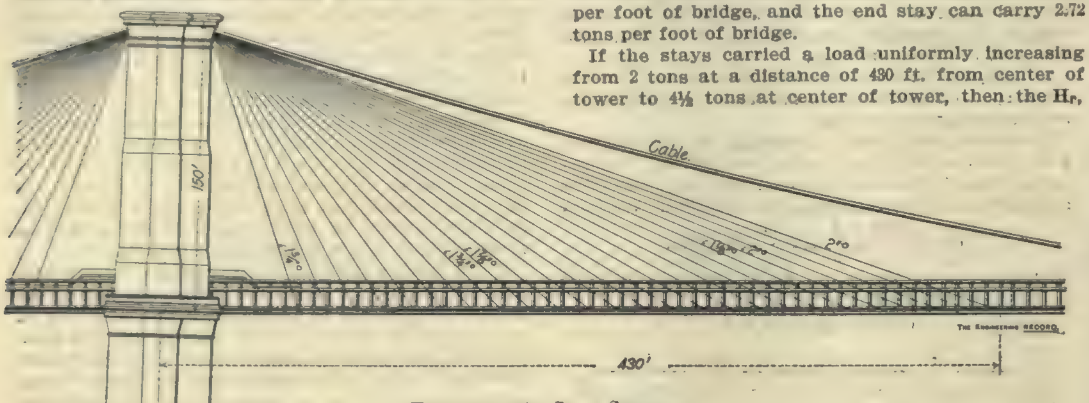
For the last stay we have: $\lambda = \sqrt{(430^2 \div 136^2)} = 451$ ft.; $\mu = \sqrt{(430^2 + 164^2)} = 460$ ft.; $\lambda + \mu = 911$ ft.; $E_0 =$

26,000,000 lbs.; $E_1 = 29,000,000$ lbs.; $a = 40,000$ lbs.; $b = 20,000$ lbs.; $K = 150$ ft.; $\delta_{430} = 5.914$ ft., if the friction is neglected.

For stays fixed at tower the formula for deflection is $\delta = (a\lambda^2 \div E_0 K) + (b\lambda_1^2 \div E_1 K)$.

We obtain from this

$$\left.\begin{array}{l} \delta_{340} = 1.915 \text{ ft.} \\ \delta_{250} = 1.134 \text{ ''} \\ \delta_{160} = 0.596 \text{ ''} \\ \delta_{70} = 0.298 \text{ ''} \end{array}\right\} \text{Values being for river span.}$$



ELEVATION OF STAY SYSTEM.

The drop of free cables from highest position at these points is obtained as follows: Equation of cable in main span with vertex at origin is $y = 4\,h\,x^2 \div l^2$; h being the dip, and l the span. The equation of this same cable with origin at point $x = \frac{1}{2}\,l$, $y = h$, is $y = 4\,h\,x\,(l - x) \div l^2$. If $\Delta\,y$ and $\Delta\,h$ are corresponding changes of y and h, we have

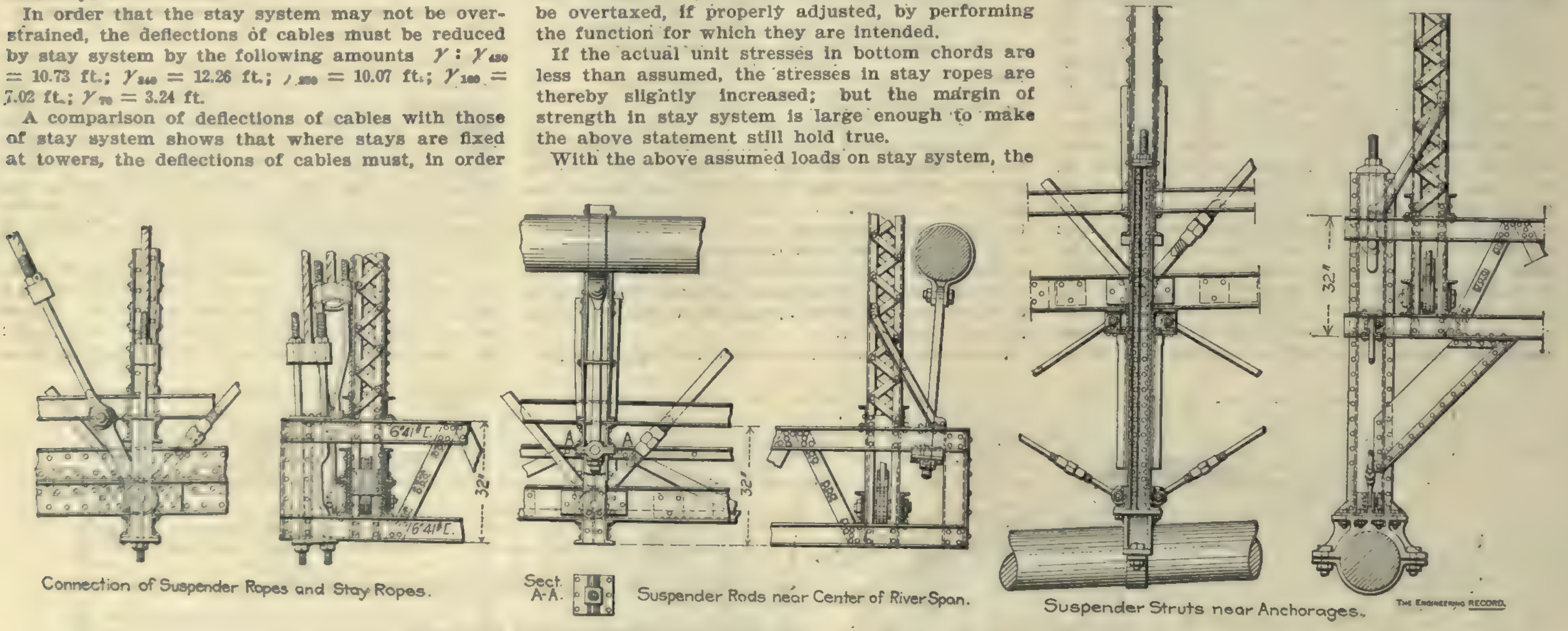
$$\Delta\,y = \frac{4\,\Delta\,h}{l^2}\,x\,(l - x).$$

If we make $\Delta\,h = 21.17$ ft., the largest change in deflection at center, then $\Delta\,y$ is the corresponding change in deflection at other points of cable. By introducing for x numerical values, we obtain $\Delta\,y_{430} = 16.64$ ft.; $\Delta\,y_{340} = 14.17$ ft.; $\Delta\,y_{250} = 11.20$ ft.; $\Delta\,y_{160} = 7.62$ ft.; $\Delta\,y_{70} = 3.54$ ft. These deflections, because of the movements of saddles, are only approximately at the same places as corresponding deflections of stays.

The deflection $\delta_{430} = 5.914$ ft. would be correct with no friction of saddles, and if the point of attachment in shore span did not change its elevation. It will rise under the load assumed and δ_{430} will thereby be increased. This applies to some of the last stays on all cables.

In order that the stay system may not be overstrained, the deflections of cables must be reduced by stay system by the following amounts γ: $\gamma_{430} = 10.73$ ft.; $\gamma_{340} = 12.26$ ft.; $\gamma_{250} = 10.07$ ft.; $\gamma_{160} = 7.02$ ft.; $\gamma_{70} = 3.24$ ft.

A comparison of deflections of cables with those of stay system shows that where stays are fixed at towers, the deflections of cables must, in order not to overstrain the stay system, be reduced to from 7.9% to 13.5% of the amounts that would exist without stay system. The reduction takes place partly by diminution of H_r, in consequence of diminution of load on cables, partly by increase of H_s, and partly by local diminution of load on cables. The former has the effect of diminishing motion of saddles and consequent deflection throughout whole span, while the latter locally straightens the cables and diminishes local deflections.



Connection of Suspender Ropes and Stay Ropes.

Suspender Rods near Center of River Span.

Suspender Struts near Anchorages.

DETAILS OF CONNECTIONS OF SUSPENDERS AND FLOORBEAMS.

The stays are attached to bottom chords at 15 ft. distance from each other. The eight ropes nearest towers are 1¾ ins. diameter, and of 100 tons ultimate strength; the next 12 are 1⅞ ins. diameter, and of 112 tons strength; and the last five are 2 ins. diameter, and of 134 tons strength. The sockets at ends of ropes have about 90% of the strength of the ropes. The ultimate strengths of the socketed stay ropes are, therefore, respectively, 90, 100 and 120 tons. With a factor of safety of 4, they would then safely carry 22.5, 25 and 30 tons.

Every 15 ft. there are four stays transversely to the bridge, or an average of one every 3¾ ft. of bridge. Where they are nearly vertical, the stays could therefore safely carry the whole load. At the first 1⅞ ins. diameter stay, attached to bottom chord 190 ft. from center of tower, the dead load can be carried. At the last 1⅞ ins. diameter stay, attached to bottom chord, 355 ft. from center of tower, 2.73 tons per ft. of bridge can be carried. The next stay, 2 ins. diameter, can carry 3.12 tons per foot of bridge, and the end stay can carry 2.72 tons per foot of bridge.

If the stays carried a load uniformly increasing from 2 tons at a distance of 430 ft. from center of tower to 4½ tons at center of tower, then the H_r, would be reduced by $430^2\,(1 + {}^5/_{12}) \div 128 = 2,046$ tons. If the stays in shore span are relieved in the same manner, the H_s, is increased by about 1,396 tons. This gives a total change in pull at tower of 3,442 tons. The changes in moving load and temperature with saddles fixed, produce a variation of 3,499 tons. This is reduced by stay system to 57 tons. The motion of saddles would, therefore, be practically prevented by the stay system, with the loads assumed on stays.

This and the straightening out of curve of cable over stays would bring the cables higher than is necessary to throw on the stays the loads assumed. The stays might be so adjusted that, with free saddles, they would be slack under those conditions of loading and temperature which give them the smallest amount of load; in this case the stresses in them for the most unfavorable load and temperature would be much reduced. The stay ropes and sockets are, therefore, strong enough not to be overtaxed, if properly adjusted, by performing the function for which they are intended.

If the actual unit stresses in bottom chords are less than assumed, the stresses in stay ropes are thereby slightly increased; but the margin of strength in stay system is large enough to make the above statement still hold true.

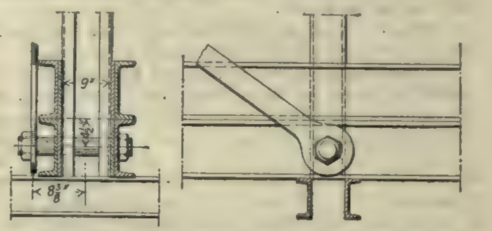
With the above assumed loads on stay system, the stress in bottom chords at tower would be $430^2 \times 1.4167 \div 150 = 1,746$ tons. The combined area of the four bottom chords at cables is 254 sq. ins. The stress per square inch in bottom chords from stay action is, therefore, 6.875 tons. This is moderate, and entirely safe.

The above assumes that all the connections are properly designed. The sections and stresses in other parts of bottom chords would have to be investigated in a similar manner to judge their adequacy. This is, however, not necessary, since extremely defective connections are the weak point in stay system and make it entirely inadequate to perform its function, if the saddles are free to move.

The bottom chords are double. The lower part alone will here be considered, since the upper part is so eccentrically connected as to be useless for the present purpose, the lower part itself is so eccentrically connected to stays as to increase the maximum compression produced in this chord by one stay to 4.72 times the amount that would be produced by a centric connection of stay. The pull of stay is applied by means of a bar to a pin in lower half of bottom chord, which consists at point selected of 4 9-in. channels, 70 lbs. per yard, and 4 plates 9 x ⅞ ins., riveted to webs of channels. The pull of stay is decomposed into two components, one P in direction of chord, and the other in direction of post. The distance of point of application of force P from vertical center line of chord is 8⅜ ins., and from horizontal center line 4½ ins. The force can therefore be replaced by a centric force P and by two couples of moments P × 4½ ins. and P × 8⅜ ins. If the total area is A, the moment of resistance around a horizontal axis through center of chord is A × 3 ins. The moment of resistance of the section around the vertical axis is A × 3.76. The pressure per square inch produced by force P is

$$\frac{P}{A}\left(1 + \frac{4.5}{3} + \frac{8.375}{3.76}\right) = \frac{P}{A}\,4.726$$

The pressure per square inch by a centric force P is P ÷ A. This pressure 4.726 P ÷ A is in one corner of the section only, and does not extend through the whole length of panel. The vertical moments are much less in the succeeding panels, but the horizontal moments continue almost undiminished through the panel points, since there is no effective connection between the two sides of chord to right and left of vertical center line. This eccentric connection of stays is undoubtedly the main cause of the failure of some of these chords three years ago.



The 1¾-in. diameter stay ropes are connected with bottom chords by means of two 1¾-in. diameter steel rods, of 70,000 lbs. per square inch ultimate strength and 40,000 lbs. elastic limit. These rods are 7 ins. apart center to center, where they pass through sockets and are bent so that their lower ends are 2½ ins. apart center to center. They are therefore each 2¼ ins. out of line where they are both bent the same amount, which is not always the case. There is, therefore, acting on each rod beside the tension ½ P a moment ½ P × 2¼ ins. The moment of resistance of 1¾-in. diameter rod is 0.525 (ins.), and the area of rod is 2.405 sq. ins. The stress per square inch due to bending is therefore ½ P × 2.25 ÷ 0.525 = 4.286 P ÷ 2. The stress per square inch due to tension is P ÷ (2 × 2.405) = ½ P 0.416. The total stress per square inch is, therefore, 4.7 P ÷ 2.

The 1¾-in. diameter wire ropes with which these rods connect have an ultimate strength of 100 tons and an elastic strength of at least 80 tons. The rods have an elastic limit of 20 tons per square inch. This gives for the two rods an elastic strength of 96.2 tons. A force of 80 tons, equal to elastic strength of stay, would produce in the rods a stress of 80 × 4.7 = 376 tons, equal to 3.91 times their elastic strength. Where the two rods are bent the same amount they would, therefore, by a large stress, be bent into shapes which give a smaller maximum stress per square inch.

The weakness of connections is a feature of frequent occurrence in the design of this bridge, and makes a reliable estimate of its strength, without correct drawings, very laborious, since it necessitates many measurements at the bridge.

The Stiffening Trusses at Stay Systems.—In the calculation of stay system we have neglected the presence of stiffening trusses for the purpose of not complicating the argument. The stiffening trusses offer resistance to changes in deflection by changes of load and temperature, and, therefore, assist stays to some extent and diminish the stresses in them. We will first ascertain whether the stiffening trusses can, without excessive stress, follow the deflections of stay system.

There are four trusses 17 ft. high, center to center of chords, and two trusses 8 ft. 9 ins. high. If we consider the trusses as girders, neglecting the deformation of webs; if we assume them fixed at towers and acting as cantilevers when the stay system goes up or down; if the unit stresses in chords with the largest bending are uniform throughout the length of the trusses—all of which are approximately true—then the stiffening trusses will bend in circles. If a is the unit stress in chords, E the modulus of elasticity, and r the radius of circle of top chord produced by bending, then we have $\frac{1 + (a \div E)}{1 - (a \div E)} = \frac{r}{r - h}$ where h is the height of truss, center to center of chords; $1 + (a \div E)$ = length of top chord after bending downward, if original length is 1, and $1 - (a \div E)$ length of bottom chord after bending.

From this equation we obtain $r = h (a + E) \div 2 a$. We find from this the deflection δ at distance x from center of tower to be closely approximate to $\delta = a x^2 \div h (a + E)$, or to $a x^2 \div E h$. The deflection δ is sometimes upward and sometimes downward; therefore the total variation in height of a point distant x from center of tower is $2 \delta = 2 a x^2 \div h (a + E)$, or $2 a x^2 + h E$.

The pressure in bottom chord from stays we found to be somewhat less than 14,000 lbs. per square inch. This 14,000 lbs. would itself produce practically the same deflection as a tension of 7,000 lbs. in one chord and a compression of the same amount in the other chord. The deflections produced in a deep stiffening truss by a compression of 14,000 lbs. per square inch in bottom chord are: $\delta_{70} = 0.670$ ft.; $\delta_{160} = 0.363$ ft.; $\delta_{250} = 0\ 887$ ft.; $\delta_{340} = 1.640$ ft.; $\delta_{430} = 2.624$ ft., if in formula $\delta = a x^2 \div h E$ we take a = 7,000 lbs. per square inch; E = 29,000,000 lbs. per square inch, and h = 17 ft.

If we subtract these deflections from the corresponding ones of stay system, we obtain the deflections γ produced by loads carried by stiffening truss; $\gamma_{70} = 0.298 - 0.070 = 0.228$ ft.; $\gamma_{160} = 0.596 - 0.363 = 0.233$ ft.; $\gamma_{250} = 1.134 - 0.887 = 0.247$ ft.; $\gamma_{340} = 1.915 - 1.640 = 0.275$ ft.

The total variations in height produced by up and down bending giving unit stresses of 5,000 lbs. per square inch are; $\beta_{70} = 0.099$ ft.; $\beta_{160} = 0.518$ ft.; $\beta_{250} = 1.267$ ft.; $\beta_{340} = 2.343$ ft.; $\beta_{430} = 3.748$ ft., if in formula $2 \delta = 2 a x^2 \div h E$ we take a = 5,000 lbs. per square inch, and E and h as before.

These deflections are more than necessary to follow the stay system, except 70 ft. from tower at the first stay and for some distance beyond. The stiffening trusses will relieve the stays in this neighborhood of part of their work and make their deflection less; the trusses are abundantly able to do this without stresses due to the bending of more than 5,000 lbs. per square inch. The total compression in bottom chords of stiffening trusses will therefore not exceed 19,000 lbs. per square inch, and the tension will not exceed 5,000 lbs. per square inch. The top chords will have stresses less than ± 5,000 lbs. The deformation of diagonals, here neglected, will diminish the stresses given above, since this deformation makes the stiffening trusses more flexible.

We see, therefore, that the stiffening trusses can follow the deflection of stays without excessive stresses, and that they are much more flexible than the stay system, except near towers. The local stiffening, as far as the stay system extends, is, therefore, mostly done by it and not by the stiffening trusses. If separate struts should be provided to take up the horizontal components of stresses in stays, the stresses in bottom chords of stiffening trusses would then be relieved to the extent of about 7,000 lbs. per square inch.

Stiffening Trusses in Center of Main Span between Stay Systems.—In the center of main span, between the stay systems, there are, for a length of 740 ft., stiffening trusses with center hinges. The ends of these trusses are continuous with those at stay system. The stay system, especially with fixed saddles as at present, is very rigid in comparison with stiffening trusses. The latter are, therefore, nearly fixed in direction and position as far as stay system extends, and will bend much more under the influence of unequally distributed moving loads where they are free, in center half of main span. They approximate trusses held fixed in direction and position, at a point a short distance toward tower from end of stay system. If they were fixed at stays, and the center held at even height, they would bend in such curves that the points of contraflexure would be near the fixed ends of trusses.

These points of contraflexure will travel somewhat with change in position of moving load. At the points of contraflexure the moments are zero. The truss between the two points of contraflexure near the ends of stay system has stresses equal to those in a truss with hinges at these points. Actual trial of various positions of these hinges shows that as long as they are reasonably near the correct ones, their position does not strongly influence the largest chord stresses in trusses. This is due to the stiffening truss decreasing in stiffness as the span considered increases, thus causing the load per foot distributed by it to become smaller, and that by the cable to become larger. We can, therefore, assume these points to be fixed in position and 740 ft. apart, at equal distances from center of main span; that is, we can calculate the stresses in stiffening trusses as if the trusses were 740 ft. long, with center and end hinges, and supported by cables of the same shape as the actual cables of the 740 ft. in center of main span. The dip of these cables for the 740 ft. is $128 \times 370^2 \div 800^2 = 27.4$ ft.

If the stiffening trusses would not deflect under the influence of moving loads, the cables would remain parabolas, the suspender pulls would be uniform over whole span, and the formulas in this case are too well known to need further proof.

The maximum moment for above condition is $M_{max} = 0.1506\ w L^2 \div 8$ and it occurs for $x = 0.234$ L when the moving load extends over 0.395 L from loaded end; w being the moving load per foot, x the distance from loaded end to point at which maximum moment occurs, and L the total span considered. If the rest of span alone is loaded, an equal moment of opposite sign occurs.

If we take w = 1.3 tons and L = 740 ft., we obtain $M_{max} = 13{,}396$ foot-tons. There are four stiffening trusses of 17 ft. depth and two of 8 ft. 9 ins. depth center to center of chords, and each chord section is equivalent to 15.8 sq. in. gross. The moment of resistance of all the stiffening trusses combined is $(126.4 \times 102^2 + 63.2 \times 52.5^2) \div 102 = 14{,}600$ (inches). The maximum stress per square inch in chords is therefore $13{,}396 \times 12 \div 14{,}600 = 11.010$ tons.

This would be the case if the suspender pulls over the whole span were uniform. The stiffening trusses deflect under loads and the cables will therefore also deflect. The suspender pulls in cables over the loaded part of span will be larger than over the unloaded part. There remains a smaller load to be distributed by stiffening trusses than would have to be distributed by them if the suspender pulls were uniform over whole span.

If we assume half the span loaded and the other half unloaded, with the suspender pulls in cables uniform over loaded half span and uniform, but smaller, over unloaded half span, we can then calculate the difference in suspender pulls in both half spans, and therefore the remaining moving load to be distributed by stiffening trusses, by equating the deflections of cables and stiffening trusses at the center of unloaded half span.

We found for deflection y_1 of cables at center of heavier loaded half span for $x = \frac{1}{4}\ l$; $y_1 = 4 h (3 p + 2 q) (p + q) \div (4 p + 3 q)^2$, where p is the load per linear foot horizontal of cable in one-half span, p + q that in the other half span, and h is the dip of cables. If y_2 is the deflection at center of half span with uniform load equal to $p + \frac{1}{2} q$ over whole cable, we have $y_2 = \frac{3}{4} h$. If we let $q \div p = t$ we obtain: $y_1 - y_2 = h t (2 + 5/4\ t) \div (4 + 3 t)^2 = \delta$. From this equation we obtain

$$t = \frac{12 \delta - h \pm \sqrt{h (h - 4 \delta)}}{5/4\ h - 9 \delta}$$

and since δ is very small in comparison with h we have approximately (by using plus root) $t = 10\ \delta \div (5/4\ h - 9 \delta)$.

If the moving load covers half the span of stiffening trusses and is $(2 p_1 + q)$ per linear foot of load, then the total moving load on bridge is $\frac{1}{2}\ l\ (2 p_1 + q)$. If $2 p_1 l \div 2$ is uniformly distributed over cables by trusses, it will produce a load p_1 per foot of bridge. If p_2 is the dead load and if $p_1 + p_2 = p$, then the load on cables in one-half span is p, and in the other half span p + q, as above. The resultant forces acting on stiffening trusses are p_1 per linear foot downward in one-half span, and upward in other half span. The deflection of stiffening trusses under this load is, at center of half span, $\delta = p_1 l^4 \div 921.6\ E\ I$, where l = length of half span in inches, E = 29,000,000 lbs.; I = moment of inertia of stiffening trusses = 1,489,000 (inches).

We had above $t = q \div p = 10\ \delta \div (5/4\ h - 9\ \delta)$. From this we obtain $\delta = 5/4\ h\ q \div (10\ p + 9\ q)$.

We have, therefore, $p_1 l^4 \div 921.6\ E\ I = 5/4\ h\ q \div (10\ p + 9\ q)$.

If we introduce $w = 2 p_1 + q$; $q = w - 2 p_1$; $p_1 + p_2 = p$, we obtain from last equation by solving it for p_1:

$$p_1 = \frac{(10 p_2 + 9 w)\ l^4 + 2{,}304\ h\ E\ I}{16\ l^4} \pm \sqrt{\left(A^2 - \frac{144\ h\ w\ E\ I}{l^4}\right)}$$

(The A under the radical sign in this equation is the fraction forming the first term after the sign of equality.)

By introducing, $p_2 = 8{,}000$; $w = 2{,}600$; $l = 370 \times 12 = 4{,}440$ in.; $E = 29{,}000{,}000$; $h = 27.4 \times 12 = 328.8$ in.; $I = 1{,}489{,}000$ (inches), we obtain $p_1 = 599$ lbs.

The moving load $2 p_1$ distributed by the stiffening trusses is therefore 1,198 lbs. per linear foot. The remainder is distributed by cables. The stress per square inch in chords of stiffening trusses at the point of maximum moment, a distance of 196.8 ft. from center of main span, is therefore $11.010 \times 1{,}198 \div 2{,}600 \pm 5.074$ tons.

Stresses in Stiffening Trusses and Center Suspenders Due to Drop of Cables in Center in Consequence of Rise of Temperature and Preponderant Moving Load on Main Span.—We found that the maximum temperature change and a full moving load of 1.3 tons per foot on main span will increase the deflection at center of main span 4.53 ft. over that of empty bridge at lowest temperature, if saddles are stationary and if stiffening system is absent. The stay system will permit very little deflection in outside quarters of main span, and the deflection at center will thereby be increased. It is estimated to be 5.5 ft. The deviation from a mean position is then 2.75 ft.

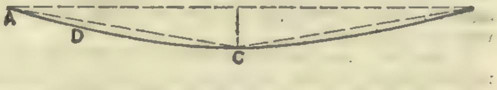
If cables are so adjusted as to form unbroken curves over center of main span at mean temperature and with half the maximum moving load on main span, they will, with full load and maximum temperature, be inclined downward toward center, and will produce there a much increased suspender pull. For calculating this suspender pull it is necessary to know the angle formed by the cables of the two half spans meeting at center of span.

They are connected with the stiffening trusses by short suspenders of large section. The deformation of these suspenders may be neglected. The change in deflection of cables will, therefore, be the same as that of stiffening trusses. The latter will drop at ends of stay system about 0.75 ft. by the stress in stays produced by rise in temperature and increase of moving load above the mean. The drop in center is 2.75 ft., the drop in the 370 ft. from end of stay system to center of span is, therefore, about 2 ft.

The point of contraflexure of stiffening trusses, after the drop in center has occurred, should be known before the curve which it will form can be calculated. For determining this the following considerations will be helpful. If the bridge is properly adjusted, the cables are parabolas over the 740 ft. in center of main span for mean load and mean temperature. After the drop in center, due to increase of moving load and temperature, has occurred, they would be parts of two different parabolas if the stiffening trusses remained straight; the suspender pulls will, therefore, be approximately uniform over the lengths free from stays.

The increase in suspender pull at each of two center floorbeams will have the effect of decreasing suspender pulls in adjacent 370-ft. spans, and will also produce a pull with equal vertical component at ends of these spans, in the last stays. The trusses in the two 370-ft. spans will thus have to carry part of the load to their ends, where it will be taken by suspenders at center floorbeams to cables and by the last stays to towers.

These trusses for 370-ft. length from center will be acted upon by approximately uniform load and will bend downwards in their centers, one end dropping 2 ft. more than the other. If, after the drop has occurred, a tangent is drawn to curve of center line of stiffening truss (which was assumed straight at mean temperature and load) from the end of this curve at center hinge C, then the point of contraflexure D would be between the point C and the point A, where this tangent touches curve, and AD would be ¼ AC. The point A will be near end of stay system. We will take CD = 300 ft. D will be approximately $2 \times 300 \div 370 = 1.622$ ft. above C.



The moment at D will be zero. The equation of curve DC will be

$$\frac{d^2 y}{dx^2} = \frac{M}{E\ I}$$

where M, E and I have the same meaning as before, and DC is the axis of x. I is the moment of inertia of all the six stiffening trusses combined, as all stiffening trusses must deflect the same amount since they are connected by floorbeams.

If the unknown uniform load carried by stiffening trusses to center of main span and end of stay system is p per linear foot, and if the span of 300 ft. between point of contraflexure and center of main span is l, then the reactions at D and C will be each ½ p l, and we obtain $M = p \frac{l}{2} x - p \frac{x^2}{2} =$ ½ plx − ½ px².

Therefore $$\frac{d^2 y}{d x^2} = \frac{p}{2 E I} (l x - x^2)$$

$$\frac{d y}{d x} = \frac{p}{2 E I} \left(\frac{l x^2}{2} - \frac{x^3}{3} \right) + C$$

for $$x = \frac{l}{2}, \frac{d y}{d x} = 0 \text{ and } C = - \frac{p l^3}{24 E I}$$

Therefore $$\frac{d y}{d x} = \frac{p}{24 E I} (6 l x^2 - 4 x^3 - l^3)$$

For $$x = l, \frac{d y}{d x} = \frac{p l^3}{24 E I}$$

The angle of axis of x (CD) with the horizontal is α, where $\tan \alpha = \delta \div l$, if δ is the deflection of C below D. The angle with the chord CD of the tangent to the curve CD at C is β where $\tan \beta = p l^3 \div 24 E I$. The angle of the last tangent with the horizontal is χ and for small angles $\tan \chi = \delta \div l - p l^3 \div 24 E I$. The angle χ is also that of the tangent to cable at center with the horizontal.

If H is the horizontal component of stress in cables, we have $\frac{1}{2} p l = H \tan \chi$; $\tan \chi = p l \div 2 H$. Therefore $p l \div 2 H = \delta \div l - (p l^3 \div 24 E I)$, $\frac{1}{2} p l = \delta H \div l \left(1 + \frac{H l^2}{12 E I}\right)$. ½ p l is the end reaction of 300-ft. span, or the pull at all the four suspenders of each center floorbeam produced by the drop of cables in center due to increase of load and temperature. If we introduce numerical values we have $H = 5.3 \times 1{,}598^2 \div 8 \times 130 = 13.010$ tons; $\delta = 1.622 \times 12 = 19.464$ in.; $l = 300 \times 12 = 3{,}600$ in.; $E = 14{,}500$ tons; $I = 1{,}489{,}000$ (in.);

$$\frac{p l}{2} = \frac{19.464 \times 13{,}010}{3{,}600 \left(1 + \frac{13{,}010}{14{,}500} \times \frac{3{,}600^2}{12 \times 1{,}489{,}000} \right)} = 42.6.$$

If we take l = 370, $\delta = 2$ ft., and assume the point of contraflexure at end of stay system, we obtain

$$\frac{p l}{2} = \frac{24 \times 13{,}010}{370 \times 12 \left(1 + \frac{13{,}010}{14{,}500} \times \frac{370^2 \times 12^2}{1{,}489{,}000} \right)} = 35.34.$$

A considerable error in locating the point of contraflexure has, therefore, not very much influence on the result.

If the saddles move, the deflection in center is considerably increased, and the suspender pull at center of span due to this deflection is increased in proportion. The results here given are the lower limit of the actual stresses.

The chord stress in stiffening truss from above cause, if the point of contraflexure is taken 370 ft. from center of main span, becomes at point where largest stress from moving load occurs, 35.34 × 370 × 12 × 0.2489 ÷ 14,600 = 2.675 tons.

Since $M = \frac{1}{2} p l x - \frac{1}{2} p x^2, = \frac{1}{2} p x (l - x); = \frac{1}{2} p \times 2 \times 0.234 l (l - 2 \times 0.234 l); = \frac{1}{2} p l \times l (0.468 \times 0.532); = 35.34 \times 370 \times 12 \times 0.2489; = 39{,}000$ in.-tons; $S = M \div R = 39{,}000 \div 14{,}600 = 2.675$ tons per square inch gross.

This stress does not occur for quite the same loading as the largest moving load stress; if we add it to the latter, we obtain a total stress which is slightly too large. This total is 7.75 tons per square inch gross; as the chord splices are of equal strength with the main section, this stress is entirely safe.

The largest shear is at ends of stiffening trusses, and is $S_{max} = w l \div 6 = 1{,}198 \times 740 \div 6 = 147{,}700$ lbs. in all the six trusses due to moving load. The shear due to drop in center is 35.34 tons. The total of both is 218,400 lbs. The shear in one high truss is 218,400 ÷ 4.53 = 48,220 lbs. In each of the two systems of diagonals the shear is 24,110 lbs. The stress is 24,110 × 1.333 = 32,200 lbs. There is 2 sq. in. cross-section. The stress per square inch is 16,100 lbs., which is quite safe.

If the stay system were absent we would have the stiffening trusses acting as cantilevers for some distance beyond towers. We would obtain approximately the stresses in stiffening trusses by assuming stiffening trusses with 3 hinges of 1,500-ft. span, and suspended from cables of 112.5-ft. dip. This would give, with 2,600 lbs. moving load per lineal foot, a load of 436 lbs. per foot distributed by the trusses, with the remainder distributed by cables.

The stress per square inch in chords would then be 15,200 lbs. due to moving load alone. The temperature stresses would be much reduced. The unequally distributed moving load would, for this long span, be much less than 2,600 lbs. The total stress per square inch in chords of stiffening trusses with stay system absent and saddles fixed would, therefore, be somewhat less than under present conditions. This indicates that the imperfect fixing of position of stiffening trusses near ends of stay system will not much modify the maximum stresses in the same, and our calculations are, therefore, approximately correct.

The Secondary Stresses in Cables Due to Change of Curvature.—At center of span, at high temperature, and with main span loaded, the cables are drawn down by stiffening trusses. If, at mean temperature, and with mean load, the cables form parabolas without angle at center, as they should, there will be angles at center at high temperature and full load. We have previously calculated the angle γ of cables at center of main span with the horizontal; 2γ is the angle of the two half spans of cables with each other at these points. We had tan. $\gamma = 35.34 \div 13{,}000 = 0.00272$. For small angles the arc and tangent are approximately equal, therefore $\gamma = 0.00272$, and $2 \gamma = 0.00544$.

The bending of cables will produce a stretch of wires at outside of bend and a consequent increase in stress. The wrapping of cables is not tight enough to make the cables act as solid bars, and the wires will slide upon each other. There will, however, be friction between the wires, offering resistance to this sliding. We will call the friction on one lineal inch of wire a × f where a is the area of wire. The friction per square inch of wire on one lineal inch is therefore f.

If r is the radius of cable, and α the arc produced by local bending of cable, then $r \alpha$ is the lengthening of the wires, at outside of bend, due to bending. The wires at inside of bend are shortened the same amount.

The lengthening of the wires locally increases the tension and produces sliding from both sides. If the final increase of tension per square inch of wire at bend is x, the sliding of wires upon each other will extend over a length l at each side of bend where $l = x \div f$, or $l f = x$, since the friction per square inch of wire in the length l, or l f, must be equal to the increase of tension per square inch of wire at bend. The increase in tension due to a short bend is, therefore, zero at a distance l from bend, and x at bend. The average increase of tension in the length 2 l is ½ x.

The stretch in consequence of this increase of tension is $\frac{1}{2} x \, 2 l \div E = x l \div E$. This must be equal to $r \alpha$; therefore $x = r \alpha E \div l$. If we introduce for l the value $x \div f$, found above, we obtain, after solving equation for x, $x = \sqrt{r \alpha E f}$.

This would give the secondary stress if there were either one suspender at center or if there were two at a distance apart larger than 2 l. In the latter case γ would have to be used instead of α.

If r = 7.75 in.;
$\gamma = 0.00272$;
E = 28,000,000;
f = 1,333;

Then x will = 28,050 lbs. per square inch, and l becomes 28,050 ÷ 1,333 = 21.05 in. The distance apart of the two suspenders in center is 33 in., which is less than 2 l; therefore the above formula does not apply.

In our case, where there are two center suspenders 33 in. apart, the wires will keep their relative position at center point between the two center suspenders, and the total stretch of wires at outside of bend will take place over a length of (l + 16.5 in.) in each direction.

If the increase in stress per square inch at bend is x, the average increase in the length l is ½ x. The increase in stress per square inch in wires at outside of bend in center between the two suspenders is x − 16.5 f, and the average increase in stress per square inch in the 16.5 in. toward center is x − 8.25 f. The stretch of the wires at outside of bend is, therefore,

$$\frac{x l}{2 E} + \frac{x - 8.25 f}{E} 16.5 = \gamma r.$$

If we introduce $l = \frac{x}{f}$, we obtain, after solving for x,

$$x = f\left[-16.5 + \sqrt{\left(544.5 + \frac{2 \gamma r E}{f} \right)} \right]$$

If we introduce above values for f, γ, r and E, we obtain x = 28,600 lbs. per square inch.

In regard to f, the statement has been made that the friction of 10 ft. of a wire in the cables is equal to the strength of the wire. The strength of the wire is at least 160,000 lbs. per square inch, and f is therefore at least 160,000 ÷ 120 = 1,333 lbs. per square inch, per inch of length.

The value of f depends on the tension in wrapping wires, on their size, and on the coefficient of friction of steel wires on steel wires. The wrapping wires are soft iron, of No. 10 B. W. G. The ultimate strength of iron wire varies according to hardness, from 45,000 lbs. to 100,000 lbs. per square inch. The strength of the wrapping wire, since it is soft, is, therefore, probably near the lower limit.

The average stress in the wrapping wire on the cables can hardly be more than 20,000 lbs. per square inch; it is very difficult to obtain a uniform stress in the wrapping wire with the machine used, and the attempt to obtain a larger average stress would have resulted in frequent breakings of the wire during wrapping.

The wrapping wire is 0.134 in. diameter. If it is closely wrapped it is equivalent in tensile strength to a solid shell of 0.134 × 0.7854 = 0.10523 in. thickness. This gives a pull in wrapping of 2,105 lbs. per lineal inch of cable, and a pressure in cable of 2,105 ÷ 7.75 = 271.6 lbs. per square inch of longitudinal section.

The No. 7 wires of cables are 0.18-in. diameter. The pressure on each wire per lineal inch is 271.6 × 0.18 × 3.1416 = 153.5 lbs. The area of each No. 7 wire is 0.025447 sq. ins.; the pressure on one lineal inch of it per square inch of wire is, therefore, 153.5 ÷ 0.025447 = 6,034 lbs.

To give a friction of 1,333 lbs. per 1 lineal inch per square inch of wire the coefficient of friction must, therefore, be 1,333 ÷ 6,034 = 22.1%. This shows, if the tension in wrapping wires is the largest practicable, that f = 1,333 lbs. is probably not far from the correct value for f.

The cables are said to have been oiled when made, but the oil would be forced out from the small surfaces along which the wires touch. The coefficient of 22.1% may, therefore, fall below the actual friction. All that can be positively said is that f may be as large or even larger than assumed; and that the secondary stress in cables at center of span with bridge fully loaded may be 28,600 lbs. per square inch or even more.

With a total load of 10,600 lbs. per foot on bridge, the cables carrying the whole load, the stress per square inch in cables at center of span is $A = 5.3 \times 1{,}596^2 \div (8 \times 130 \times 580) = 22.38$ tons. The stay system at high temperature carries considerable load and may reduce this stress in cables as much as 10%. The total stress in cables at center of span is, therefore, estimated at 69,000 lbs. per square inch, inclusive of the secondary stress due to local bending. This calculation is only roughly approximate, and the actual stress may be considerably larger or smaller than 69,000 lbs. per square inch; but it does show that large (though not accurately known) secondary stresses must exist in the cables at the center of span.

The actual factor of safety in the cables is reduced by the secondary stresses above calculated from 3.3, which is about what it is if the secondary stresses are neglected, to about 2.3. If the saddles were made movable, without accompanying this change by the suggested improvement in stay system, the secondary stresses in cables would be made still larger and might become dangerous.

The nature of the design makes it impossible to calculate the secondary stresses in cables with the desirable degree of accuracy. Both the uncertainty and the large amount of these stresses are caused mainly by the tight wrapping of the cables near the center of main span. If this wrapping were removed for a length of 18 ft., and replaced by steel shells which would keep out the water while permitting free sliding of the wires, these secondary stresses would become much more certain in amount and only about one-fifth as large as they were computed above.

There are secondary stresses of considerable size in cables near saddles also, but in consequence of the presence of stay system, which greatly reduces changes of deflection near towers, these secondary stresses are much smaller than those at center of bridge. The secondary stresses at towers can, however, be lessened by the same means suggested for the center of span, unwrapping a short section of each cable.

Besides the secondary stresses above calculated, there are other secondary stresses, due to the bending of the individual wires, which make the stress per square inch different in different parts of the cross section of each wire. With the existing design, we do not find it practicable to calculate these stresses, but we estimate, by assuming their curve to be a circle, that they amount to about 2,000 lbs. per square inch. By using cast steel sleeves around cables at center of main span the least radius for this bending can be so fixed by the design of the sleeves that the stress due to the bending of the individual wires becomes moderate in amount and easily calculable.

The secondary stresses above are due to changes of temperature and to moving loads. Other secondary stresses, due to wind pressure, also occur in the cables at the middle of main span. This is due to the wind pressure causing a horizontal deflection of the bridge, and to this deflection, because of the slip joints at the middle of span, causing a local horizontal bending of the cables. These secondary stresses from wind combine with those from load and changes in temperature and increase the total stress in the cables at this point.

The calculation of the secondary stresses due to wind pressure would require a calculation of the lateral deflections. This presupposes a knowledge of the lateral system of bridge. The sketch of the lateral system obtained from the Bridge Department is not only incorrect in what it does show, but even if it were correct it is not complete enough to give the necessary information. Extensive measurements at bridge and many sketches would have to be made to obtain the data for these calculations. They would also be very complicated and would take much more time than is available. The secondary stresses in cables due to wind pressure cannot therefore be given in our report. These stresses also would be greatly reduced by the changes suggested.

The maximum stress in cables from the addition of all these secondary stresses to the main stress can only be caused by a simultaneous occurrence of: (1) the maximum moving load on the main span; (2) the highest temperature, and (3) the greatest wind pressure.

New York and Brooklyn Bridge. Estimates of Weights, Main Span between End Suspenders, 1,515 Feet.

	(a) From report of W. A. Roebling, Ch. Engr., Jan. 9, 1882.		(b) From drawing No. 4,651, Hildenbrand, 1881.		(c) From drawing No. 4,651 "Actual Weight," as computed in Chief Engineer's office, August, 1892.		(d) From report of C. C. Martin, Ch. Engr., Dec. 2, 1898.		(e) From drawing, not numbered, computed in Ch. Engr's office, August, 1901.		(f) From independent approxim'te computati's made as check by E. D. and J. M., August, 1901.	
	Total. tons.	Per lin. ft. lbs.	Total. tons.	Per lin. ft. lbs.	Total. tons.	Per lin. ft. lbs.	Total. tons.	Per lin. ft. lbs.	Total. tons.	Per lin. ft. lbs.	Total. tons.	Per lin. ft. lbs.
Suspended superstructure (steelwork)	3,050	3,950	2,795	3,619	2,940	3,810	2,940	3,810	2,940	3,810	2,965	3,840
Timber flooring, tracks, etc	1,530	1,982	1,527	1,978	1,097	1,420	1,097	1,420	1,174	1,520	1,190	1,540
Total	4,580	5,932	4,322	5,597	4,037	5,230	4,037	5,230	4,114	5,330	4,155	5,380
Under-floor stays (for wind)	.....	.....	124	161	45	58	45	58	45			
Hauling cables and line-sheaves (for bridge trains)	.....	.....	50	65	.....	.....	(see below)	......	31	143	110	143
Elec. feeder cables and trolley arms (for trolley cars)	[1]560	[1]726	.....	.....	.....	.....	(see below)	......	34.28			
Telegraph and telephone cables	.....	.....	.....	.....	22.24	29	22.24	29	39.60	170	131	170
Pneumatic tubes	.....	.....	.....	.....	.....	.....	(see below)'	......	91.76			
Suspenders and connections	.....	.....	158	205	125	162	125	162	125	162	178	230
Over-floor stays (for vertical loads)	.....	.....	135	175							193	250
Total	5,140	6,658	4,789	6,203	4,229	5,479	4,229	5,479	4,481	5,805	4,767	6,173
Cables	1,600	2,070	1,545	2,000	1,600	2,070	1,600	2,070	1,600	2,070	1,613	2,090
Total	6,740	8,728	6,334	8,203	5,829	7,549	5,829	7,549	6,081	7,875	6,380	8,263
Weight added 1892-1898; additional new bridge-track and trolley tracks, hauling cables and sheaves, electric feed-wires and cables, trolley-arms, telegraph and telephone wires and cables, and pneumatic mail tubes	.....	.....	.....	.....	.....	.....	430	557	.....	.....	.....	.....
Total fixed-loads on main span as computed at various dates	6,740	8,728	6,334	8,203	5,829	7,549	6,259	8,106	6,081	7,875	6,380	8,263
Moving Loads:												
Bridge trains, 2 tracks	.....	.....	.....	.....	.....	.....	532	690	.....	.....	530	686
Trolley cars, 2 tracks	.....	.....	.....	.....	.....	.....	425	550	.....	.....	567	735
Roadways, 2	.....	.....	.....	.....	.....	.....	425	550	.....	.....	383	496
Promenade, 1	.....	.....	.....	.....	.....	.....	580	750	.....	.....	464	600
Total moving-loads on main span as computed at various dates	[2]1,380	[2]1,790	1,380	1,790	.....	.....	[3]1,962	[3]2,540	1,962	2,540	[4]1,944	[4]2,517
Sum of fixed-loads and moving-loads	8,120	10,518	7,714	9,993	.....	.....	8,221	10,646	8,043	10,415	8,324	10,780
Total loads on suspenders, neglecting temp. loads and reduction on account of loads carried by stays and trusses	6,520	8,448	6,164	7,993	.....	.....	6,621	8,576	6,443	8,345	6,711	8,690
Total loads on cables, neglecting temp. loads and reduction on account of loads carried by stays and trusses	8,120	10,518	7,714	9,993	.....	.....	8,221	10,646	8,043	10,415	8,324	10,790

[1] The 560 tons include suspenders, wrought and cast iron cable-bands, over and under floor-stays, wire netting, railing, hauling-cables and line-sheaves, grate-bars, cable cross-connections, etc.

[2] No details of moving loads given for this date.

[3] The 690 lbs. per ft. on 2 bridge tracks is from 4-car trains on each track, run at 45 sec. headway and 11.3 m. per hr. = trains of 256,000 lbs. each, 748 ft. apart front to front. The 550 lbs. per ft. on 2 trolley tracks is from trolley-cars weighing 28,000 lbs. each and run 102 ft. apart front to front on each track. The 550 lbs. per ft. on 2 roadways is from a continuous line of trucks on each roadway, each truck occupying 20 ft. and weighing 5,500 lbs. The 750 lbs. per ft. on 1 promenade is from 50 lbs. per sq. ft. on the 15 ft. width of the promenade.

[4] The 686 lbs. per ft. on 2 bridge tracks is from 4-car trains on each track, run at 45 sec. headway and 11.3 m. per hr. = trains of 256,000 lbs. each, 748 ft. apart front to front. The 735 lbs. per ft. on 2 trolley tracks is from 8-wheel trolley-cars weighing 37,500 lbs. each (with 100 passengers) and run 102 ft. apart front to front on each track. The 496 lbs. per ft. on 2 roadways is from a continuous line of wagons on each roadway, 1/3 two-horse at 8,400 lbs. each, and 2/3 one-horse at 3,200 lbs. each, each wagon averaging 20 ft. long with horse. The 600 lbs. per sq. ft. on 1 promenade is from 40 lbs. per sq. ft. on the 15 ft. width of the promenade.

All fixed loads above are the average for the main span. The weights of the middle 740 ft. of main span, between stay-systems, are much less, the estimate for the total fixed load being 7,485 lbs. per lin. ft. by (e) and 7,616 lbs. per lin. ft. by (f); estimate (f) was hastily made and is believed to be somewhat too liberal.

The adopted figures for span-loads, covering the whole or any part of the span, are 8,000 lbs. per ft. of bridge for total fixed load and 2,600 lbs. per ft. for total moving load; or the two combined, 10,600 lbs. per ft. of bridge. This is believed to safely cover the maximum of the actual loads on the bridge at present, under the existing regulations.

The above loads all relate to span-computations. For computing the strength of the floors, the following concentrated moving loads were adopted: Railways, wheels of 11,000 lbs. each, those of 44-ton grip-car; trolleys, wheels of 8,100 lbs. each, those of 4-wheel car; roadways, wheels of 4,000 lbs. each, those of 8-ton truck; promenade, a crowd weighing 100 lbs. per sq. ft.

These loads are the largest now occurring on railways and trolleys, and are believed to be the maximum ones probable on roadways and promenade.

Attention is called to the very small total and relative weight of telegraph and telephone cables and pneumatic tubes.

This combination is very improbable; (for example, it is hardly possible for the highest temperature to occur again before next summer) and may even never have happened since the completion of the bridge. It is not at all impossible, however, and may occur during any summer, so that the fact that no serious failure of bridge has yet occurred is no guarantee that one would not occur should this unfavorable combination of conditions arise before the suggested changes have been made.

While it is probable that the unknown secondary stresses in the cables due to wind pressure are not large enough under any circumstances to decrease greatly the safety of the bridge, it would, as the factor of safety of the cables is small even without them, be very injudicious to be satisfied with such a probability.

The fact that large secondary stresses arise in the cables of a suspension bridge with stiffening trusses having center hinges has been pointed out by other engineers and used as an argument against such hinges. By proper design, however, these stresses can be so reduced that the total maximum stress per square inch in cables of such bridges is less in center of span that at towers.

The Moving Loads.—There is one promenade in center of bridge 15 ft. wide in the clear, two railway tracks next to it, and two roadways 18 ft. 9 ins. wide in the clear. On each of the latter is a track for electric trolley cars, leaving 10 ft. width on each roadway for wagons. On the promenade it is assumed there may be a crowd weighing 40 lbs. per square foot, or 600 lbs. per lineal foot of bridge. Two kinds of four-car trains make use of the railway tracks, those hauled by the cable and those hauled by electric motors. The former trains have both train and wheel loads the heavier and are described below.

Each train hauled by cable consists of one motor or grip car and three trailers. The loaded motor cars weigh 44 tons each, with four axle loads of 11 tons; the distances between axles are 5 ft. 6 ins., 26 ft. 9 ins., and 5 ft. 6 ins., and the length over all is 48 ft. 4 ins. The loaded trailers weigh 28 tons each, with four axle loads of 7 tons; the distances between axles are 4 ft. 6 ins., 27 ft. 9 ins., and 4 ft. 6 ins., and the length over all is 48 ft. 4 ins. The whole train weighs 128 tons. The speed is 11.3 miles per hour, that of the cable, and the least practicable time interval is 45 sec. This gives a least distance of 746 ft. center to center of trains. The load per lineal foot of both tracks therefore averages 686 lbs.

On the trolley tracks run cars of various weights. The heaviest are 37 ft. long over all, and weigh 37,500 lbs. fully loaded. The axle loads are 12,500 lbs., 6,250 lbs., 6,250 lbs. and 12,500 lbs. Distances between axles are 4 ft., 15 ft. and 4 ft. A board of engineers consulted, previous to the introduction of trolley cars on the bridge, recommended that they should run at 102 ft. clear distance between cars. The Bridge Department, according to their published report of 1898, rules that they may run at a distance of 102 ft. center to center. With the latter distance, the load on the two trolley tracks will be equivalent to 735 lbs. per foot of bridge. For the calculation of floor a somewhat lighter four-wheel car gives the greatest stresses. It is 32 ft. long over all, weighs fully loaded 32,400 lbs., or 16,200 lbs. per axle, and axles are spaced 8 ft. apart.

The roadways, outside of trolley tracks, are 10 ft. wide in the clear. Observations by the Bridge Department have shown that there are about two one-horse wagons to one two-horse wagon. The three wagons occupy a space of 60 ft. length and are estimated to have the following weights: Four horses, 4,800 lbs.; two single wagons, 4,000 lbs.; one two-horse wagon, 6,000 lbs.; total, 14,800 lbs. This gives 496 lbs. per lineal foot of bridge for the two roadways

For the whole bridge we obtain, therefore: Promenade at 40 lbs. per square foot, 600 lbs.; two railway tracks, 686 lbs.; two trolley tracks, 735 lbs.; two roadways, 496 lbs.; total per lineal foot of bridge, 2,517 lbs.

The moving load assumed for the original calculation of the bridge was 1,790 lbs. per lineal foot. The dead loads were estimated, in a report by Washington A. Roebling, of January 9, 1882, so much in excess of what they now are that the total loads are now, notwithstanding the increase in moving loads, practically no larger than as estimated in 1882. Various estimates of dead load are given in the table. That used by us was 8,000 lbs. per lineal foot of bridge. The actual moving loads, if regulations are observed, can hardly much exceed the amounts here given.

The very maximum loads which could come on the bridge from cars in use at practicable speeds are about as follows: If the trolley cars were spaced one car length apart in the clear, they would be about as near as practicable. The load per lineal foot of bridge would thereby be increased 278 lbs. If one more trailer were attached to the bridge trains, the load per lineal foot would be increased 150 lbs. If there were 50 lbs. per square foot on promenade instead of 40 lbs., the load per lineal foot of bridge would be increased another 150 lbs. The total moving load per lineal foot would thereby become 3,095 lbs. If the bridge is strengthened to carry this moving load with adequate safety, which is easily practicable, there will be no partial failures.

The uniform moving load of 686 lbs. above given as equivalent to two four-car trains and that of 686 + 150 = 836 lbs. to two five-car trains, are only equivalent for the calculation of cables, towers and anchorages.

For the calculation of stiffening trusses, they are not equivalent. In a 740-ft. span stiffening truss the loading of only 740 × 0.395 = 292 ft. of length produces the maximum chord stress; and the loading of only one-third of the span, or 247 ft. length, gives the maximum shear at end of span. For some of the stresses the five-car train is about equivalent to 1,300 lbs. per lineal foot of bridge, or to 2,600 lbs. per lineal foot of bridge for the two trains. The other moving loads are approximately uniformly distributed over bridge, except in case of accident.

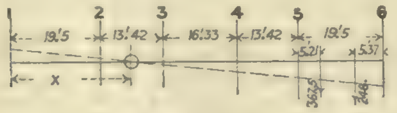
Should a breakdown occur on roadways, however, either on north approach in Brooklyn or on south approach in New York, there would, in a short time thereafter, be no load on one roadway of shore span and full load on same roadway on main span. A little later there would be partial load on stiffening trusses of main span. If there should occur at the same time the most unfavorable position of the trains on the two railway tracks, the moving load of 2,600 lbs. per foot, assumed in our calculation of stiffening truss of 740-ft. span, would be exceeded by about 45% on one of the six trusses. This would be the case with trolley cars 102 ft. apart center to center, and with five-car trains on each railway track. It is, therefore, apparent that the moving load of 2,600 lbs. assumed for the calculation of the 740-ft. span stiffening trusses is not excessive, but rather too low, if all possible contingencies are considered. The derivation of the amount of this excess (45%) is given below.

Distribution of Moving Loads Among the Six Trusses.—Since the choice of moving load in the calculation of stiffening trusses is of the greatest importance, we shall give here in detail the calculation of the approximate effect on one of the six trusses produced by an accident on one roadway approach, in combination with an unfavorable position of trains on railway tracks. For the maximum chord stress in stiffening trusses of 740-ft span, two five-car trains of 156 tons each are equivalent to about 2,200 lbs. uniform moving load. With the trolley cars spaced 102 ft. apart center to center, the load on one trolley track is equivalent to 367.5 lbs. per lineal foot. The load of wagons assumed is equivalent to 248 lbs. per lineal foot on each roadway. The load of the two railway trains produces the largest stresses when they are abreast. In this case, the stresses in the four high trusses produced thereby are alike.

The loads carried by each of the six trusses are in proportion to their moments of inertia. The part of the total railway load carried by one of the four high trusses is 2,200 ÷ 4.53 = 486 lbs. per lineal foot of bridge.

With one roadway only loaded, the load of trolley cars and wagons will be unequally distributed over the six trusses. We can neglect the deformations of floor beams, since they are small in comparison with those of trusses. After the deflections of trusses due to one-sided load have taken place, their bottom chords, which were before in a straight horizontal line at a floor beam, will be in a straight inclined line, and the deflections of the six trusses will, therefore, be proportional to distance of each truss from the intersection of position of floor beam before with that after deflection. The loads which the high trusses carry will also be proportional to their distance from this point of intersection. The load of a low truss will be 0.265 times that of a high truss in the same position.

We obtain, therefore, for the loads per foot carried by the six trusses:



$$\begin{array}{lr} -.265\,a\,x & (1) \\ (-x + 19.5)\,a & (2) \\ (-x + 32.92)\,a & (3) \\ (-x + 49.25)\,a & (4) \\ (-x + 62.67)\,a & (5) \\ (-x + 82.17)\,a \times 0.265. & (6) \end{array}$$

The sum of all the roadway loads is equal to 248 + 367.5 = 615.5 lbs. per foot. Therefore,

$$-4.53\,a\,x + 186.12\,a = 615.5.$$

The moments of these loads in regard to 0 are

$$\begin{array}{lr} .265\,a\,x^2 & (1) \\ a\,(-x + 19.5)^2 & (2) \\ a\,(-x + 32.92)^2 & (3) \\ a\,(-x + 49.25)^2 & (4) \\ a\,(-x + 62.67)^2 & (5) \\ a\,(-x + 82.17)^2 \times 0.265 & (6) \end{array}$$

The sum of all the moments must be equal to the moment of the loads on roadway around 0.

We obtain, therefore, $4.53\,a\,x^2 - 186.12 \times 2\,a\,x + 9{,}606\,a = 367.5\,(67.87 - x) + 248\,(76.79 - x)$.

If we multiply the first equation by x and add it to the second, we obtain $-186.12\,a\,x + 9{,}606\,a = 43{,}980$. From this and the first equation, we obtain $a = 9.60$, $x = 26.97$.

The loads on the six trusses are,

$$\begin{array}{lr} -\ 70 \text{ lbs.} & (1) \\ -\ 74 \text{ ''} & (2) \\ +\ 56 \text{ ''} & (3) \\ +\ 215 \text{ ''} & (4) \\ +\ 346 \text{ ''} & (5) \\ +\ 142 \text{ ''} & (6) \end{array}$$

In truss (5) we have, therefore, a total load of 486 + 346 = 832 lbs. This load would also come on this truss if the whole bridge should have a moving load of 3,768 lbs. per foot symmetrically disposed toward axis; which latter load is 45% more than the 2,600-lb load we have assumed in our calculation.

The cables distribute in both cases about the same proportion of the load, and the results would be only slightly modified by considering their effect. It is, therefore, evident that the moving load assumed of 2,600 lbs. per foot is not extravagant, and would even be considerably exceeded should any accident occur, such as would cause the unsymmetrical loading described.

Strength of the Materials in Structure.—The following ultimate strengths and elastic strengths are compiled from the various printed specifications which governed the qualities of the materials. The amounts given as safe working stresses are our own judgment. In adopting the values for working stresses, we were guided not only by the best modern practice, but also by the additional considerations that, (1) steel of the hardness used in this bridge could hardly at that date have been fully equal in uniformity to steel of this same hardness made at present; and (2) the slow speeds used on this bridge (a maximum of 11.3 miles per hour for the heaviest trains) and the absence of steam locomotives with unbalanced drivers would make the impact-effect of the loads very small—and thus allow the use of larger working stresses in the metal of floors than would be considered good practice in ordinary steam railroad bridges.

Steel in 2½-in. diameter suspender rods near middle of main span: Ultimate, 75,000 lbs.; elastic limit, 45,000 lbs.; working stress, 10,000 lbs.

All other steel in the superstructure, including that in stirrups for suspender ropes and stay ropes: Ultimate, 70,000 lbs.; elastic limit, 40,000 lbs.; working stress in the stiffening trusses, 20,000 lbs.; main-floor beams, 14,000 lbs.; intermediate floor beams and channels supporting same, 14,000 lbs.; stirrups for wire ropes, 10,000 lbs.

Steel wires of cables: Ultimate, 160,000 lbs.; working stress, 60,000 lbs.

Yellow pine in floors: Working stress, 1,300 lbs.

The above stresses are tension per square inch.

Wire ropes of suspenders and stays: 1⅝ ins. diam.: Ultimate, 90 tons each; working stress, 20 tons; 1¾ ins. diam.: Ultimate, 100 tons each; working stress, 22½ tons; 1⅞ ins. diam.: Ultimate, 112 tons each; working stress, 25 tons; 2 ins. diam.: Ultimate, 134 tons each; working stress, 30 tons.

Socketed ropes are assumed to have 10% less ultimate strength than above.

Granite masonry of towers: Working stress, 20 tons pressure per square foot.

The Floor.—The stringers of railway tracks rest on main floor beams and intermediate floor beams. The latter are 6-in. I-beams, 40½ lbs. per yard. If they are calculated in the usual manner, the stress per square inch is 27,000 lbs. The stringers of railway tracks are yellow pine timbers, one 4 x 6 ins. and one 8 x 6 ins. under each rail, the 6-in. sides being vertical. If the intermediate floor beams were adequate the unit stress per square inch on the outer fiber would be 1,600 lbs. The weakness of intermediate floor beams greatly increases this stress. In many places the stringers lap in center of panel, which is a great additional source of weakness.

The intermediate floor beams of railroad rest at inside stiffening trusses on 6-in. channels riveted to the posts of trusses. The unit stress in these channels is 17,000 lbs. per square inch. At the trusses between railway and roadway there is in some places only one channel to support both the intermediate floor beam under railway track and that under roadway. In such cases the unit stress in the single channel is doubled if intermediate floor beams carry their proper share of load. The intermediate floor beams of roadways are continuous with those of railways and rest on bridging and channels running along stiffening trusses. The stress per square inch below trolley rail in these intermediate floor beams is in some places 23,000 lbs.

The trolley rails are flat rails, resting, between stay-systems, on 4 x 10-in. planks. If the rails are not counted as assisting planks the stress per square inch in planks is 3,140 lbs. The bridging supporting intermediate floor beams is of a safe strength. The parts of promenade floor are also safe for a load of 100 lbs. per square foot. Neither railway nor highway floors are as strong as good practice prescribes, and should both be strengthened to make them reasonably safe.

Main Floor Beams.—These are supported at four points by cables and at six points by stiffening trusses. Their maximum stresses occur when the moving loads are so placed that there are heavy wheels on floor beams, and when the whole span is fully loaded so that the reactions at cables become large. If the whole span is only partly loaded the reactions at cables are reduced, the stiffening trusses carry more, and the moments become smaller, since the effective supports are nearer together. The stiffening trusses carry the loads of intermediate floor beams to the nearest main floor beams. For the calculations of the main floor beams the whole bridge is assumed to have an average moving load of 2,600 lbs. per lineal foot and a dead load of 9,700 lbs. per lineal foot at floor beam considered. Each of the four cables, since they must deflect equal amounts on account of their connection by the floor beams, carries an equal amount of the load. The surplus load on floor beam over the average floor-beam load is transferred partly by stiffening trusses to neighboring less-loaded floor beams and partly by cables, since we have found that cables largely participate in the function of distributing unequal moving loads. It was estimated that of the surplus over average moving load on the floor beam here considered 20% is taken by cables and 80% is transferred by stiffening trusses to neighboring beams.

All these considerations combined enable us to determine the reactions at cables and stiffening trusses. The reactions cannot be calculated by considering the floor beam continuous, with supports at fixed height. The height of supports changes, so that the reactions assume the values following from above considerations. The loads assumed are on each railway track the heaviest motor car with axle above floor beam and on each trolley track the heaviest four-wheel trolley car with axle above floor beam. On each roadway there was assumed a wagon of 8 tons on a base 5 x 8 ft., with one axle over floor beam. On the promenade a moving load of 100 lbs. per square foot was assumed.

With these loads the largest chord stress becomes 15,500 lbs. tension per net square inch and the largest stress in web becomes 11,100 lbs. tension per net square inch. These stresses may be largely increased by inaccurate adjustment of suspenders.

Resume of Appendix D.—The length of Appendix D and the many separate subjects comprised in it seem to make it advisable to give in a condensed form the sequence of the various parts and the principal results obtained.

The bridge is composed of three systems, the cables, the stay system and the stiffening trusses. Since these systems are all connected to each other, they must deflect together and their deflections at any one point must be the same. This feature of equal deflections under loads and temperature changes is used to find the division of the work among the three systems and thus, as closely as the available information will permit, to find the approximate stresses in each system.

Temperature Deformation of Unstiffened Cables.—A fall of temperature of 120 degs. Fahr., with saddles fixed, causes a rise of approximately 3.16 ft. in center of main span, and of 3.18 ft. in center of shore spans. If the saddles move without friction the corresponding rises are 4.60 ft. and 1.55 ft. and the motion of each saddle toward shore is 0.34 ft.

Moving Load Deformation of Unstiffened Cables.—With saddles fixed and a moving load over whole bridge of 1 ton per foot, the drop in center of main span is approximately 1.10 ft. and that in center of shore spans 1.12 ft. If the saddles move without friction the corresponding drops are 1.73 ft. and 0.58 ft., and the motion of each saddle toward river is about 0.13 ft.

If the saddles move without friction and there is a uniform moving load on main span only of 1 ton per foot, the drop in center of main span is approximately 8.24 ft. and the rise in center of each shore span 6.14 ft.

If the uniform moving load of 1 ton per foot is on shore spans only, saddles moving without friction, the rise in center of main span is approximately 8.33 ft. and the drop in center of each shore span 6.87 ft.

The total change in elevation of unstiffened cables at center of main span, due to above conditions, loads and changes of temperature is approximately 8.24 ft. down from load + 8.33 ft. up from load + 4.60 ft. temperature = 21.17 ft. total, if saddles move without friction. For centers of shore spans the corresponding change in elevation is 6.14 ft. up + 6.67 ft. down + 1.55 ft. temperature = 14.56 ft.

Horizontal Pull on Towers.—If the main span is loaded with 1.3 tons per foot and each shore span with 0.65 ton per foot, and if saddles are fixed and exert no horizontal pull on towers at the same temperature with bridge unloaded, then the cables will pull toward river with a force of 1,674 tons at each tower.

If the main span is loaded with 0.65 ton per foot, and shore spans with 1.3 tons per foot, the saddles being fixed and exerting no horizontal pull at the same temperature with bridge unloaded, then the cables will pull toward shore with a force of 1,283 tons at each tower.

The horizontal pull on a tower due to changes of temperature alone, for the above moving loads and saddles fixed, is 337 tons in either direction.

The total pull on a tower due to above moving loads and changes of temperature is 2,011 tons toward river, or 1,620 tons toward shore, if the saddles are fixed in such a position that they exert no horizontal pull on the towers with bridge unloaded at mean temperature. If they exert a pull of 195.5 tons toward shore with bridge empty at mean temperature, then they will exert a maximum pull of 1,815.5 tons in either direction with above loads at extremes of temperature.

Pressure on Masonry of Brooklyn Tower.—The total pressure on the masonry of the smaller tower (Brooklyn) will reach a maximum of 39.64 tons per square foot with above moving loads at extremes of temperature, or even more unless the present positions of saddles are such as will give the least maximum pressure on the towers. The actual pressure on the masonry for above loads and temperatures cannot be determined from the information in our possession and may be considerably more than the amount given.

Strength of Stay System.—The calculation of the stay system shows that the socketed stay ropes are strong enough to perform their proper function if the stays are properly adjusted. The stay ropes are, however, connected to bottom chords of stiffening trusses by bent rods of only 25.6% the elastic strength of the ropes. The connection with bottom chords is also so eccentric as to increase the largest stress per square inch produced in bottom chord by one rope to 4.72 times the amount that would be produced by a centric connection. This eccentric connection was without doubt the main cause of the failure of these bottom chords in 1898.

Strengths of Stiffening Trusses.—The stiffening trusses were found to be strong enough at center of bridge; also at stay system, with the exception of the bottom chords serving as struts for the latter.

Owing to lack of time and of sufficient drawings and data in regard to the shore spans, only the main span was calculated. The stresses are believed to be less in the shore spans, however, and the sections of trusses are supposed to be the same as in the main span.

Deflection Stresses on Center Suspenders.—Computation shows the stresses in suspenders at the two center floor-beams to be increased by reason of the deflection and hinge to an amount nearly double that in the other suspenders.

Secondary Stresses in Cables.—The cables, with the most unfavorable adjustment of stay system, give a factor of safety of 3.3 if the primary stresses alone are considered. There are, however, large secondary stresses at several points of cables. The largest ones occur at center of main span and are due partly to the fact that the stress in the wires at the outside of a local bend in cables is more than in those at the inside, and partly to the fact that in each wire the stress is more at outside of the bend in the wire than at the inside. The former of these secondary stresses are reduced by the sliding of wires upon each other wherever there is a sharp bend. Their magnitude is therefore dependent upon the amount of friction between the wires forming the cables. Since this is only approximately known, these secondary stresses cannot be accurately calculated. An approximate calculation shows that they reduce the factor of safety in cables to about 2.3.

The secondary stresses due to the bending of individual wires are of smaller size and are estimated to increase the maximum stress per square inch by about 2,000 lbs. This leaves a factor of safety of cables of about 2.25.

The secondary stresses in cables produced by wind pressure on bridge still further reduce their factor of safety. They have not been calculated because of the lack of time and of reliable drawings and data.

We have also assumed, in all our calculations, that the cables over middle half of main spans are parabolas at mean temperature and with mean load. If this is not the case, the secondary stresses may be much larger even than calculated.

The Moving Loads.—These need no special resume. They are the maximum loads probable on the bridge under the enforcement of the present regulations.

Distribution of Moving Loads Among the Six Trusses.—Computation shows that with one roadway of bridge unloaded the above moving loads may throw a load on one truss 45% in excess of what was assumed in our calculations of stiffening trusses.

Unit Strengths of the Structural Materials.—This needs no resume. The selection of the working stresses was governed by the fact that the conditions on this bridge are much more nearly those of a highway than of a railway bridge.

Strength of Floor.—The floor was found defective in strength in some of its parts and is therefore liable to occasional partial failures.

Necessity and Order of Improvements.—The most urgent improvement is that of the cables in the center of main span. Next in importance is the improvement of the floors and stay system, accompanied by the introduction of auxiliary bents to diminish bending stresses in towers and stresses in cables and anchorages.

Appendix E.—Methods of Bridge Inspection in Use on Several American Railroads.

Illinois Central R. R.—"We make a systematic inspection of wooden bridges each fall, and in connection with these the iron bridges are also examined. This inspection is made by the Assistant Engineer of Bridges, accompanied by the division officers, usually the Division Supervisor of Bridges and occasionally the Division Road Master.

"The bridges on the Illinois Central Lines are all under the care of the Superintendent of Bridges, who has men at work in various parts of the system, and who make examinations from time to time of bridges under their charge, making such adjustments or immediate repairs as are necessary to keep the bridges in thoroughly good order."

Michigan Central R. R.—"Our bridges are inspected twice a year by engineers. Our Bridge Foremen also inspect them when they find time to do so, but most reliance is placed on the engineers' inspection."

New York Central & Hudson River R. R.—All bridges are inspected quarterly "by the Supervisor of Bridges, assisted by an Inspector, who is usually a technical man." An independent inspection and report is also made quarterly by the Supervisor of Tracks.

Chicago, Burlington & Quincy R. R.—"We make inspection twice a year of all the truss and girder bridges; these inspections starting usually in May and in October, and being made by the engineers. In addition to this, of course, the bridges are inspected constantly by the Bridge Superintendents, by the bridge foremen, and by the section men."

Special additional inspections and reports are also made at least once each year, by some outside expert engineer, of each of the C., B. & Q. R. R. Co.'s eight long-span bridges over the Missouri and Mississippi Rivers.

Pere Marquette R. R.—An inspection of all bridges is made once a year, and when a bridge is old or light or any weakness is suspected, special additional inspections are made. The inspections are made by the Engineer of Bridges and Buildings and his assistant engineers. The structures are also inspected by the bridge foremen and the section foremen whenever occasion arises in the course of their work.

Northern Pacific Ry.—"Two regular inspections shall be made each year, as follows:

"First.—In the month of January, by the Supervisor of Bridges for each division, of all truss and large trestle bridges.

"Second.—In the month of September, by the Division Engineers and Supervisors of Bridges, of all bridges, culverts, waterways, etc.

"In addition, the Supervisors of Bridges shall at all times make such other inspections as may be necessary to insure safety."

Appendix F.—The Suggested Improvement of Stiffening System.

Our calculation of the deflections of stay-system and cables with movable saddles has shown that—if the load on stay-system changes from zero in the case of one loading of bridge to, in the case of another loading of bridge, a load on stay-system varying uniformly from 4,000 lbs. per foot of bridge at end of stay-system to 9,000 lbs. per foot at tower—the motions of saddles are reduced to small amounts, even if their friction is negligible.

In this calculation the moving load was assumed to be sometimes 1 ton per foot on river span with the shore spans unloaded, and sometimes 1 ton per foot on shore spans with the river span unloaded; it was always assumed symmetrical to axis of bridge.

Much smaller amounts of moving load, if unsymmetrical to axis of bridge, will produce the same effect on one of the four stay systems, but not on the center pillars, which are the weakest parts of towers. It is for this reason that the inequality of moving loads in main and shore spans, assumed for the calculation of bending stresses in towers, was taken at 1,300 lbs. per foot of bridge, while it was taken 2,000 lbs. per foot of bridge in the calculation of stay-system.

The fixed saddles at top of towers produce increased and not accurately known bending stresses in center pillars of towers. If the saddles are made free, largely increased stresses will occur in stay-system; it is unable to carry them and should, therefore, be strengthened. This strengthening of stay-system increases bending stresses in towers.

The floors should also be strengthened, and this will increase dead loads and the stresses in cables, towers and anchorages.

It would be very desirable to be able to safely remove the existing restrictions on car traffic. This would increase the moving loads, and the stresses in cables, towers, anchorages, stiffening trusses and stay-system.

In making any or all of above changes, increase in the stresses in cables and anchorages should be avoided. It is also very desirable to reduce the bending stresses in towers.

These aims can all be attained by strengthening stay-system, freeing the saddles, and introducing anchored bents or ropes near shore ends of stay-system.

By the strengthening of stay-system, the cables and anchorages can be relieved of part of their present load, and will thereby be enabled to carry instead, with equal safety as at present, the increased dead and moving loads due to strengthening of floors and removing of restrictions on car traffic.

This strengthening of stay system consists in improving the connections of present stays, introducing some new stays, and providing altogether new horizontal struts at bottom ends of stays.

The stay system can only be made to carry more load by straightening the cables above it, which would let down the center of main span and diminish the least clearance above the river. To avoid this, and to reduce bending stresses in towers, anchored bents or ropes should be introduced near shore ends of stay system. The last stays connecting with floor near anchored bents should run over movable saddles on top of towers. The stays nearer towers should be immovably connected to tops of towers. The cables should be connected with the anchored bents or ropes by ropes of adequate strength.

By these means the floor and cables near anchored bents may be kept at an almost uniform height near the lowest position which they now take at high temperature with shore spans fully loaded. If anchored ropes are used the cables and floor must be held by them at the lowest position which moving load and high temperature will produce. This might result in making the least clear height at center of main span much more than at present, which is not desirable. The calculations necessary to determine the balance of advantage for either ropes or bents cannot be made without knowing the present curve of cables, or their length. The stays fixed to top of towers should be so adjusted that at mean temperature, with half the largest moving load uniformly distributed over bridge, they carry the same load on both sides of tower. In this case their horizontal pulls at top of tower will balance. The stays which run over movable saddles at tops of towers will exert no horizontal pull on towers under any circumstances, except that due to friction of rollers; this, with good roller beds, is small.

The principal bending stresses in towers arise from change in position of preponderant moving load. An increase in moving load on main span will lower the cables of main span and increase the loads on stays. The stays running over saddles will produce a tension in anchor bents. The cables in shore spans will rise and also produce a tension in anchor bents. If the anchor bents are 400 ft. from center of towers, if the height of stay system at center of tower is 150 ft., and if the tension in anchor bent is T, then the pull toward river at the top of each tower is reduced through the presence of the anchor bents by $T\ 400 \div 150$.

If the shore spans are loaded, the cables will fall in shore spans and rise in main span. The tension in stays running over saddles is reduced and this produces compression in anchor bent; the falling of cables in shore spans also produces compression in anchor bent. If the total compression is C, the pull at top of tower is reduced through the presence of the anchor bent by $C\ 400 \div 150$. The total reduction of variation of horizontal pull at top of tower is, therefore, $(C + T)\ 400 \div 150$.

Most of the variation in dip of main span of cables with stiffening system absent, and most of the motion of saddles, is due to the change in dip of shore spans and the consequent change of curve of cables from anchorage to saddles. The bents near shore ends of stay system prevent most of the change in deflection of rear cables, and reduce thereby the motion of saddles to a small part of what it would be in their absence. They perform, therefore, with the assistance of the stays connected near them and running over moving saddles at tops of towers, the major part of the function of stay system, and that without producing bending stresses in towers. They also prevent rise of shore span, and consequently fall of main span when the latter is preponderantly loaded, more effectively than would be done by the stay system alone; and thus prevent the reduction of least clearance above river in center of main span which would occur, in their absence, in consequence of straightening of cables over stays.

The stresses and deflections due to the introduction of these bents can be calculated with sufficient accuracy. It is, however, important that the adjustment of stays and suspenders should be made to agree with the assumptions of the calculations.

It is estimated that over six-tenths of the bending stresses in towers can be removed by the introduction of these bents, thereby reducing the largest stress per square foot in the masonry by over 10 tons. The strengthened stay system, with the anchored bents, will permit all the necessary additions to dead load of bridge which would be caused by strengthening its floors, and also the increases in moving load due to removal of restrictions on trolley cars, without producing larger stresses in any part of bridge than are perfectly safe.

Book Notes.

There is no question that Prof. A. Prescott Folwell's "Sewerage" fills the requirements of many engineers, for the fourth edition has now appeared, although the book is only three years old. It was reviewed at some length when it was first published, and to the favorable notice then printed it is only necessary to add that the new matter, mostly on sewage disposal, has increased the pages in the book from 372 to 445. It is a valuable discussion, not only of the principles of design, but also of the methods of construction of sewerage systems, and is sold at $3 by John Wiley & Sons, New York.

The principles of operation of small gasolene engines are set forth in clear language in Mr. C. C. Bramwell's "Construction of a Gasolene Motor Vehicle," published in attractive form by Emil Grossman & Brother, New York. The explanation of the theory of electric ignition is somewhat labored, and it is doubtful if anyone unacquainted with electrical principles can derive benefit from the treatment of the subject. The author concludes that the primary spark is far better than the induced high-potential spark. The discussion of gears and light power transmission apparatus is good. Altogether it is a work which will be of value to the non-technical reader interested in motor vehicles, and the engineer will find the many dimensioned drawings of considerable service.

A book which every designer of structural work will find useful is Mr. Constantine Smoley's "Parallel Tables of Logarithms and Squares." The tables of squares prepared by Buchanan and Hall are greatly amplified in this work. It contains the squares and logarithms of feet, inches and thirty-secondths of an inch from 0 to 50 feet, being thus more elaborate than any work previously attempted. Hall's tables, it is true, extend to 100 feet, but their increment is a sixteenth of an inch; it is easy to use Smoley's tables for distances between 50 and 100 feet by dividing the given distances by 2 and then doubling the final result. The distinctive feature of the work is, however, the logarithms, which can be used to much advantage in a number of problems that occur frequently. Numerous examples of the use of the tables are given, and a full explanation of the methods followed in calculating it; the latter were difference methods for both squares and logarithms. The tables are also stated to have been checked carefully, but whether these checks were made on the printed proofs or the manuscript does not appear. The proofs should, of course, be checked over with great care. The book is published at $3 in well printed and bound form by the author, whose address is 1A Ewald Street, Cincinnati.

A pamphlet intended as a guide for self-taught men to a course of study has been written by Mr. John Phin. It bears the title "How to Become a Good Mechanic." It is a curious mixture of dissertations on the uselessness of history and geography, quotations from the Bible, Scotch proverbs, "The Natural History of Hell"—whatever this work may be—and an appendix pointing out the fact that the author's suggestion to use tide motors when the world's coal supply is exhausted is both practical and certain of fulfillment. A short discussion on the difference between money and capital, while not germane to the subject, is inserted as a sort of "voluntary." The course of study outlined is wholly theoretical and is about that of a technical school whose standard is low. There is nothing in the book of a practical nature to assist the mechanic, or to show him how to improve in his work. As a help it is of little value, but it is strangely well written so far as the English and diction are concerned, and as a curio is worth the price, 25 cents, for which it is sold by the Industrial Publication Company, New York.

"The Elements of Electrical Engineering," by Mr. C. P. Steinmetz, is an excellent work in the author's well-known style. The first part deals with the theoretical elements of alternating currents, and the methods of treatment are in many instances new. Numerous examples assist in giving a clear understanding of the formulas and their use. The paragraph on impedance of transmission lines deserves special mention. In Part II., synchronous generators, motors and converters are considered, as are also induction and commutating machines. Altogether it is a work which should be in every electrical engineer's library, but it is by no means suitable for beginners in the study of alternating currents. While Mr. Steinmetz starts with the fundamental principles, he proceeds too fast for any but trained minds with a thorough knowledge of mathematics to follow. The only point open to criticism is the author's use of the word "spiral" to indicate a helix, but the engineering fraternity so persistently uses this term wrongly that Mr. Steinmetz was probably driven to using it in the same way in order to make clear his meaning. Why a figure of three dimensions and a constant radius should be called by the name of a plane figure having a varying radius, is one of the mysteries difficult to fathom, and the continued misapplication of the term "spiral" to describe a helix by men who claim to be accurate in all things technical is yet to be explained, though no explanation could ever be satisfactory or relieve this use of the word of inaccuracy and ambiguity. The book is published at $2.50 by the Electrical World & Engineer, New York.

The "Practical Electric Railway Hand Book," by Albert B. Herrick, recently published at $3 by the Street Railway Publishing Company, New York, should find a broad field of usefulness in the hands of street railway managers, superintendents and engineers, as well as investors who are interested in the operation of railway properties. The book is of pocket-book form, and the data contained are systematically arranged and readily found. The book contains the tables of weights and measures usually found in similar volumes, although somewhat abridged. There are also chapters on testing, the track, power station, the line, the car house, the repair shop, the equipment and the operation of railways. The appendix treats of storage batteries, boosters and underground conduits. The chapter on testing gives, in convenient form, many useful methods for the various tests which the street railway engineer may be called upon to make. Many data are given which, while not new, are condensed and presented in excellent form for practical use. The book altogether may be said to fill a long-felt want in the street railway community, but it is to be hoped the author will from time to time increase the data on operation, which in the present volume are very limited.

An outline of all the conditions to be considered in selecting a steam power plant for a given purpose is sketched in a 50-page book entitled "The Steam Engine Problem," by Prof. S. H. Barraclough, of the University of Sydney, N. S. W. The author shows first the financial aspect of the problem, then its mechanical aspect, and finally its scientific aspect. No claim is made for an exhaustive account of the subject, as the book was written for students possessing only an elementary knowledge of the steam engine. It brings together in a concise manner all the facts which must be constantly borne in mind if undue attention to any one of the aspects of the problem is to be avoided, and on this account is to be commended to students in technical schools.

An interesting and timely bulletin entitled "Texas Petroleum" has just been issued by the University of Texas. It was written by Dr. W. B. Phillips, professor of field and economic geology and director of the University of Texas Mineral Survey. There is a historical sketch of the attempts to utilize the oil fields of the State, and, among other facts, it will be noticed in the report that Col. Prather, president of the University, was himself one of the petroleum pioneers. The nature and origin of petroleum and the various oil and gas-bearing formations are fully discussed, and finally the various uses of petroleum are reviewed. The text has been prepared with special reference to Texan conditions, but it is also sufficiently general to show wherein these conditions approach and diverge from those at other fields. The illustrations of gushing wells are numerous and merit particular mention. Another interesting article on the same subject is the paper on "Petroleum from the Beaumont, Tex., Field," by Messrs. Clifford Richardson and E. C. Wallace, which was published in the "Journal" of the Society of Chemical Industry for July.

The third volume of the "Transactions" of the American Ceramic Society shows that this comparatively young organization is an earnest one and endeavoring to put the clay-working industry of this country on the same scientific basis as that of Germany. Among the papers is one on the rational analysis of clays for cement manufacture, by Mr. A. V. Bleininger, and a committee report on Seger cones. The volume is sold at $4 by the treasurer of the Society, Mr. Stanley G. Burt, Rookwood Pottery, Cincinnati, O.

Messrs. Joseph W. Ellms and Jay C. Beneker, of the laboratory staff of the new Cincinnati water-works have an interesting paper on the estimation of carbonic acid in water, in the June "Journal" of the American Chemical Society. It is an account of an investigation to determine the sources and amount of the errors in the three common volumetric methods of analysis. The oldest is Pettenkofer's, which was considerably modified by Trillich, while Seyler's method, although called by him the Lunge-Trillich, differs materially from that of Trillich. The Seyler method was found to be the most accurate, then that of Trillich, and last that of Pettenkofer. For ease and rapidity of manipulation, for avoidance of difficulties arising from the presence of magnesium salts, and for its greater accuracy, the Seyler method is therefore preferred by the authors to either of the others.

The design and construction of water-towers and standpipes has been the subject of many pamphlets and papers before engineering societies, but no one discussed the subject so exhaustively as Mr. J. N. Hazlehurst, M. Am. Soc. C. E., in his "Towers and Tanks for Water-Works." It begins with a brief historical note, the least useful part of the book, and then takes up the materials employed in structural metalwork. Two chapters are given to a discussion of the stability of structures and the mechanical principles employed in designing tanks and towers; subjects so simple that the space devoted to them is ample for a complete treatment. Riveting is next taken up, and it is gratifying to note that the author has included selections from the writings on this head of Mr. J. M. Allen, of the Hartford Steam Boiler Inspection & Insurance Company; the views of this company on riveting of all classes might be added to future editions of the book with much advantage to the reader. Two chapters are devoted to designing, which is ample for its thorough consideration, as the only difficulties occur in a few of the details, and these are of an insignificant nature. Three more chapters, on foundations, painting and shop practice and erection, respectively, complete the book, which is well worth the $2.50 charged for it by the publishers, John Wiley & Sons, New York.

In the course of many years of practice in designing and building municipal works of all classes, Messrs. William B. and Joseph B. Rider have accumulated a mass of data, tables, rules and specifications which the latter engineer has just published under the title of "Rider's Little Engineer." It is a morocco-bound pocket-book of about 500 pages, and, unlike most similar manuals, it is of restricted scope, being confined to subjects relating to surveying, water supply and water purification, pavements, surveying, sewerage and sewage disposal, and the like. There are a large number of original tables relating to such work, and many suggestions concerning the conduct of engineering operations. The book is sold at $3 by the author, whose address is South Norwalk, Conn. It is impossible to summarize its contents, owing to their extent, in this notice, but engineers engaged on municipal work will find in it a large amount of information never before brought together in convenient form for reference. Some of the statements are contrary to the views held by this journal and some of the tables hardly seem worthy of a place in the book, but these criticisms apply only to a small percentage of the volume.

The disposal of the refuse of towns has become such a serious matter that the lack of a good work on the subject is surprising. To supply this lack of collated information, Mr. W. Francis Goodrich, the engineer of a British firm making refuse incinerators, has recently written a book of 350 pages entitled "The Economic Disposal of Towns' Refuse," which is published at $3.50 by John Wiley & Sons, New York. It contains descriptions of many varieties of incinerators, reports of more or less useful tests of their capacity, chapters on the character of refuse and its value as fuel, and a survey of the refuse disposal methods in various parts of the world. There are many small errors of statement throughout the book, where the author has been misled by the reports from which he condensed his notes, and, so far as his data on United States furnaces are concerned, more attention is paid to plants that have failed than to those operating in a successful manner. Nevertheless the book is of much value as the most thorough compilation of useful information on the subject now in print, and the criticisms made against it must be read in the light of the knowledge that so much new information is being gathered every month as to render it impracticable for any book to be strictly up to date.

Personal and Obituary Notes.

John L. Thorndike, M. Am. Soc. C. E., for many years closely associated with railway work in Peru, died in Lima on October 12.

Mr. W. S. Kinnear, assistant chief engineer of the Michigan Central R. R., has been appointed assistant superintendent of the Canadian division of the road.

James B. Eads is to have a fitting memorial at Washington University, St. Louis, to which school his daughter, Mrs. James F. How, has given $100,000 for the purpose.

Mr. E. N. Scofield, formerly manager of the Youngstown plant of the American Bridge Co., has been engaged to build and manage the new bridge works at Groton, N. Y.

Prof. Wm. R. Ware, of Columbia University, has been retained by the Pennsylvania Capitol Commission to advise it in matters relating to new plans for the State capitol.

Mr. Wm. L. Miller has resigned the office of city engineer of Winona, Minn., to take charge of a contract he has secured for building the new plant of the Missouri River Power Co., Butte.

Mr. William Easby, Jr., has been appointed assistant professor of civil engineering at the University of Pennsylvania, and Mr. A. W. Schramm assistant professor of electrical engineering.

Prof. R. A. Smart has severed his connection with Purdue University to become head of the department of experimental engineering recently established by the B. F. Sturtevant Co., Boston, to investigate problems relating to blower practice.

Mr. Watson Vredenburgh, Jr., has recently accepted the position of professor of engineering in the science department of Manhattan College. He will also continue his private practice at 32 Broadway, New York, and is just now engaged in directing the engineering work of the Pacific Portland Cement Co., San Francisco, Cal.

Paul Canfield, son of Mr. Edward Canfield, M. Am. Soc. C. E., and himself an engineer of much promise, died suddenly at Middletown, N. Y., of brain fever on October 16. He had recently been an expert witness in the litigation over the construction of the Rutland Canadian Railway, and the strain of a prolonged examination on technical matters is believed to have been the cause of his fatal illness.

Mr. Ernest L. Ransome, Assoc. Am. Soc. C. E., has opened an office at 11 Broadway as consulting engineer for concrete-steel construction. He has been identified with such work for many years, and many important designs by him for structures on the Pacific Coast and in the Eastern States have been illustrated in this journal. He is now the consulting engineer of several large concrete contracting companies.

Mr. Trevor McClurg Leutze, M. Am. Soc. C. E., died in Albany on October 14, after a lingering illness. He was born in Germany but came to this country at an early age. His first work was in the South, but in 1887 he joined the staff of the State Engineer of New York. He rose steadily, and at the time of his death was engineer of the eastern division. He was one of the consulting engineers in charge of the last barge canal survey, and in his regular work was engaged on a large part of the road improvements under the State aid law, as well as on the maintenance of the State water-ways.

Messrs. McKim, Mead & White, Messrs. Carrere & Hastings and Messrs. Babb, Cook & Willard have been retained by the trustees of the New York Public Library to design and supervise the construction of the forty-two branch Carnegie libraries in that city, with the exception of one which, it is expected, will be constructed from designs furnished by Mr. James Brown Lord. The three firms above named are to act in collaboration and decide jointly all matters of common import regarding the designs and construction and other details relating to the various buildings. The designing of each separate building, however, and the supervision of its construction are to be entrusted by allotment to the several firms.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS BUILDERS, ENGINEERS AND
MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Plymouth, O.—Bids are wanted Nov. 2 for the construction of a system of water-works, as advertised in The Engineering Record.

Merrillan, Wis.—C. E. Reichenbach, Village Clk., writes that the special election held Oct. 15 resulted favorably, bids for water-works and an electric light plant to be opened Oct. 22, as advertised in The Engineering Record.

Bloomington, Ind.—Press reports state that the Council will extend the water mains a distance of 4,000 ft.

Madison, Neb.—Plans and specifications for the new steel stand-pipe and water-works extensions are being prepared by Arnold C. Koenig, of Grand Island, Neb. Clyde G. Rynearson, Clk.

Bloomington, Ill.—City Engr. Elmer Folsom writes that the question of securing an additional water supply has been referred to a committee for investigation.

Pierce, Neb.—See "Power Plants, Gas and Electricity."

Centralia, Ill.—Press reports state that the City Council has awarded the contract for constructing a dam for reservoir to N. W. Irish & Co., of Carlyle.

Jacksonville, Ill.—City Clk. Sam'l B. Stewart has been instructed to receive bids for the taking over, by a syndicate, of the city water-works.

Modesto, Cal.—Press reports state that the Directors of the Modesto Irrigation District are receiving bids for $125,000 bonds issued for the construction of canal works, according to plans and specifications prepared by Engineer Goodwin.

Muskegon Heights, Mich.—Press reports state that plans have been prepared for a system of water-works, and a proposition to bond the district for $25,000 will be presented to the electors in the near future.

Alfred, N. Y.—A vote is stated to have been taken in favor of expending $15,000 for the construction of water-works.

Owego, N. Y.—A village election will be held Oct. 22 to vote on the proposition to purchase the Owego water-works plant at a price not to exceed $100,000.

Jasper, Ala.—T. L. Long writes that this city is desirous of granting a franchise for water-works and an electric light plant.

Mt. Union, Pa.—The Mt. Union Water Co. proposes to construct a reservoir and make other improvements. Address, Edgar B. Kay, of Ithaca, N. Y.

Highspire, Pa.—Edgar B. Kay, of Ithaca, N. Y., Pres. and Engr. of the Highspire Water Co., writes that contracts are about to be let for pipe, specials, etc., for the construction of water-works, estimated to cost $40,000.

Ellendale, Minn.—Village Recorder E. M. Thompson writes that it is proposed to put in the compressed air system of water-works, at a probable cost of $6,000.

East Liverpool, O.—A 10,000,000-gal. reservoir, recently completed and owned by the city, is reported to have burst Oct. 13.

Salt Lake City, Utah.—The Raft River Power & Water Co. has filed articles of incorporation. It is stated that the company intends to build a reservoir on Raft River and to supply the Park Valley with 5,000 electric H. P. A. V. Taylor, Pres.; E. T. Taylor, Vice-Pres.; A. W. Casey, Secy.

Yankton, S. D.—Press reports state that the Council has decided to supplant artesian wells as a source of water supply and take water from the Missouri River.

Greenwood, S. C.—See "Sewerage and Sewage Disposal."

Sloan, Ia.—An election will soon be held for the purpose of voting bonds for water-works. Plans and specifications are being prepared by Arnold C. Koenig, Grand Island, Neb. S. J. Oliver, Town Clk.

New York, N. Y.—Bids are wanted Dec. 17 for furnishing material and building a pumping plant in the engine-room and shaft No. 25 of the new Croton aqueduct, near 179th St. and Amsterdam Ave. John J. Ryan, Pres. Aqueduct Commrs.

Jacksonville, Fla.—Bids are wanted by the Board of Bond Trustees until Nov. 15 for $400,000 water-works and improvement bonds. B. F. Dillon, Chmn.

Cambridge, Minn.—Bids are wanted Nov. 11 for $11,500 water-works bonds. P. M. Torell, Village Recorder.

Chisholm, Minn.—Bids are wanted Nov. 2 for $8,000 water-works bonds. Chas. E. Stein, Village Recorder.

Winnipeg, Man.—City Engr. H. N. Ruttan writes that contracts for water-works supplies, for which bids were opened Oct. 4, have been awarded as follows: To the Canada Fdy. Co., Toronto, Ont., cast-iron pipe, $36.07 per ton, and specials at $54 per ton; to E. H. Bissett, of Winnipeg, Agt. for National Iron Wks., Wingham, Ont., 6-in. and 4-in. valves at $10 and $6 respectively.

River Forest, Ill.—It is stated that bids are wanted Nov. 4 for sinking a deep well for an increased water supply. Chas. A. Butler, Village Clk., 420 Ashland Blk., Chicago.

Fresno, Cal.—In a recent report City Engr. I. Teilman submitted plans and estimates on two sources of water supply, one for pumping water from well, in the city, by steam or electricity, total estimated cost $280,000; the other for a water supply from San Joaquin River, total estimated cost $582,000.

Cincinnati, O.—Bids are wanted Nov. 15 for furnishing and delivering one 100-H.-P. steam boiler, for supplying steam at 150 lbs. pressure per sq. in., with all necessary adjuncts and fittings, on the water-works grounds near California. Chas. G. Roth, Clk. Bd. Trus., "Commrs. of Water-Works."

Cumberland, Md.—The Board of Water Commissioners has recommended the purchase of a new pump.

Wilmington, O.—Local press reports state that bids are wanted by the Council for the construction of water-works.

Kansas City, Mo.—Bids are wanted Oct. 25 for furnishing to the Water Department at Quindaro Station 1 42-in., 2 30-in. and 2 36-in. gate valves. Harry B. Walker, Sec'y Bd. Pub. Wks.

Louisburg, N. C.—Bonds to the amount of $30,000 are stated to have been voted for water-works and sewerage.

Colorado Springs, Colo.—The County Commissioners are considering a proposition from the Portland Mining & Milling Co., which wants to build a dam across Bear Creek.

Emporia, Kan.—City Clk. G. O. Mathewson writes that water-works improvements contemplated will cost about $5,000, and include the raising of present dam 2 ft. Another dam will probably soon be built. Alva J. Smith, Engr. in Charge.

Mechanicsburg, O.—G. W. Shartle, of Osborn, O., is President of a company which has secured the franchise to erect and operate an electric light and water-works plant at Mechanicsburg. They also propose to light towns within a radius of 16 miles.

Tampa, Fla.—Local press reports state that plans and specifications for the water plant which Tampa proposes to build are now ready for the City Council.

Marlin, Tex.—At the election held Oct. 8, $18,000 water-works bonds and $20,000 school bonds are stated to have been voted.

Kirkwood, Mo.—At a recent mass meeting a resolution was adopted authorizing the Town Board to receive bids for pumping water from the Meramec or Missouri River.

Lafayette, Ind.—It is stated that bids are wanted by the Board of Water-Works Trustees until Oct. 21 for constructing an auxiliary pumping station, to cost $9,000. J. F. Alexander & Son, Archts., Lafayette.

Brooklyn, N. Y.—Mayor Van Wyck has signed the ordinance providing for a bond issue of $75,000, to be used in building a pumping engine at Millburn. Ordinances have also been approved providing for the laying of numerous water mains in the Boro. of Brooklyn.

Fargo, N. D.—A committee is stated to have been appointed to investigate the matter of securing a supply of artesian water.

Howell, Ind.—A. O. Jones, Attorney for Town, writes that arrangements have been made to purchase water from the city of Evansville, 1 mile distant; pipe only will be required. Cost, $7,500. C. C. Genung, of Evansville, Engr. in Charge.

Marseilles, Ill.—See "Power Plants, Gas and Electricity."

Goshen, N. Y.—Plans are under consideration for the improvement and enlargement of the present water supply. Jas. H. Fuertes, 120 Liberty St., New York City, Engr.

Madison, Minn.—M. B. Haynes, of Mankato, Minn., is said to be preparing plans for a water system, to be installed in the spring.

Matawan, N. J.—Specifications are stated to have been completed for new water-works.

Fairmont, W. Va.—The Council has decided to submit to a vote of the people the question of issuing $35,000 bonds for improving the water system and $25,000 bonds for sewerage purposes.

Montezuma, Ga.—Bonds to the amount of $15,000 have been sold for water-works and a sewer system.

West Lebanon, Ind.—Town Clk. Ike Hall writes that bids will probably be received in November for the construction of water-works, estimated to cost $16,000. W. H. Gemmer, of Williamsport, Ind., Engr. in charge.

Brockton, Mass.—The Finance Committee has voted in favor of the order authorizing the expenditure of $10,000 in preliminary work toward the adoption of the Silver Lake source of water supply.

Merchantville, N. J.—Isaac Ferris, Jr., and others, of Merchantville, are interested in a project to build a new water plant here.

Boyertown, Pa.—The Supreme Court has handed down a decision giving this place the right to build municipal water-works.

Pittsburg, Pa.—On the recommendation of the Finance Committee all resolutions making provision for the new filtration plant, including $1,700,000 for machinery, for the drilling of test wells and for additional pumps at Brilliant station were finally passed by the Common Council on Oct. 14, but said resolutions were held up by the Select Council.

Wellington, Kan.—The Council has passed a resolution approving Mayor Hunter's plan to build a dam below the old dam in Slate Creek.

Austin, Tex.—An injunction suit has been filed against the city, restraining the Council from buying the plant of the old water company.

Cleveland, O.—The City Council on Oct. 14 adopted a resolution authorizing the Director of Public Works to ask for bids for both 5,000 and 10,000 water meters.

Terre Haute, Ind.—The Council has appropriated $500 for experimenting with driven wells as a source of supply, should municipal water-works be decided upon.

Randolph, Neb.—Bids are wanted Nov. 1 for furnishing material and labor for the construction, erection, installation and delivery of the following items: Brick pumping station, triplex power pump, furnishing gasoline engine, installed complete and erecting pump, and for brick lining in a well 80 ft. deep. H. S. Fisher, City Clk.; Arnold C. Koenig, Engr., Grand Island.

New York, N. Y.—Bids are wanted Nov. 7 for furnishing double-nozzle case hydrants, lead-lined iron pipe, unions, elbows and couplings; for furnishing, delivering and laying water mains from standpipe at new high-service pumping station to Jerome Ave., in Jerome and Mosholu Aves., in 233d St., and in Kingsbridge Road; a 48-in. water main from the Croton Aqueduct, near Gun Hill Road, through Van Cortlandt Park, Bailey Ave. and Harlem River Terrace to Fordham Road; and water mains in Hunt's Point Road, Spofford Ave. and Manida St., to and under the East River to Riker's Island, and on Riker's Island, Boroughs of Manhattan and Bronx. Wm. Dalton, Commr. of Water Supply.

SEWERAGE AND SEWAGE DISPOSAL.

Washington, D. C.—Bids are wanted Nov. 2 for constructing sewers in the District of Columbia, as advertised in The Engineering Record.

Beaumont, Tex.—Bids are wanted Oct. 30 for constructing 2 brick trunk sewers and pipe laterals, estimated to cost $70,000. T. C. King, City Secy.; M. A. Orlopp, of Beaumont, Engr.

Emeryville, Cal.—John C. Coburn, Clk of the Bd. of Trustees, writes that bids will be received about Nov. 4 for the uncompleted portion of the sewer system. Thos. N. Badger, Engr. in Charge.

Glenville, O.—Bids are wanted Nov. 4 for constructing sanitary sewers, with flush tanks, manholes and other appurtenances in St. Clair and Eleanora Sts. Ira C. Farley, Village Clk.

Ft. Sam Houston, Tex.—Col. John Clem, Ch. Q. M. for Department of Texas, San Antonio, is stated to have received authority for construction of a complete sewerage system; cost, about $15,000.

Buffalo, N. Y.—R. G. Parsons, Secy. Bd. of Pub. Wks., writes that the contract, for constructing sewers in Mumford and Cumberland Aves., has been awarded to Thos. McKeown, of Buffalo, for $9,919. The work includes 2,909 ft. of brick and 320 ft. of pipe sewers from 63-in. to 20-in. in diameter, 13 manholes and 20 catch-basins. The trench is to average 10.63 ft. in depth.

Greenwood, S. C.—Mayor J. B. Park writes that the proposition to construct a system of sewerage and extend the water mains will be submitted to a vote of the people at an early date. Total estimated cost of improvements, $30,000. A. J. Sproles, Supt. of Water-Works.

St. Johnsville, N. Y.—Frank B. Towman, C. E., St. Johnsville, writes that if plans, for a system of sewers, are approved by the State Board of Health, the question of issuing bonds for said work will be submitted to a vote of the people.

Omaha, Neb.—Bids are wanted Oct. 25 for constructing pipe sewers in Sewer Dist. No. 266. Wm. Coburn, Secy., Bd. Pub. Wks.

Mendota, Ill.—C. M. Rickard, of La Salle, Ill., is making surveys for surface drainage for the entire city.

Woonsocket, R. I.—Contracts for constructing sewers in four streets have been awarded to F. E. Shaw, of Providence, for $15,500 total. The contract for Hamlet Ave. sewer has been awarded to Wm. H. Sherman, of Providence, for $4,500.

Springfield, Mo.—City Engr. H. G. Horton writes that the city is about to construct 3 district sewers of 8-in. pipe, averaging 1½ miles in length.

Blackwood, N. J.—Fred. W. George, Clk. and Aud. of the Bd. of Chosen Freeholders, Camden Co., Camden, writes that it is proposed to construct a sewerage system for the county buildings at an estimated cost of $5,000. Sam'l. Wood, Chmn. of Asylum Com. John J. Albertson, Co. Engr.

Aitkin, Minn.—The Council is stated to have decided to construct, at once, a sewer from the school house to the Mississippi River, according to plans prepared by R. K. Whitely, of Brainerd, Minn. Estimated cost, $6,000.

Montezuma, Ga.—See "Water."

Bradley Beach, N. J.—The Borough Council is stated to have granted the petition for the construction of a sewer system, estimated cost $18,000.

Sheraden, Pa.—Ordinances have been passed providing for the construction of sewers on several streets and alleys. W. R. Bell, Ch. Burgess.

Toledo, O.—Bids are wanted Nov. 4 for constructing circular brick and pipe sewers in 2 alleys and for a circular brick sewer in Oneida St. John E. Connell, City Clk.

Hyde Park, Mass.—Bids are wanted Oct. 23 for constructing about a mile of pipe sewers, including a crossing of the Neponset River. David Perkins, Chmn. Bd. Sewer Commrs.

St. Paul, Minn.—Bids are wanted Nov. 4 for constructing sewers in a portion of Winifred St. C. H. Bronson, Clk. Bd. Pub. Wks.

Saratoga Springs, N. Y.—Snow & Barbour, of Boston, have submitted to the Sewer, Water & Street Commission a detailed plan and description of the proposed plant for the disposal of the sewage of Saratoga Springs. The septic tank method with intermittent sand filtration is recommended and the total estimated cost of plant, including a new main sewer, is $98,000.

Hammond, Ind.—It is stated that bids are wanted Oct. 29 for constructing a 15-in. sewer in Alice and Walter Sts. and an 18-in. sewer in Thornton St. Peter J. Lyons, City Engr.

Marshall, Mich.—A resolution has been passed by the Council for the construction of a sewer in Mansion St.

Brownwood, Tex.—Plans and specifications have been prepared for a sewer system. H. P. Hardeman, City Engr.

Winchester, Ont.—It is stated that bids are wanted Nov. 1 for $51,810 drainage bonds. Thos. Hamilton, Reeve.

Roswell, N. Mex.—Bids are wanted Nov. 16 for furnishing material and constructing a sanitary pipe sewer with flushing water supply and drainage system. Approximate quantities: 3,000 ft. of 12-in., 2,640 ft. 10-in. and 29,240 ft. of 8-in. vitrified sewer pipe; 9 flush tanks, 139 manholes, 1 river crossing, masonry outlet and disposal bed, 29,240 ft. of 4-in. drainage tile, 3,600 ft. of 8-in. drainage tile, 2 artesian wells approximately 250 ft. deep, and connecting pipe for flushing purposes. Samuel Atkinson, Town Clk.

Washington, Pa.—Bids are wanted Oct. 21 for constructing 6,871 ft. of sewers in several streets, also for 950 ft. of 24-in. surface water sewer in South College St. Wm. H. McEnrue, Sec'y, Town Council.

Plymouth, Ind.—Bids are wanted Oct. 21 for constructing an 8-in. tile sewer on Washington St. Arthur E. Rhodes, City Clk.

Louisburg, N. C.—See "Water."

Swissvale, Pa.—D. V. Ault & Co., of Pittsburg, are stated to have received two drainage sewer contracts, at $5,257 and $23,857.

Toledo, O.—Present City Engineer Tonson estimates the cost of sewer construction for the relief of Monroe St. sewer district at $10,372.

Washington, D. C.—The District Commissioners have awarded the contract for a sewer in New Jersey Ave. to E. G. Gummel, at $42,365. For bids received see The Engineering Record of Oct. 12.

Shelton, Conn.—Residents of the South End are said to be in favor of the construction of sewers, for that section, according to plans prepared by Boro. Engr. D. S. Brinsmade.

Rochester, N. Y.—The contract for Sawyer St. sewer has been awarded to Whitmore, Rauber & Vicinus, the lowest bidders, for $6,520.

South Bend, Ind.—City Engr. A. J. Hammond is preparing plans for a trunk sewer for the southwestern part of the city.

New Hartford, N. Y.—At a recent election a vote was taken in favor of constructing a sewer system. Probable cost, $20,000.

Swedesboro, N. J.—The Swedesboro Sewer Co. has let the contract for building sewers to B. F. Sweeten & Son, of Camden.

St. Charles, Mo.—It is stated that bids are wanted Oct. 22 for constructing 1,960 ft. of sewer. Carr Edwards, City Engr.

Liberty, N. Y.—City Clk. Geo. L. Hill writes, that on Oct. 11 it was voted to issue $3,500 bonds for the purchase of property adjacent to the sewage disposal beds and $6,500 bonds for the enlargement and improvement of the disposal works.

Beverly, N. J.—The Town Council has under consideration the question of constructing a sewer system. M. Parsons, Chmn. of Com.

Mapleton, Minn.—Plans, for the construction of sewers, are stated to have been adopted.

Pittsburg, Pa.—See "Paving and Roadmaking."

Seattle, Wash.—Mayor Humes has signed an ordinance designating a new improvement district, which is to be laid with sewers at an estimated cost of $36,500.

Adrian, Mich.—Bonds to the amount of $50,000 are to be issued at once for paving and sewers.

Indianapolis, Ind.—Bids are wanted Oct. 28 for constructing sewers in first alley south of Downey St. and first alley southeast of Sutherland Ave. Harold C. Megrew, Chmn. Bd. Pub. Wks.

Hillsdale, Mich.—Bids are wanted Oct. 26 for constructing a sewer along the St. Joseph River. Henry K. Wilson, Clk. Bd. Pub. Wks.

Trenton, N. J.—The Common Council on Oct. 15 adopted plans prepared by Rudolph Hering, of New York City, for a separate sewerage system for the recently annexed district, which includes the 14th Ward and parts of the 2d and 13th Wards.

Boston, Mass.—The following bids were opened Oct. 8 by the Metropolitan Water & Sewerage Board, for constructing Section 75 of the High Level sewer in Roxbury:

Items and Quantities.	Met. Cont'g. Co., Boston.	Nat. Cont'g. Co., New York.	H. P. Nawn, Boston.	E. W. Everson & Co., Providence.
Rock or earth excav. and refill in tunnel:				
78-in. x 84-in. sewer, 2,200 ft.	$39.50	$33.00	$31.00	$30.00
Brick masonry:				
Amer., 600 cu. yds.	15.00	15.00	14.00	13.00
Port., 500 cu. yds.	16.00	17.00	16.50	15.00
Concrete masonry:				
Amer., 200 cu. yds.	6.00	8.00	7.00	6.00
Port., 600 cu. yds.	7.00	9.00	8.00	7.00
Totals	$109,300	$97,100	$91,050	*$86,700

*Contract awarded.

Newark, N. J.—Bids are wanted Oct. 24 for constructing brick sewers in Bank, Wickliffe and Academy Sts. J. Crowell Mundy, Gen. Supt. of Wks., Bd. Street & Water Commrs.

Le Mars, Ia.—The Council has voted to issue $4,000 bonds for sewers.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that the following bids were opened Oct. 9 for the construction of a joint district sewer in Districts Nos. 15, 220, 221, 222, 227 and 228, the work to include 8,237 ft. of 24-in. pipe to 7 ft. 8 in. brick sewers, 6 catch basins and 21 manholes. Bidders all of Kansas City. *Contract awarded:

Items.	Michael Walsh.	W. C. Mullins.	Robt. J. Boyd P. & C. Co.	Mat. Kinlin.
Pipe sewer, 24 in.	$2.00	$2.21½	$2.04	$2.25
Brick sewer, 3 ft. 2 in.	3.50	4.26½	2.96	3.00
Brick sewer, 3 ft. 4 in.	3.50	4.24½	3.34	3.30
Brick sewer, 3 ft. 8 in.	3.75	4.64½	3.69	3.70
Brick sewer, 4 ft. 0 in.	3.75	4.65½	3.79	3.76
Brick sewer, 4 ft. 2 in.	3.75	4.87½	4.04	3.91
Brick sewer, 4 ft. 4 in.	4.00	5.12½	4.04	4.05
Brick sewer, 5 ft. 2 in.	4.30	5.29½	4.74	4.50
Brick sewer, 5 ft. 6 in.	4.50	6.32½	5.14	5.13
Brick sewer, 5 ft. 8 in.	4.50	5.89½	5.07	5.15
Brick sewer, 6 ft. 0 in.	6.40	6.64½	8.19	8.70
Brick sewer, 7 ft. 4 in.	9.50	10.85½	9.87	10.75
Brick sewer, 7 ft. 8 in.	10.50	11.46½	11.06	12.50
Masonry	3.00	4.00	4.00	4.00
Catch basins	20.00	20.00	20.00	22.00
Manholes	35.00	25.00	25.00	35.00
Concrete	3.00	4.00	4.00	4.50
Rock excavation	2.50	1.00	1.60	2.40
Interceptor	250.00	200.00	275.00	350.00
12-in. catch basin con.	.50	.50	.50	.50
15-in. catch basin con.	.60	.60	.60	.65
Totals	$66,160	$63,303	*$62,848	$71,458

Bids opened at the same time were as follows for a joint sewer in Districts Nos. 89, 157 to 219, the work to include 14,145 ft. of 27-in. pipe to 6-ft. brick sewer, and 24 manholes. *Contract awarded:

Items.	Michael Walsh.	R. J. Boyd P. & C. Co.	W. C. Mullins.
Pipe sewer, 27 in.	$3.50	$2.00	$3.00
Brick sewer, 3 ft. 6 in.	4.50	4.28	1.42
Brick sewer, 4 ft. 8 in.	5.75	5.88	5.20
Brick sewer, 5 ft. 0 in.	6.90	6.48	5.90
Brick sewer, 5 ft. 2 in.	6.00	6.38	5.13
Brick sewer, 5 ft. 4 in.	6.65	6.08	5.88
Brick sewer, 5 ft. 6 in.	7.00	6.80	6.13
Brick sewer, 5 ft. 10 in.	7.00	6.62	6.37
Brick sewer, 6 ft. 0 in.	7.60	7.46	6.11
Manholes	40.00	25.00	35.00
Rock excavation	1.00	.25	3.75
Rubble masonry	4.00	4.00	4.00
Concrete	3.00	4.00	7.00
Special connections	300.00	250.00	500.00
4 ft. 6 in. brick sewer.	4.90	5.00	4.68
Totals	$97,343	$91,568	*$87,952

BRIDGES.

Montgomery, Pa.—A petition is being circulated by Burgess Weller, for the building of a bridge across Susquehanna River, at Montgomery.

El Paso, Tex.—Local press reports state that permission has been granted to the El Paso Electric Ry. Co. to construct a bridge across the Mexican side of the Rio Grande, also to take the necessary steps to construct an electric line through Juarex, Mex. This will necessitate the extension of their lines in El Paso.

Chautauqua, N. Y.—Press reports state that the building of a bridge across Chautauqua Lake at the Narrows is contemplated.

Denver, Colo.—It is stated that bids are wanted at once for the construction of a $5,000 viaduct at Mesa Ave.

St. Louis, Mo.—R. P. Garrett, Engr. of the Board of Public Imp., writes that the following bids were opened Oct. 11 for constructing sewers in Fillmore St., Sewer District No. 2. *Contract awarded. Bidders all of St. Louis:

Items and Quantities:	McIntyre & Teese.	Hill-O'Meara Con. Co.	Buehler-Cooney Con. Co.	Heman Con. Co.	Fruin-Bambrick Con. Co.	Fruin & Colnon.	H. Ruecking & Co.	Jas. Black Mas. & Con. Co.
Excavation:								
Earth, 80,000 cu. yds.	$.49	$.60	$.45	$.75	$.56	$.50	$.45	$.80
Loose rock, 100 cu. yds.	1.00	1.25	1.00	1.00	.95	1.25	1.00	.80
Solid rock, 2,000 cu. yds.	4.00	4.50	3.00	4.00	3.90	3.50	3.00	5.00
Quicksand, 10 cu. yds.	4.00	2.00	5.00	10.00	3.15	2.00	1.00	10.00
Earth furnished, 10 cu. yds.	.20	.60	.30	.10	.53	.50	.40	.25
Concrete:								
Class "A," 10 cu. yds.	6.00	7.00	7.25	7.00	8.40	6.00	7.00	7.00
Class "B," 10 cu. yds.	5.50	6.00	6.50	6.00	7.35	5.50	6.00	6.00
Class "C," 50 cu. yds.	5.00	5.50	6.00	5.00	5.25	5.00	5.00	5.00
Masonry:								
Rubble stone, 20 cu. yds.	4.00	5.50	4.00	5.00	7.35	5.00	5.00	6.00
Brick, 5,730 cu. yds.	8.25	8.35	8.00	8.50	8.05	8.00	8.00	9.50
Sewer Pipe:								
6-in., 100 ft.	.15	.15	.28	.15	.27	.12	.15	.20
9-in., 40 ft.	.20	.25	.28	.25	.32	.15	.25	.30
12-in., 11,600 ft.	.35	.45	.38	.50	.32	.37	.30	.35
15-in., 18,460 ft.	.45	.50	.48	.60	.37	.50	.40	.45
18-in., 5,440 ft.	.70	.65	.59	.70	.50	.62	.57	.65
21-in., 1,510 ft.	.90	.80	.76	.80	.70	.85	.75	.85
Vit. br. masonry, 580 cu. yds.	11.00	12.00	12.00	12.00	12.60	11.50	11.00	12.50
24-in. pipe sewers, 1,150 ft.	1.20	1.25	1.25	1.00	.90	1.25	1.20	1.40
Junctions, 2,580 pieces	.80	.90	1.00	1.50	.60	1.00	1.25	1.25
Slants, brick sewers, 720 pieces	.50	.65	.75	.60	.55	.50	.50	.50
Inlet stones, 4,940 sq. ft.	.50	.65	.65	.60	.52	.75	.50	.75
Cast iron, 110,000 lbs.	.02½	.03	.03	.03	.03	.03	.02½	.03
Wrought iron, 18,000 lbs.	.04	.05	.05	.05	.04	.04	.04	.05
Lumber in trench, 50 M. ft., B. M.	20.00	25.00	20.00	30.30	21.00	20.00	17.00	20.90
Timber foundation, 1 M. ft., B. M.	30.00	40.00	20.00	30.00	42.00	30.00	25.00	25.00
6-in. drain pipe, 1,000 ft.	.25	.50	.28	.50	.15	.25	.25	.30
Totals	$130,021	$145,119	$126,404	$160,909	$131,902	$131,704	*$121,966	$168,011

Cape May, N. J.—Robt. E. Hand is stated to have secured the contract for building bridges across creeks on the proposed road between the mainland and the resorts on Five-Mile Beach, for $45,788.

Clinton, Ia.—The Board of Supervisors has plans under consideration for the construction of a bridge near Ryerson Mill site, at a probable cost of $10,000.

Daleville, Ind.—Local press reports state that the County Commissioners will soon receive bids for building a bridge across White River, near Daleville. The bridge and masonry will cost about $8,000.

Crowley, La.—The citizens are considering the construction of a bridge across Descanes Bayou.

Lafayette, Ind.—The County Commissioners have decided to replace the Brown St. bridge, recently destroyed by fire, with a modern steel structure, to cost $25,000.

Rushtown, O.—It is stated that the Norfolk & Western Ry. Co. will build a bridge across Scioto River, east of Rushtown. C. C. Wentworth, Bridge Engr., Roanoke, Va.

Lewisburg, Pa.—The construction of a $100,000 bridge across Susquehanna River, at Lewisburg, between the counties of Union and Northumberland, is under consideration.

Sherbrooke, Que.—Local press reports state that bids received for building a bridge at Wolfe St. have been rejected and that new bids will be asked. F. J. Griffith, City Secy-Treas.

Pendleton, Ore.—The Washington & Columbia River R. R. Co. will, according to reports, build an $85,000 bridge across Umatilla River at Pendleton, to replace present structure.

Janesville, Wis.—The construction of a 2-span iron bridge, on stone piers, to replace present Milwaukee St. structure, is contemplated.

Elizabeth, N. J.—The Board of Freeholders has decided to construct a bridge at Prince St., also one at Crane St., at a total cost of $25,000.

Watervliet, N. Y.—The United Traction Co. is said to be contemplating the removal of the present bridge at 23d St., and replacing it with a more substantial structure.

Baltimore, Md.—Press reports state that the Merchants' Coal Co., of Baltimore, has awarded a contract to the Columbia Bridge Co., Pittsburg, Pa., for the construction of a viaduct and tipple, to be 1,084 ft. long, and requiring over 1,000 tons of structural steel.

Colorado Springs, Colo.—Bids will soon be asked, according to local press reports, for a bridge at South Tejon St., which the County Commissioners and the Rapid Transit Ry. Co. intend constructing jointly. Probable cost, $15,000.

Grand Rapids, Minn.—J. Lindeur, of Grand Rapids, is reported to have received the contract for constructing a bridge across Mississippi River, at Grand Rapids, for $5,975.

Philadelphia, Pa.—See "Paving and Roadmaking."

Quincy, Ill.—The Council has decided to grant to the Wabash R. R. Co. the right to build a viaduct at York St., provided that said company will assume all expenses and pay whatever damages may be done to property by reason of the change of grade.

Montreal, Que.—Press reports state that Arthur I. Myers, Pres. of the South Shore Ry., and a syndicate composed of American and English capitalists, have secured the franchise for the bridge from Longuel to Montreal, across St. Lawrence River.

Perth Amboy, N. J.—The Chamber of Commerce is contemplating the construction of a bridge, at a probable cost of $150,000, across Raritan River.

Wilkesbarre, Pa.—It is stated that the construction of a foot bridge in North Wilkesbarre, at a probable cost of $60,000, is under consideration.

Philadelphia, Pa.—See "Miscellaneous."

Dartmouth, Mass.—Press reports state that the only bid received Oct. 9 for constructing a bridge across Apponegansett River, at Dartmouth, was submitted by Beattie & Wilcox, of Fall River, at $27,900.

Jersey City, N. J.—The American Bridge Co. is stated to have secured the contract for repairing the Newark Ave. bridge, at $29,817.

Brooklyn, N. Y.—A resolution has been passed by the Council, authorizing an appropriation of $50,000, for the construction of a bridge across Gowanus Canal, at 9th St.

Germantown, O.—Press reports state that the Cincinnati Northern R. R. Co. has authorized the construction of a $25,000 bridge, 300 ft. long, near Germantown. W. D. Williams, Ch. Engr., Van Wert.

Gilbert Plains, Man.—It is stated that bids are wanted Oct. 28 for building a bridge across Valley River. Jas. C. Turner, Municipal Clk.

Nauvoo, Ill.—It is stated that bids will be received by the Highway Commissioners for constructing a steel bridge across Cheny Creek. The bridge is to be 108 ft. long, including approaches, and 14 ft. wide.

Vicksburg, Miss.—The contract for constructing an iron bridge across Big Black River has been awarded to the American Bridge Co., of New York City, for $13,396.

Roswell, N. Mex.—Co. Clk. F. P. Gayle writes that the contract, for constructing a steel bridge 400 ft. long, 3 miles east of Roswell, has been awarded to the Midland Bridge Co., of Kansas City, Mo., for $11,008.

Columbus, Ga.—City Clk. M. M. Moore writes that on Oct. 10 it was voted to issue $40,000 bonds for the construction of a steel bridge across Chattahoochee River.

Manhattan, Kan.—The contract for constructing a steel bridge across Kansas River in Ashland Township, has been awarded to the American Bridge Co., of New York City (Edw. Applebey, of Kansas City, Mo., Agt.), for $9,475.

Waterloo, Ia.—The citizens have voted in favor of appropriating $25,000 toward the construction of a concrete or steel bridge at 4th St. Total cost of said bridge to be about $50,000.

Kansas City, Mo.—An ordinance has been passed by both branches of the Councils, providing for the construction of a bridge at Allen Ave.

Godfrey, Ill.—Press reports state that the Chicago & Alton R. R. Co. will rebuild all overhead bridges on its Jacksonville branch, between Roodhouse and Godfrey. H. C. Draper, Ch. Engr., Chicago.

Fargo, N. D.—Bids are wanted Nov. 12 for constructing a 200-ft. steel and iron approach to bridge at North Pacific Ave. O. J. Olson, Co. Aud.

Boston, Mass.—Bids are wanted Oct. 24 for rebuilding piers of Broadway bridge over Ft. Point Channel. Wm. Jackson, City Engr.

McKeesport, Pa.—A press report states that a company has been formed by McKeesport capitalists to construct a bridge across Monongahela River, above McKeesport, to build a traction line to Blair Station, which will connect with the line of the United Traction Co. above Glassport.

Hinton, W. Va.—Jas. T. McCreery, Pres. of the Hinton New River Bridge Co., has awarded to the American Bridge Co., of New York, the contract for constructing a bridge across New River at Hinton. The bridge is 1,200 ft. long, 18 ft. roadway, and 60 ft. above low water. Contract price, $45,000.

Hartford, Conn.—Press reports state that the citizens of West Hartford have voted to construct a concrete bridge, 30 ft. wide, across Trout Brook; cost not to exceed $4,000.

PAVING AND ROADMAKING.

Fowler, Ind.—Bids are wanted by the County Surveyor until Nov. 4 for the construction of 4 gravel roads, as advertised in The Engineering Record.

Greensburg, Ind.—Bids are wanted Nov. 1 for paving with hard-burned brick on a portion of North Lincoln St. Wm. R. Brazelton, City Clk.

Chester, Pa.—Bids are wanted Oct. 21 for paving with sheet asphaltum a portion of 7th St. Frank W. Harrison, City Clk.

Freemont, O.—Bids are wanted Nov. 8 for grading, curbing, draining and macadamizing East State St. E. Schwartz, Chmn. Improvement Com.

New Orleans, La.—Bids are wanted Oct. 21 for paving with asphalt on a portion of Jefferson St. V. Tujague, City Compt.

Lorain, O.—Bids are wanted Nov. 11 for $31,000 street improvement bonds. J. J. Mahony, City Clk.

Gaylord, Mich.—A project is said to be under consideration for the construction of a stone road through Otsego County. Estimated cost, $40,000.

San Francisco, Cal.—The Street Committee of the Board of Supervisors has recommended the paving of Mission Road, estimated cost $30,000; 4th St. with basalt block, cost $5,400; and Stockton St. with bituminous rock, cost $9,390.

Milwaukee, Wis.—The Board of Public Works on Oct. 8 let the contract for paving Juneau Ave. with asphalt from Milwaukee to Jackson St. to the Western Paving & Supply Co., for $2.35 a sq. yd. John T. Hoff secured the paving of the same street from Jackson to Van Buren Sts., 1,259 yds., with brick at $2.19 a sq. yd.

Whitebear Lake, Minn.—The Board of County Commissioners, Glenwood, Minn., is said to have under consideration the bonding of the county for $100,000 for macadamizing the main roads to the city from Whitebear Lake and Lake Johanna and the Rice St. road.

Sullivan, Ind.—The people of Turman Township have voted for the construction of 15 miles of gravel road, to cost $52,000.

Philadelphia, Pa.—According to the estimate of Chief Brooks, as approved by the Committee on Highways on Oct. 14, $2,564,468 will be required for the Bureau of Highways next year, including the following items: Paving intersections, $175,000; repairing and maintaining unpaved streets and roads, $175,000; general repairs to bridges, $200,000; surfacing and resurfacing unpaved streets and roads, $200,000; repairs to asphalt streets and breaks in footways, $100,000; resurfacing streets with sheet asphaltum, $300,000; repairs to paved streets, $175,000.

Madison, Wis.—Local papers state that the city's share of the cost of paving the streets about Capitol Sq. is estimated at $39,000 for asphalt or $21,600 for granite top macadam.

Mendota, Ill.—C. M. Rickard, of La Salle, Ill., is preparing plans, specifications and estimates for about $60,000 worth of street improvements to be done in the spring.

Seattle, Wash.—The City Council has passed ordinances providing for the laying out of 120-ft. highways, to be known as the "North Shore Boulevard" and the "South Shore Boulevard."

Cohoes, N. Y.—The contract for completing the contract of Martin Murray for grading the Garner St. extension, 55,851 cu. yds., has been awarded to Wm. Stanton, of Cohoes, for $12,000.

Oskaloosa, Ia.—The City Council has decided to pave, with brick, one of its principal streets.

Latrobe, Pa.—The Borough Council has passed an ordinance authorizing the paving of a portion of Ligonier St. with brick. J. F. Toner, Burgess.

Gallipolis, O.—The contract for paving a portion of Second Ave. with brick has been awarded to A. K. Williams, for $8,144.

Huntington (L. I.), N. Y.—Eldert & Johanknect, of Jamaica, have submitted the lowest bid at $36,820 for the construction of about 7 miles of gravel road, from Huntington through Syosset to the Woodbury boulevard.

Sag Harbor (L. I.), N. Y.—A plan is said to be on foot to build a macadam boulevard from Southampton to this village.

Newport News, Va.—A proposition is under consideration for the macadamizing of about six miles of road between Newport News and Morrisons, the county to pay $20,000 and the city $5,000.

St. Paul, Minn.—Bids are wanted Nov. 4 for macadamizing a portion of Arcade St. C. H. Bronson, Clk. Bd. Pub. Wks.

Seymour, Conn.—Bids are wanted Oct. 28 for constructing a macadam and gravel road in the town. Geo. R. Divine, 1st Selectman.

Jersey City, N. J.—Bids are wanted Oct. 22 for 4,000 sq. yds. of asphalt pavement on Highland Ave. and 310 sq. yds. Belgian pavement on Merseles St. Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

Omaha, Neb.—Bids are wanted Oct. 25 for repaving, readjusting the old curbs and replacing all defective curbing in a portion of Howard St. Bids are to be for either asphalt, vitrified brick, stone block, vitrified block or disintegrated granite. Wm. Coburn, Sec'y Bd. Pub. Wks.

Braddock, Pa.—Bids are wanted Oct. 24 for grading and paving with vitrified brick Center and George Sts., and part of Mills Ave., Willow, Cherry and April alleys. Address, Wm. Howat, Supt. Pub. Wks.

Columbus, O.—The contract for resurfacing Town St. with asphalt has been awarded to the Cleveland Trinidad Paving Co. at $1.31 per yd.; total, $28,939.

Cleburne, Tex.—An issue of $13,000 school and street improvement bonds is said to have been decided by vote.

Hackensack, N. J.—See "Electric Railways."

Oakland, Cal.—The total estimated cost of the proposed tunnel road between Contra Costa and Alameda Counties is placed at about $50,000, including 452 ft. of tunnel required on the Alameda side and 610 ft. on the Contra Costa side.

Wilkinsburg, Pa.—Bids are wanted Oct. 31 for $60,000 street improvement bonds. Arthur Stuart, Chmn. Finance Com., 907 Wallace Ave.

Niles, O.—Bids will be received Oct. 28 for paving with asphalt block. Wm. Wilson, City Engr.

Beeton, O.—See "Power Plants, Gas and Electricity."

Camden, N. J.—Bids are wanted Nov. 11 for constructing Clementon and Gibbsboro gravel road. J. J. Albertson, Co. Engr.; Irving Buckle, Chmn. Road Com.

Boston, Mass.—Supt. of Streets B. T. Wheeler has reported that the necessary improvement of a portion of Orleans St. calls for paving with granite block at an estimated cost of $6,000.

St. Paul, Minn.—The Board of Public Works is about to let contracts for paving with asphalt on Shelby Ave., estimated cost $75,000, and South Wabasha St., estimated cost $34,000.

Ft. Rodman, Mass.—See "Government Work."

Tampa, Fla.—Bonds to the amount of $400,000 having been voted on Oct. 8, Hillsboro County will rebuild 100 miles of road with rock or cypress blocks. A. J. Knight, Chmn. Bd. of Co. Commrs.

Nashville, Tenn.—Press reports state that the Bond Committee of the County Court will receive bids Oct. 29 for $250,000 turnpike bonds.

Niagara Falls, N. Y.—Local press reports state that the Board of Public Works will soon ask bids for paving a portion of First St.; cost not to exceed $9,199.

Pittsburg, Pa.—Both branches of the Council have passed 91 ordinances for street grading and paving, laying sewers and general street improvements.

St. Joseph, Mo.—Local press reports state that 13th St. is to be paved with brick.

Adrian, Mich.—See "Sewerage and Sewage Disposal."

Toledo, O.—Bids are wanted Nov. 13 for macadamizing Stone Road No. 35. Wm. M. Godfrey, Co. Aud.

St. Louis, Mo.—R. P. Garrett, Engr. of the Board of Pub. Imp., writes that repaving contracts, for which bids were opened Oct. 11, have been awarded as follows: A portion of Garrison Ave. and two sections of Theresa Ave. to the Barber Asphalt Paving Co., using the best quality of refined asphaltum, at $3,855, $12,407 and $1,948, respectively; to J. C. Finck, Jr., portions of Beaumont St., Ewing, Leffinwell and Leonard Aves., using vitrified brick on a concrete base, with granite curbing, at $9,186, $12,169, $12,064, and $8,697, respectively; to Stifel & Ruckert, of St. Louis, portions of Compton Ave. and Merchant St., using vitrified brick on a concrete base, with granite curbing, at $19,282 and $4,469, respectively.

POWER PLANTS, GAS AND ELECTRICITY.

Media, Pa.—Bids are wanted Oct. 30 for furnishing and installing a complete pole line, including poles, cross-arms, wires and other apparatus for electric lighting plant for this borough, as advertised in The Engineering Record.

Middletown, N. Y.—Bids are wanted Nov. 1 for electric work, rewiring, etc., of main building at Middletown State Hospital, as advertised in The Engineering Record.

Merrillan, Wis.—See "Water."

Boonville, N. Y.—Village Clk. H. R. Tubbs writes that on Oct. 15 it was voted to issue $45,000 for the erection and equipment of a lighting plant.

Almonte, Ont.—Bids are wanted Oct. 23 for $30,000 electric light bonds. L. Coulter, Town Clk.

Salt Lake City, Utah.—The Directors of the Utah Light & Power Co. are stated to have approved the plans of Clemens Herschel, 2 Wall St., New York, N. Y., for the proposed dam in Ogden Canyon. It will impound about 2,000,000,000 cu. ft. of water, and cost about $250,000. Work will probably commence this fall.

Ft. Scott, Kan.—City Clk. J. O. Brown writes that on Oct. 8 it was voted to issue $10,000 bonds to bore for gas.

Jasper, Ala.—See "Water."

Wadena, Minn.—Bids are wanted Oct. 23 for a tubular boiler for the electric light plant. F. F. Latta, Recorder.

Princeton, Ind.—See "Electric Railways."

San Bernardino, Cal.—The Supervisors of San Bernardino County are stated to have granted the Mentone Power Co. a franchise to construct a pole line for the transmission of electricity from Mill Creek Canyon to the west line of the county, with privilege of constructing spur lines to various cities in the county.

Delphos, O.—A vote will be taken Nov. 5 on the issue of $25,000 bonds for the construction of an electric lighting system. J. N. Fisher, Village Clk.

Columbia, S. C.—Bids are wanted Oct. 30 for the electric wiring of the State House. J. Q. Marshall, Chmn. Commn. for the Lighting of State Bldgs.

Pierce, Neb.—Efforts are being made to organize a company among the business men, to install an electric light plant in connection with the proposed water-works, for which plans are being prepared by Arnold C. Koenig, Grand Island, Neb. L. R. Hertert, Clk.

Salt Lake City, Utah.—See "Water."

Altoona, Pa.—W. H. Herr, Louis Plack, and others, are reported interested in a new company about to be organized, with a capital of $150,000, to construct an electric light plant.

Tacoma, Wash.—The Washington Power Co. has been incorporated, with a capital of $1,000,000. Incorporators: A. M. Ingersoll, A. J. Hayward, and others.

Braddock, Pa.—The Council is stated to have granted the Keystone Electric Co. a right of way through the borough. F. T. Redman, of Braddock, is one of the incorporators.

Salt Lake City, Utah.—Mayor Thompson is reported to have approved the action of the Sewer Committee in granting right of way to the Telluride Power Co. for the construction of a power transmission line connecting the Logan and Provo canyon plants.

Auburn, N. Y.—A press report states that C. D. Beebe, of Syracuse, has received a gas and electric light franchise.

Newark, O.—See "Electric Railways."

Los Angeles, Cal.—Lynn Helm, Secy. Los Angeles Suburban Gas Co., has petitioned the Fire Commission for permission to construct a gas plant on St. John and Holly Sts.

Ouray, Colo.—See "Electric Railways."

Salem, O.—The Council is stated to have granted the Salem Electric Light & Power Co. a franchise to construct and operate an electric light plant. Milton Davis, Pres.

Warren, O.—C. H. Struble and associates are stated to have secured a franchise for gas mains to be laid under the public highways from Girard, Niles and Mineral Ridge to Warren.

Evanston, Ill.—The Council is stated to have passed an ordinance giving the Evanston Electric Illuminating Co. the right to lay pipes for steam and hot water heating in the territory a half-mile square with Maple Ave. and Clark St. as the center.

Marshall, Ill.—A. M. Patitz is stated to have been employed as Consulting Engineer for an electric light plant for this place.

Marseilles, Ill.—F. S. Donnell, 43 Milk St., Boston, Mass., Pres. Ottawa Ry. Light & Power Co., is stated to have purchased the plant of the Marseilles Land & Water Co. It is reported that a new dam and power house will be constructed.

Monroe, Ia.—This town is reported to have voted for a gas plant. The Practical Gas Co., of Chicago, Ill., will install the plant.

Muscatine, Ia.—It is stated that bids are wanted Nov. 1 for a 10-year public and private lighting contract. Bert. C. Benham, City Recorder.

Toronto Junction, Ont.—The Humber Light & Power Co. is stated to have received the contract to supply 100 arc lights of 2,000 c. p. at $60 per light per year. The company will purchase the town's plant.

Mechanicsburg, O.—See "Water."

Beeton, Ont.—The citizens are stated to have voted to issue $7,000 bonds for extending the electric-light system, and for street improvements.

ELECTRIC RAILWAYS.

Philadelphia, Pa.—W. S. Turning is reported to be preparing plans for the erection of a power house for the Union Traction Co., to be located on Wyoming and Broad Sts.

El Reno, Okla. Ter.—The Oklahoma Electric Ry. & Light Co. is reported to have been formed here, with a capital of $1,000,000, to construct about 400 miles of electric railway in Okla. Ter. Incorporators, Fred'k Ehler, Hennessey, Okla, Ter.; R. A. White, El Reno, and others.

Glassport, Pa.—It is stated that the United Traction Co. will shortly begin extending its lines from Glassport up the Monongahela River to Elizabeth and Monongahela.

Maywood, N. J.—The Council is reported to be considering the question of granting a franchise to the Hudson River Ferry & R. R. Co. for a trolley line from Hackensack through Maywood to the Midland Township line.

El Paso, Tex.—See "Bridges."

Hackensack, N. J.—The Hackensack Improvement Commission is stated to have granted the Bergen Turnpike Co. a franchise for a trolley line through Hackensack. The company agrees to pave Hudson St. with Belgian block between the tracks and macadam on each side of tracks; gutters to be paved with blocks. Main St. to be paved to Anderson St. with brick, and new curbs set (feed wires and conducts under ground) from Anderson St. to Cherry Hill, with blocks inside of tracks and macadam outside to gutters.

McKeesport, Pa.—See "Bridges."

Ava, Mo.—The Ava Northern Ry. has been incorporated, with a capital of $50,000, to construct an electric road from this place to intersect with the San Francisco road at Cedar Gap, 14 miles north of here. W. J. Turner, Pres.; H. S. Wilson, Sec'y.

Marinette, Wis.—H. McCallum & Co., of Marinette, have commenced the work of laying out a right of way for the interurban electric line to be constructed between Marinette and Peshtigo by the Marinette St. Ry. Co. The distance is about 7 miles. H. C. Higgins, of Marinette, Supt. and Gen. Mgr.

Shreveport, La.—Frank W. Kane is preparing plans for an electric belt railway line 8 miles in length, for the Peoples' Belt Ry. Co.

Stamford, Conn.—The Stamford St. Ry. Co. is stated to have decided to extend its lines westward to meet the Greenwich lines. N. H. Heft, Pres., New Haven.

Schenectady, N. Y.—The Schenectady Ry. Co. is stated to have secured permission from the Highway Commissioners of the town of Colonie to construct and operate a double track through that town, beginning at the town line of Niskayuna, and extending along the Troy road to the city line of Watervliet, a distance of about 7 miles.

Albany, N. Y.—The United Traction Co. is reported to be considering the construction of a line from Albany to Delmar and Singerlands and back to Albany via the New Scotland plank road. J. W. McNamara, Gen. Mgr., Albany.

Concord, Mass.—The State R. R. Commissioners are stated to have authorized the issue of original stock to the amount of $50,000 by the Concord, Maynard & Hudson St. Ry. Co., for building and equipping its road, and the issue of original stock to the amount of $60,000 by the Concord & Clinton St. Ry. Co. for building and equipping its road.

Dunkirk, Ind.—The Council is stated to have granted a franchise to the Eastern Indiana Traction Co.

Seattle, Wash.—The Seattle Electric Co. is reported to have made the preliminary surveys of a car line to the army post, which as now planned will connect at Interbay, Wash., with the present Ballard line. H. S. Hanford, Engr. Charge of Construction.

Newark, O.—The Columbus, Newark, Zanesville & Wheeling Electric Ry. Co., of Newark, has been incorporated with a capital of $150,000, by Joseph M. Ickes, Lakin C. Taylor, and others, to construct and operate an electric railway through Newark, Zanesville, Cambridge, Barnesville, Coshocton and New Comerstown. The company has also the right to generate and sell electricity.

Washington, D. C.—Gen. Mgr. H. W. Fuller writes that the City & Suburban Ry. Co. proposes to extend its line from Berwyn, Md., to Laurel, Md.

Richmond, Ind.—The Wayne County Commissioners are stated to have granted franchises to Theo. Shockney, of Union City, representing the Richmond, Union City & Portland Interurban Railway Co., and to the Eastern Indiana Traction Co.

Rosedale, Kan.—A charter has been granted to the Kansas City & Olathe Electric Ry. Co., with a capital of $1,000,000, to construct an electric railway from Kansas City to Olathe. Directors: T. C. Goodwin, Kansas City; B. L. Stine, Rosedale, and Wm. Lockman, Olathe.

Richmond, Cal.—E. S. Tewksbury, John Nicholl, and others, have petitioned the Supervisors of Contra Costa County, at Martinez, for a franchise to construct and operate an electric railway in Richmond.

Knoxville, Tenn.—The County Commissioners have granted Ashley S. Johnson a franchise to construct an electric railway from Knoxville to Sevierville.

Princeton, Ind.—A 50-year franchise is stated to have been granted to Edw. J. Baldwin, for an electric railway through Gibson County, and for electric light and power privileges. He will organize a company and construct a line from Evansville through Princeton to Coats Springs. He will also erect hotel buildings and otherwise improve the springs.

Paris, Tex.—The Paris Transit Co. has been incorporated, with a capital of $100,000, to construct, acquire and operate street railways in Paris and Lamar County. Incorporators: John A. Porter, F. N. Stormont, and others, of Paris.

Omaha, Neb.—J. J. Boucher, attorney of the Douglas County Suburban Ry. Co., has petitioned the County Commissioners for a franchise for the construction and operation of a suburban line.

Ouray, Colo.—The San Juan Ry. & Electric Co. has been incorporated, with a capital of $300,000, to construct an electric railway about 20 miles long, in Ouray County, and to furnish power for the mines in San Juan District. G. A. Taft, Gen. Mgr., Colorado Springs, Colo.

Lexington, Ky.—Col. Tobias Gibson has petitioned the County Commissioners for a franchise to construct an electric railway along Harrodsburg pike, from the town limits to the military road, and to the county line.

Royersford, Pa.—The Royersford Electric Ry. Co. and the Montgomery & Chester Ry. Co., of Spring City, Pa., have petitioned the Borough Council for franchises.

Mt. Vernon, O.—The Columbus & Granville Interurban Ry. Co. is reported to be petitioning for a right of way in Knox County, with a view to extending its proposed road to Mt. Vernon.

Portsmouth, Va.—The Norfolk, Portsmouth & Newport News Electric St. Ry. Co. has secured a franchise from the City Council to extend its line about 1 mile. In the spring it will probably extend its line about 7 miles, to Churchland, Va. M. J. Jones, Gen. Supt., Port Norfolk, Va.

Springfield, O.—The Clark County Commissioners are reported to have granted the Little Miami Traction Co. a franchise to construct a line from Beattytown, along the Yellow Springs pike, to the Greene County line.

Logansport, Ind.—Nelson G. Hunter, of Wabash, attorney for the Wabash River Traction Co., now operating between Wabash and Peru, is stated to have petitioned the County Commissioners for a franchise through Cass County.

East Alton, Ill.—The Council is stated to have granted a franchise to the Alton & East Alton Ry. & Power Co.

Goshen, N. Y.—The Orange County Traction Co. has been incorporated; capital, $325,000. Directors: F. H. Moffatt, New Brighton; B. J. Bloodgood, Brooklyn, W. C. Hascey, of Montclair, N. J., and others.

Brunswick, Me.—The Selectmen are stated to have granted a franchise to the Portland, Yarmouth & Brunswick Electric Ry. Co.

RAILROADS

St. Louis, Mo.—The St. Louis, Kirkwood & Manchester R. R. Co. has been incorporated, with a capital of $250,000, to construct a railroad along the Manchester road from St. Louis to Manchester, Mo. Incorporators: Merrit H. Marshall, Dr. John M. Berry, and others.

Council Bluffs, Ia.—The Chicago Great Western R. R. has surveyed a line between Ft. Dodge and Council Bluffs, and expects to complete construction by next fall. Sam'l C. Stickney, Gen. Mgr., St. Paul, Minn.

Valparaiso, Ind.—A press report states that on Oct. 8 the citizens of Morgan and Porter townships voted to aid in constructing the Cincinnati, Richmond & Muncie R. R. through Porter County. The line is now being constructed to North Judgson, Ind., and will be extended to Chicago this fall.

Union Centre, Wis.—The Hillsboro & Northeastern R. R. Co. is stated to have been formed with a capital of $50,000, to construct a railroad from Union Center, on the Chicago & Northwestern road, to Hillsboro, a distance of about 6 miles. Incorporators: F. L. Pinch, L. H. E. Webster and others.

Allegheny, Pa.—A press report states that the Pennsylvania R. R. Co. will, during the next 2 weeks, receive bids for the Ft. Wayne R. R. improvements through Allegheny, which will involve an expenditure of over $2,000,000. Frank F. Robb, Div. Supt., Allegheny. W. H. Brown, Ch. Engr., Philadelphia.

Ensley, Ala.—The Warrior Southern R. R. Co. is reported incorporated, to construct a railroad from the Mobile and Ohio extension to Warrior fields, to Ensley, and connect with the Alabama Great Southern. A. B. Andrews, Pres., Raleigh, N. C.

Ely, Minn.—It is stated that the Port Arthur, Duluth & Western section of the Canadian Northern Ry. will be extended early next season from Gunflint Lake to Ely, Minn., a distance of 45 miles. A. J. Corrie, Port Arthur, Ont.

Portland, Ore.—The Council is stated to have passed an ordinance, granting a franchise to Geo. W. Weidler to construct a single track railroad on Sherlock Ave. and North Front St.

San Francisco, Cal.—The California Midland R. R. has been incorporated, with a capital of $15,000,000, to construct and operate 500 miles of road with terminal at Stockton, Yosemite Valley, Bakersfield, and at a point near the Nevada line. Incorporators: W. H. Hart, W. M. Graham, E. Dexter and others.

Randsburg, Cal.—A press report states that the Randsburg Ry. will be extended to Keeler, a distance of about 100 miles. E. H. Stagg, Gen. Mgr., Johannesburg, Cal.

Cincinnati, O.—The Cincinnati & Dayton R. R. Co., of Cincinnati, has been incorporated, with a capital of $100,000, by J. W. Daly, Geo. H. Argus, Jr., and others, to construct and operate a steam railway from Cincinnati to Dayton.

Laurel, Miss.—The Laurel & Tullahoma Western Ry. Co. is stated to have been incorporated, to construct a railroad from Laurel to Raleigh, Miss. G. S. and Phillip S. Gardiner are among the incorporators.

Dothan, Ala.—Hardaway, Jones & Co., of Columbus, Ga., are stated to have secured the contract to construct the line of the Dothan, Hartford & Florida R. R. Co. from Dothan, Ala., to St. Joseph, Fla., a distance of 102 miles.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Brooklyn, N. Y.—Bids are wanted Oct. 23 for erecting a 1-story brick laundry building and for the furnishing and installing of a steam laundry plant in the Kings County Hospital. John W. Keller, Commr. Dept. Pub. Charities, New York City.

Birmingham, Ala.—Bids are wanted by the Board of Managers of the Hillman Hospital until Nov. 4 for erecting a hospital. Address, Thos. U. Walter, Archt., 421 Chalifoux Bldg.

Boston, Mass.—The Board of Aldermen on Oct. 10 appropriated $90,000 for a bath house in the North End, and $20,000 for a bath house in Ward 15.

Columbus, Ga.—The Trustees of St. Paul's Church are stated to have decided to erect a new edifice, to cost about $30,000.

Chelsea, Pa.—Frank Miles Day & Co., 801 Penn Mutual Bldg., are stated to have prepared plans for the Children's Seaside Home, to be erected in Chelsea. The plans call for a main building 4 stories high, 84 x 300 ft., 2 cottage buildings, each sub-divided, with 16 minor ones.

Montreal, Que.—The directors of the Notre Dame Hospital on Oct. 9 are stated to have decided to rebuild the hospital. C. P. Hebert, Pres.; Dr. Denoit, Secy.

Vincennes, Ind.—The members of the Christian Church are reported to have decided to erect a new stone church, to cost $30,000.

Mansfield, O.—Williams & Beavers, of Shelby, are stated to have secured the contract for reconstructing and improving the Richland County court house, for $49,834.

San Antonio, Tex.—The city will sell its present city hospital, also the block of ground, and build a new city hospital on the cottage plan.

Mankato, Minn.—The Library Board will soon let contracts for the construction of the Carnegie Library, work not to be started until early next spring.

Nashua, N. H.—The contract for constructing Hunt Memorial Library has been let to the Nashua Building Co., of Nashua, for $38,000; $12,000 additional will be expended on finish and furnishings for same. John F. Stark, Nashua, N. H., Chmn. of Com. Cram, Goodhue & Ferguson, Boston, Mass., Architects.

Lincoln, Ill.—J. A. Simpson, of Lincoln, is stated to have received the contract to erect an infirmary at the asylum at Lincoln, for $33,334.

Hartford City, Ind.—The plans of J. Brown are stated to have been accepted for a $15,000 city hall. The jail department will contain 40 cells.

Philadelphia, Pa.—Bids are wanted Oct. 28 for erecting a bath house in the 13th and 20th wards, a fire house in the 15th ward, and for grading, etc., in League Island Park. Abraham I. English, Dir. Dept. Pub. Safety, Bureau of City Property.

Sycamore, Ill.—It is stated that $100,000 has been appropriated by the Supervisors of DeKalb County for a new court house and jail.

Martinsburg, W. Va.—The Presbyterian Society is stated to have accepted plans for a $20,000 church.

New York, N. Y.—Bonds to the amount of $275,000 are reported to have been authorized by the Board of Estimate for erecting the new Harlem Hospital on Lenox Ave. and 136th St.

Fargo, N. D.—The plans of Hancock Bros., of Fargo, are stated to have been accepted for the Carnegie Library.

New Iberia, La.—The Diebold Safe & Lock Co., Canton, O., is stated to have secured the contract for erecting a jail, for $19,000.

Traverse City, Mich.—The Congregational Society is reported to have voted to erect a $15,000 church.

Hazlehurst, Miss.—A press report states that only one bid was received Oct. 7 for erecting the Copiah County court house; and the Supervisors did not open the bid, but new bids will be received Dec. 2, and postponed action until the November term; probable cost, $50,000. J. Rieley Gordon, Archt., Dallas, Tex.; J. B. Mayes, Clk. Bd. of Supervisors.

Galveston, Tex.—The First Baptist Society is stated to have accepted the plans of G. W. Bulger, Levy Bldg., for a $20,000 edifice.

Lincoln, Neb.—Bids are wanted Oct. 24 (extension of date) for constructing 60 steel cells in the State Penitentiary at Lincoln. Geo. D. Follmer, Pres. Bd. Pub. Bldgs.

Springfield, Ill.—Frank H. Hamilton, City Hall, is stated to have prepared plans for the $150,000 State armory to be erected here.

Portland, Me.—Mrs. Mary E. Wilde, of New Jersey, is reported to have presented $20,000 to this city, to be used for the erection of a memorial chapel in Evergreen cemetery.

Springfield, O.—It is stated that a $20,000 building will be erected here to be used as a patrol and station house.

Lake Village, Ark.—Wm. Stanton & Son, of Vicksburg, Miss., are preparing plans for a court house for Lake Village.

Jackson, Miss.—Press reports state that bids will be received by the Board of Supervisors until Nov. 18 for erecting a court house, to cost about $55,000. Architects, F. B. & W. S. Hull, Jackson.

South Bend, Ind.—Plans and specifications will be received by the Department of Public Works until Nov. 4 for a fire station to be erected on Wayne and St. Joseph Sts. Arthur L. Hubbard, Chmn. Bd.

Geneva, Ill.—It is stated that bids are wanted Oct. 22 for erecting buildings at the State Home for Juvenile Female Offenders. H. C. Whittemore, Pres. Bd. Trus.

Terre Haute, Ind.—Bids are wanted Nov. 4 for repairs to the county jail, including plumbing and steam heating. W. P. Boatman, Chmn. Bd. Co. Commrs.

National Military Home. Ind.—Bids are wanted Oct. 31 for erecting officers' quarters and a blacksmith shop. H. W. Sanderson, Acting Treas.

Mauston, Wis.—Bids are wanted Nov. 11 for installing a steam heating plant in the court house at Mauston. M. Knickerbocker, Co. Clk.

BUSINESS BUILDINGS.

New Haven, Pa.—Bids are wanted by the Pittsburg, McKeesport & Connellsville Ry. Co., Bank for Savings Bldg., Pittsburg, until Oct. 25, for erecting a steel and brick car shop, 80 x 200 ft., at New Haven. M. R. McAdoo, Gen. Mgr.

Boston, Mass.—Architects Winslow & Bigelow, 3 Hamilton Pl., have filed plans for an 8-story warehouse, 254 x 149 ft., to be erected on Summer St. near Dorchester Ave. Trustees for owner, Charles E. Cotting and Francis Welch, Barristers' Hall, Pemberton Sq. Builder, L. P. Soule & Son, 116 Devonshire St.

Plans have been filed by Architects Winslow & Bigelow, 3 Hamilton Pl., for a 5-story brick warehouse (second-class construction, slow burning) at 62 and 72 Chardon St. Owner, Clover & Willcomb, 36 Canal St.; builder, Whidden & Co., 43 Milk St. Estimated cost, about $55,000.

Plans have also been filed by Architect F. A. Norcross, 110 Tremont Bldg., for a 3-story brick stable at 316-318 Commercial St., and 339 North St. Owner, Daniel J. Kane, 93 Charter St. Builder, Michell Milan, 3 Jackson Ave. Estimated cost, $20,000.

Wilmerding, Pa.—It is stated that the Pennsylvania R. R. Co. will erect a station here to cost $20,000. W. H. Brown, Ch. Engr., Philadelphia.

Worcester, Mass.—W. C. Edwards, of West Chelmsford, Mass., is stated to have secured the contract to erect a round house for the Boston & Maine R. R. Co. for $33,000.

Princeton, Ind.—See "Electric Railways."

New York, N. Y.—Plans have been filed for a 14-story brick, Indiana limestone and terra cotta hotel to be erected on the site of St. Cloud Hotel, 42d St. and B'way, to cost $2,500,000.

Pittsfield, Mass.—Osteyee Bros., of Pittsfield, are stated to have secured the contract to erect a car house and offices for the Berkshire St. Ry. Co. for about $35,000.

Trenton, N. J.—The Pennsylvania R. R. Co. is reported to have plans for a $110,000 freight depot to be erected on the n. s. of Perry St. W. H. Brown, Ch. Engr., Philadelphia, Pa.

Boulder, Colo.—E. P. Varian, of Denver, has prepared plans for a $60,000 brick and stone hotel. Owner, Thomas McCauley.

Pittsburg, Pa.—The Pennsylvania R. R. Co. is stated to have awarded to Wm. Miller & Sons, of Pittsburg, and Roydhouse, Arey & Co., of Philadelphia, the contract for improvements on the Pittsburg, Virginia & Charleston R. R. at Ormsby station, 32d St., on the South Side, the improvements to include a roundhouse, machine shop, repair shop, paint shop, oil house, car shop and minor buildings—nine in all; cost will be about $150,000.

Lorain, O.—Jacob Meyer, of Lorain, is stated to have secured the contract for erecting a theater for $32,000.

Philadelphia, Pa.—It is stated that bids will be received by W. H. Brown, Ch. Engr. Pennsylvania R. R., until Oct. 21, for erecting a passenger station at 32d and Market Sts.

Gallipolis, O.—The Industrial Building at the Epileptic Hospital is reported to have been destroyed by fire Oct. 15.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

148 Chambers St, br store bldg; c, $50,000; o, Jas A Campbell; a, Buchman & Fox.

28 and 30 E 4th St, br loft bldg; c, $100,000; o and a, Frank Borasky.

122 and 124 W 49th St, br hotel; c, $265,000; o, Mannes & Taylor; a, Pollard & Steinam.

44 to 50 W 45th St, and 43 W 44th St, br hotel; c, $750,000; o, Seaboard Realty Co; a, Ludlow & Valentine.

106th St & Park Ave, br and stone stores & tenem't; c, $28,000; o, Robertson & Grant; a, Jos C Cocker.

DWELLINGS.

Omaha, Neb.—John McDonald, N. Y. Life Bldg., is stated to be preparing plans for a $100,000 residence, to be erected on 34th and Davenport Sts., for Geo. A. Joslyn.

Alexandria Bay, N. Y.—Williams & Johnston, of Ogdensburg, are the architects for a $25,000 cottage, to be built at this place, for Royal C. Vilas, of Chicago. Contractor, J. B. Reid, of Alexandria Bay.

Denver, Colo.—E. P. Varian, 36 Taber Blk., has prepared plans for a $15,000 brick and stone building to be built on Logan Ave. for L. E. Campbell.

Sault Ste. Marie, Mich.—Wright & Tomlinson, of Chicago, Ill., are stated to be preparing plans for a 2-story stone residence to be erected here for V. E. Metzger, to cost $20,000.

Buffalo, N. Y.—The residence of John J. Albright on W. Ferry St. is reported to have been destroyed by fire Oct. 16.

Chicago, Ill.—L. Mart Mitchell, 145 La Salle St., is stated to have prepared plans for 4 flats to be erected on 42d Place and Vincennes Ave., to cost about $85,000. He has also prepared plans for an apartment house to be erected on Calumet Ave., north of Garfield Boulevard, for Sherman T. Cooper, to cost $40,000.

Geo. O. Garnsey, 185 Dearborn St., is stated to have prepared plans for a 3-story flat to be erected on 44th St. and Langley Ave., for Wallace Hume, to cost $20,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

Madison Ave & 53d St, br dwellg; c, $125,000; o, Gilbert C Brown; a Buchman & Fox.

226 to 232 W 107th St, br tenement; c, $185,000; o, Ivy Court Realty Co; a, Wm C Huylett.

113th St & Lenox Ave, br tenement; c, $70,000; o, Leon A Liebeskind; a, G F Pelham.

SCHOOLS.

Berlin, Wis.—The contract for erecting the high school is stated to have been awarded to J. A. Silver, of Appleton, for $28,860.

Ithaca, N. Y.—The Building Committee of the Board of Education has under consideration the erection of a $15,000 school on South Hill.

Schenectady, N. Y.—Ridgeway & Taylor, of Albany, are stated to have secured the contract for ventilating and heating the high school, for $13,498.

Lexington, Mass.—It is proposed to erect a high school here, to cost about $57,000. Robt. P. Clapp, Chmn. Bldg. Com.

Flint, Mich.—Clark & Munger, of Bay City, Mich., have prepared drawings for a 12-room brick and stone school, 73 x 133 ft. The cost, including steam heat, fan system, plumbing, etc., $36,000.

Bermidji, Minn.—Bids are wanted Oct. 28 for $12,000 school bonds. D. C. Smyth, Clk. Bd. Educ.

Cambridge, Mass.—The city will erect a school, to cost about $70,000, on Willow St. Hartwell, Richardson & Driver, of Boston, will probably make the plans.

Madison, Wis.—T. C. McCarthy is stated to have secured the contract to erect the College of Agriculture at the State University, for $148,148.

Woonsocket, R. I.—The Building Committees of the 4th and 5th Ward schools are stated to have accepted the plans of Cooper & Bailey, Boston, Mass., for a 6-room school on Earle and Snow Sts., and of Wm. R. Walker & Son, Providence, for an 8-room school at Social and E. School Sts.

Springfield, Mass.—Geo. W. Burnham, 53 Bridge and Round Hill, is stated to have secured the contract to erect the N. Chestnut St. school for $84,500. Geo. Smith, 154 Bridge St., received the plumbing contract for $5,000.

Cleburne, Tex.—See "Paving and Roadmaking."

San Marcus, Tex.—E. Northcraft, of San Marcus, is stated to have been selected to prepare plans for the Southwest Texas Normal School to be erected here, for which the Legislature is reported to have appropriated $45,000.

Decatur, Ill.—Patton & Miller, 115 Monroe St., Chicago, are reported to be preparing plans for a group of six buildings to be erected for Milliken University at Decatur, to cost about $200,000.

Asheville, N. C.—Bids are wanted Oct. 25 for $10,000 school bonds. Wm. R. Heston, City Treas.

McKeesport. Pa.—Local press reports state that the time for receiving bids for erecting the 10th Ward school has been extended from Oct. 7 to Oct. 21. D. P. Smith, Sec'y Bd. School Controllers.

Washington, D. C.—Bids are wanted Nov. 9 for erecting a 4-room addition to girls' cottage building, on grounds of the Industrial Home School, Tenleytown Road, Washington. Lansing H. Beach, Commr., D. C.

Flint, Mich.—Clark & Munger, Bay City, are stated to be preparing plans for a $35,000 school.

Marlin, Tex.—See "Water."

Stapleton, N. Y.—Bids are wanted Oct. 28 for installing a heating and ventilating apparatus and gas and electric fixtures in school No. 32, Stapleton, Boro. of Richmond. Rich'd H. Adams, Chmn. Com. on Bldgs., Dept. of Educ., N. Y. City.

Buffalo, N. Y.—The Council is stated to have approved the aldermanic resolution authorizing the employment of Prof. S. H. Woodbridge, of Boston, to draw plans for heating and ventilating School 24.

Alton, Ill.—City Clk. C. H. Hummert writes that on Oct. 16 it was voted to issue $50,000 bonds for a high school.

STREET CLEANING AND GARBAGE DISPOSAL.

Lowell, Mass.—The Board of Aldermen has passed an order to borrow $25,000 for the establishment of a garbage plant.

Birmingham, Ala.—Mayor Drennen has been empowered to investigate the present system of removing garbage, also the cost of a municipal system.

Boston, Mass.—Mayor Hart has signed the order, passed by the Common Council on Oct. 10, for a loan of $140,000 providing for the removal of the garbage plant from Cow Pasture, Dorchester, to Spectacle Island, and the renewal of the existing contract with the New England Sanitary Product Co. for a period of 10 years.

Hartford, Conn.—Mayor Harbison on Oct. 14 approved the 5-year street sprinkling contract with the Edward Balf Co.

Hamilton, O.—The contract for constructing a garbage crematory has been awarded to the Dixon Garbage Crematory Co., of Toledo, for $11,270.

East Liverpool, O.—The Board of Health has recommended to the Council the immediate establishment of a garbage crematory.

Allentown, Pa.—Mayor Jas. Schaadt writes that the contract for constructing a garbage crematory (bids opened Sept. 17) has been awarded to the Dixon Garbage Crematory Co., of Toledo, at $15,735, with brick stack, no guaranty.

Brooklyn, N. Y.—The present contract, for the collection and final disposal of garbage in the Boro. of Brooklyn, expires Dec. 31, and the city authorities are now preparing specifications, etc., for a new contract.

GOVERNMENT WORK.

Clinton, Ia.—Bids are wanted at the Treasury Dept., Washington, D. C., until Dec. 2, for heating apparatus, and until Dec. 3 for conduit and wiring system for the U. S. Post Office at Clinton, as advertised in The Engineering Record.

Ft. Terry, N. Y.—Bids are wanted Nov. 19 for constructing, plumbing, heating and electric wiring, frame barrack building, as advertised in The Engineering Record.

Ft. Rodman, Mass.—Bids are wanted Oct. 28 for constructing a road at Ft. Rodman. Address H. P. Young, Q. M., Newport, R. I.

Detroit, Mich.—Bids are wanted Oct. 24 for repairing buildings and for electric light wiring and fixtures for the marine hospital at Detroit. Address E. K. Sprague, Passed Assistant Surgeon; M. H. S., Acting Custodian.

Jeffersonville, Ind.—Bids are wanted Oct. 23 for repairing buildings at the Jeffersonville Depot. Address J. M. Marshall, Asst. Q. M.

Portland, Ore.—Bids are wanted Nov. 14 for furnishing material and labor for the removal and erection of a brick building, including steam heat, plumbing and gas piping at Umatilla Agency, Oregon. Address Chas. Wilkinson, U. S. Indian Agent, Umatilla Agency, Ore.; W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C.

Tompkinsville, N. Y.—Bids are wanted Nov. 2 for rebuilding wharf at Falkner Island Light Station, Conn. Maj. Wm. T. Rossell, Corps Engrs., U. S. A.

Elmira, N. Y.—The following bids were opened Oct. 10 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits), of the U. S. Post Office and Court House at Elmira: Kuher & Fulton, Buffalo, N. Y., $201,874; Chas. McCaul, Philadelphia, Pa., $188,872; Harry Knerr, Pottstown, Pa., $226,770; Davidson Bros. Marble Co., Chicago, Ill., $198,000; Richardson & Burgess, Washington, D. C., $190,700; Ambrose B. Stannard, New York City, $174,700; Constable Bros. Co., Erie, Pa., $198,750; J. C. Williamson and Alfred Hodgkins, Elmira, N. Y., $199,841; C. A. Pulford, Elmira, N. Y., $189,997; J. Feist & Sons Co., Buffalo, N. Y., $261,184.

New York, N. Y.—The following bids were opened Oct. 12 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a plant for receiving, storing and delivering coal at the Navy Yard: Appropriation $60,000: *a*, price for a coaling plant, cost not exceeding $60,000; *b*, the Bureau intends to recommend an additional appropriation being made by Congress of $100,000 for an extension to the plant bid on under *a*, which, if granted, will become available not later than July 1, 1902, and invites proposals upon this extension to cost not more than $100,000. Haskins & Coffin, New York, *a* $57,500, *b* $157,500; Riter-Conley Mfg. Co., Pittsburg, *a* $60,000, *b* $160,000; Exeter Machine Wks., Pittston, Pa., *a* $66,385 and $58,545, *b* $156,000; Share & Triest, New York City, *a* $60,000, *b* $158,000 and $156,000; Augustus Smith, *a* $60,000 and $56,800.

New York, N. Y.—The following bids were opened Oct. 12 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a 3-story brick and steel fire-proof building, 375 x 65 ft., at the New York Navy Yard: Penn Bridge Co., Beaver Falls, Pa., $157,687; O'Brien & Hoolihan, Syracuse, N. Y., $159,375; Merrick Fireproofing Co., New York, $147,850; P. J. Carlin & Co., Brooklyn, N. Y., $149,236; Cramp & Co., Philadelphia, $145,990; R. H. Hood & Co., New York, $149,300; R. H. Griefen, Chicago, $150,500; J. A. Stevenson, Long Island City, $166,338; L. L. Leach & Son, Chicago, Ill., $165,573.

Manila, P. I.—Major Clinton B. Sears, Corps of Engrs., U. S. A., Ch. Engr., Office of the Division of the Philippines, writes that the following bids were opened Aug. 1 for constructing a harbor at Manila. Address of all bidders, Manila. *Contract awarded:

Items and Quantities.	L. W. Bates.	Philippine Develop. Co.	Atlantic Gulf & Pacific Co.
Dredging, 5,000,000 yds..	$.29	$.24¾	$.219
Rip-rap, 188,745 tons.....	4.00	2.90	2.48
Rubble, 14,396 yds.......	10.00	10.50	13.00
Concrete, 1,185 yds......	14.00	12.50	15.00
Coping, 3,190 yds........	12.00	37.00	40.00
Conc'te blks., 1,165 yds.	5.00	12.00	9.00
Bulkhead, 4,700 lin. ft...	5.00	8.50	9.50
Totals	$2,433,135	$2,122,791	*$1,950,746

The Atlantic Gulf & Pacific Co., Manila, on Aug. 1 submitted a bid at 33 cts. per cu. yd. for dredging Pasig River, Manila, P. I., 325,000 cu. yds., total bid $107,250. Said bid was rejected.

MISCELLANEOUS.

Willoughby, O.—Bids are wanted Oct. 26 for furnishing material and labor for the protection and improvement of the river bank on Erie St., in Willoughby. E. D. Hartwell, Co. Aud., Painesville.

New Orleans, La.—Bids will be received at the office of the Board of State Engineers, Cotton Exchange Bldg., New Orleans, until Oct. 22 (readvertisement), for the enlargement of the Mill Bayou to Glen Mary levee, Avoyelles Parish. J. R. Thornton, Secy., Bd. Commrs., Red River, Atchafalaya and Bayou Boeuf Levee Dist., Alexandria.

Boston, Mass.—Supt. of Streets Wheeler has awarded to **Miller & Ellis**, of this city, at $17,693, the contract **for building** a sea wall, new boat house, run, **steps, wharf**, etc., at Moon Island.

Alpena, Mich.—The Common Council has passed a resolution to enter into a contract with the Alpena & Western Railway Co. for the construction of a breakwater in the bay, extending a distance of about 5,000 ft. The price to be paid is $25,000.

Flushing (L. I.), N. Y.—A map has been filed with the Clerk of Queens County, showing the proposed course of the 6-mile canal, 200 ft. wide and 20 ft. deep, connecting Newtown Creek and Flushing Bay.

New Orleans, La.—Bids are wanted Nov. 6 for digging a drainage canal in New Orleans. Bids will be received separately for excavating only (by hand), and for furnishing and constructing culverts, and for the work as a whole. Bids for a dredged canal will also be entertained. John E. Huffman, Sec'y New Orleans Land Co., 338 Carondelet St.

Mayersville, Miss.—Bids will be received by the Board of Mississippi Levee Commissioners at Greenville, until Oct. 22, for constructing a levee near Filters Landing in Issaquena County, estimated at about 350,000 cu. yds. C. H. West, Ch. Engr.; H. L. Foot, Sec'y & Treas.

Boise, Idaho.—Press reports state that the State Land Board has determined to grant a franchise for the improvement of Santa Creek and St. Marie and St. Joe rivers to the St. Joe Improvement Co. The proposed improvements will cost an aggregate of about $75,000.

Michigan City, Ind.—Bids are wanted Nov. 11 for constructing, approximately, 2,000 ft. of dock. Edw. J. Heise, City Clk.

Charleston, S. C.—Bids are wanted Oct. 24 for constructing an addition to the concrete wall on the south side of Tradd St. J. B. Keckeley, Supt. of Streets.

Milwaukee, Wis.—Press reports state that the Abbot docks at the mouth of Milwaukee River will be rebuilt shortly by the owner, E. H. Abbot, of Boston. It is stated that the improvements, which are to include new buildings, will cost $300,000.

Philadelphia, Pa.—Included in the total of $2,574,560 asked by the Bureau of Surveys for next year, and approved by Councils' Committee on Surveys, are items of $500,000 for deepening the channels of the Delaware and Schuylkill rivers; $500,000 for new bridges, and $500,000 for main sewers.

New York, N. Y.—Bids are wanted Oct. 24 for furnishing labor and material necessary to erect and complete ready for use the approaches to the Sailors and Soldiers' monument in Riverside Park, included under schedules A, B, and C,—the south approach, the north approach, and the belvidere.' Geo. C. Clausen, Pres. Park Bd.

New York, N. Y.—Bids are wanted Oct. 25 for furnishing and delivering 10,000 bbls. of Portland cement. J. Sergeant Cram, Dock Commr., Dept. of Docks & Ferries.

Randall's Island, N. Y.—The contract for furnishing and installing pipe covering at the House for Juvenile Delinquents has been awarded to R. A. Keasbey, 83 Warren St., New York City, for $1,639.

NEW INDUSTRIAL PLANTS.

The National Cereal Co., Battle Creek, Mich., will erect a 60 x 110-ft. factory and a 30 x 50-ft. power house. The company is in the market for a 100 or 125-H.-P. engine and two boilers of 125 to 150-H.-P. each.

Ed. Muhleman, 109 S. Penn St., Wheeling, W. Va., is organizing a company to build a glass works at Bellaire, O., to be approximately 500 x 200 ft., two stories and basement and have a central power plant.

The Shaw-Walker Co., Muskegon, Mich., will erect a 3-story, 50 x 100-ft. factory and a 30 x 50-ft. power house and dry kiln.

The C. W. Leatherbee Lumber Co., 520 Albany St., Boston, Mass., will erect a new mill, for which contracts have not yet been let.

The Florence, S. C., Ice & Fuel Co. will install a 15-ton can ice-making plant.

The recently burned plant of the Birmingham, Ala., Ice Factory Co. will be rebuilt. L. B. Hart, Pres., Savannah, Ga., should be addressed.

The saw-mill of the Loomis & Hart Mfg. Co., Chattanooga, Tenn., recently burned, will be rebuilt with a daily capacity of about 60,000 ft. The capacity of the power plant will be about 200 H.-P.

The Pittsburg Clay Pot Works, Allegheny, Pa., will erect a 4-story, 110 x 140-ft. building to replace one recently burned, and install boilers of about 200 H.-P. and a 150-H.-P. engine.

The Colorado, Tex., Salt Co., is in the market for a steam salt dryer and a pipe cutting and threading machine for 1 to 4-in. pipe.

The Clipper Lawn Mower Co., Norristown, Pa., will build a 3-story, 135 x 65-ft. warehouse and foundry.

The White Mountain Freezer Co., Nashua, N. H., will erect a 228 x 50-ft. brick and steel foundry.

The St. Louis, Mo., Portland Cement Co. is building a plant having 8 rotary kilns and a daily capacity of about 1,400 bbls.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., has recently furnished engines to the following: Provincetown, Mass., Electric Light Co.; an 80-H.-P. engine to the Omaha High School; Sweet Home Plantation, Assumption Parish, La., and two engines for the New York Infant Asylum.

The following firms are among those receiving awards at the Pan-American Exposition: Lamb & Ritchie, Cambridgeport, Mass., makers of tin-lined and lead-lined iron pipe, a gold medal; the Lunkenheimer Co., Cincinnati, O., a gold medal for valves, lubricators and engine fittings; Buffalo Forge Co., two gold medals for a 500-H.-P. high-speed tandem compound engine in the service power plant and for the Buffalo fan system of heating and ventilating, and a silver medal for Buffalo hand punches and shears, forges, induced draft apparatus and blacksmith drills; Morris Machine Works, Baldwinsville, N. Y., gold medal for centrifugal pumps and steam engines.

The inspection of the materials in the new reservoir at Cedar Grove, N. J., has been made by W. R. Conard, of Burlington, N. J., who has also recently completed tests on the cast iron in pumping engine for the new water supply system at Atlantic City.

The Spiral Riveted Tube Co., 284 Pearl St., New York, was recently incorporated to manufacture and deal in spiral riveted pipe and machines for making it, light and heavy sheet iron work, brass and iron castings, and do all kinds of galvanizing. The company owns several new patents on improved spiral riveted pipe machines. It is now erecting a factory on West Side and Fisk Aves., Jersey City, and the galvanizing department will be ready for operation in a fortnight. Machines for making pipe 3 to 30 ins. in diameter are now being constructed for the company by Geo. M. Ball & Son, Brooklyn. The officers of the company are: President and treasurer, John A. Wilbur, president of the Salem Nail Co.; secretary, A. Howard Abendroth; general superintendent, Frederick W. Stapf; the last two were formerly with the Abendroth & Root Mfg. Co.

The Schroon River Pulp & Paper Co. has been incorporated with a capital of $315,000. The directors are Louis W. and James A. Emerson, Albert H. Thomas and Lewis Thompson, of Warrensburg, N. Y.; John R. Durkee and Jos. Goodfellow, of Fort Edward; John H. Derby, Chas. T. Besch, Grenville M. Ingallsbee and John J. Cunningham, of Sandy Hill, and Geo. R. Finch and Patrick Moynehan, of Glens Falls.

The London office of the Buffalo Forge Co., recently opened at 39 Victoria Street, London, S. W., under the management of D. W. Roper, has recently closed an important contract with the British Westinghouse Electric & Mfg. Co., at Manchester, for the apparatus for heating and ventilating its new machine shop, foundry stores, the carpenters' shop and box factory. The machine shop building is 900 ft. long, 420 ft. wide and 59 ft. high. To accomplish the heating and ventilating of this shop eight steel-plate fans, each one capable of delivering 60,000 cu. ft. of air per minute and driven by a separate induction motor, will be provided; also a separate heater for each fan, a total of more than ten miles of 1-in. pipe being used.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Oct. 21	Lafayette, Ind	Oct. 19
Oct. 22.	Merrillan, Wis. Adv., Eng. Record, Oct. 12, 19.	Oct. 5
Oct. 24.	Chimney, Cleveland, O.	Oct. 5
Oct. 25.	Kansas City, Mo.	Oct. 19
Oct. 26.	Pumps, Washington, D. C. Adv., Eng Record, Oct. 5.	Oct. 5
Oct. 28.	Pipe, Atlantic City, N. J. Adv., Eng. Record, Oct. 12, 19.	Oct. 12
Oct. 28.	Fayette, Miss. Adv., Eng Record, Oct. 12.	Oct. 12
Oct. 30.	Pumping plant, Savannah, Ga. Adv. Eng. Record, Oct. 12, 19.	Oct. 12
Nov. 1	Hazlehurst, Miss.	Oct. 5
Nov. 1.	Greenwood, Miss. Adv., Eng. Record, Sept. 21 to Oct. 5.	Sept. 21
Nov. 1.	Randolph, Neb.	Oct. 19
Nov. 2.	Plymouth, O Adv., Eng Record, Oct. 19.	Oct. 19
Nov. 4.	River Forest, Ill.	Oct. 19
Nov. 7.	New York, N. Y.	Oct. 19
Nov. 11.	Water-works franchise, Yazoo, Miss.	Sept. 14
Nov. 12.	Grand Rapids, Mich. Adv., Eng. Record, Oct. 12.	Oct. 12
Nov. 15.	Cincinnati, O.	Oct. 19
Nov. —.	West Lebanon Ind	Oct. 19
Nov. —.	Farmersville, Tex.	Oct. 12
Dec. 4.	Sale of pumping works, Chicago, Ill. Adv., Eng. Record, Oct. 12.	Oct. 12
Dec 17.	New York, N. Y	Oct. 19
	SEWERAGE AND SEWAGE DISPOSAL.	
Oct. 21.	Washington, Pa	Oct. 19
Oct. 21.	Plymouth, Ind.	Oct. 19
Oct. 22.	St. Charles, Mo	Oct. 19
Oct. 23.	Hyde Park, Mass.	Oct. 19
Oct. 23.	Havana, Cuba. Adv., Eng. Record, June 29 to July 20, Oct. 19.	June 29
Oct 23.	Long Island City, N. Y.	Oct. 12
Oct. 24.	Rochester, Ind. Adv., Eng. Record, Oct. 12.	Oct. 12
Oct 24.	Newark, N. J	Oct. 19
Oct. 25.	Omaha, Neb.	Oct. 19
Oct. 26.	Youngstown, O.	Oct. 12
Oct. 26.	Hillsdale, Mich	Oct. 19
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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

Excessive Refinement in Bridge Design.

History repeats itself in bridge design as in other things. Probably the most striking feature in the earliest bridge designs by American engineers was the extreme individuality or differentiation of members. The analysis of stresses was as refined in its way as the knowledge of mechanics would permit. The stresses in members were absolutely defined and treated as single forces, their lines of action being taken as the axes of the members. The member itself was emphasized and so attentively considered that all connections at panel points were treated as little else than joints, and frequently as perfectly flexible joints only. Practically the extreme limit of articulation was not only striven for but attained. Joint details were many times imperfect, but they in no wise failed in strength so far as the principal stresses were concerned, any more than they lacked in flexibility. Nor, with the exception of the original Phoenix bridge and a few other specimens of cast-iron abutting chord joints, was there any absence of efficient chord continuity. The obvious aim in the beginning of American bridge design was to meet in the most direct manner the principal truss stresses, but without such evident intention a very high degree of flexibility at the joints was also secured.

As a matter of fact, these early processes signified great refinement in design and constituted a field of structural operations of a high degree of excellence. As time passed and experience extended, bridge theory was correspondingly advanced, but it was at the same time found that there was too great flexibility in railroad and other bridges to meet the exacting requirements of high-speed railroad traffic. Rapidly moving trains shook the flexible bridge structures into vibrations that threatened to be destructive in some cases. It was found that the trusses, lateral systems of bracing, and floor systems of crossing floorbeams and stringers, while abundantly strong to resist the principal or computed stresses, were each going their own way altogether too independently, resulting in at least a prejudicial amount of relative motion. Among other things the suspension of floorbeams on U bolts hung from lower-chord pins was found to be about as shaky and pernicious a method of support as could be conceived. It became clearly evident that greater rigidity of structure was imperative, and that it must be gained by giving joints, particularly lateral joints, the greatest practicable stiffness. That was one of the earliest lessons taught American engineers engaged in bridge building. Extreme flexibility was tried and well tried, and found fatally wanting. Every advance in bridge design from the earliest structures to the present time has been characterized by increased stiffness of joints, and the creation of details calculated to attain that stiffness has wholly constituted those advances in many cases. That observation is markedly true in connection with the rigid riveted connection between railroad bridge floorbeams and columns, which is one of the most admirable features of modern American bridges.

It is not forgotten in making these statements that a considerable number of transverse tension bracing rods of double-track bridges were formerly broken under a loading of one track. That particular failure was largely due, and perhaps wholly, to the extreme flexibility of the structures in which the rods were found. Vertical and transverse vibrations of excessive amount were set up so as to subject those light tension members to heavy overstresses so suddenly as practically to constitute shocks. Those failures were the most emphatic protest possible against excessive flexibility and articulation. They were decisive evidences of the imperative need of a much more rigid connection between the two trusses, compelling them to act together and prevent violent vibrations Equally effective advances have been prompted by experience in using all stiff members in lateral and transverse bracing, at the same time making their connections with the trusses of great stiffness. As a result of these improvements in design no railroad train need vary its speed out of consideration for a modern bridge; the roadbed on the latter may take its burden precisely like any other portion of the track. Abundant experience in the bridge practice of this country has demonstrated conclusively that the so-called "secondary stresses" need not be regarded as an objection in any degree whatever to properly designed rigid connections.

These statements have been prompted by some recent products of European bridge practice. In The Engineering Record of September 14 of this year there was described one of these rather remarkable bridge structures across the Rhine at Worms. A reference to that description will make clear the scrupulous care which was taken in the design to avoid all those features of structural stiffness which bridge practice in this country has shown to be so essential to meet the demands of the heaviest railroad traffic at high speeds. Between the ends of the 383-foot spans there is no transverse bracing, and not a stiff connection either between the floorbeams and their supports or between the upper lateral system and the upper chords. Completely independent action of the trusses is encouraged, as is that of the floor system and the upper lateral bracing. The freest distortion of the transverse section of the bridge is invited. It would seem difficult to attain more certainly active, not to say violent, lateral and vertical vibrations under high-speed trains. All this sacrifice of some of the most essentially excellent qualities of a bridge structure is for the purpose of avoiding secondary stresses, found chiefly in the results of computations based largely on conditions that do not exist. The rigid portals constitute the saving feature of the structure. They are massive, as they should be, for there are concentrated in them the vibration effects of the entire span. It will probably strike many American engineers to be the part of wisdom to distribute efficient preventive means against vibration throughout the structure at points of inception of vibration, rather than at the remote extremities, where the effects have accumulated manifold force, and after the body of the bridge has been perhaps injuriously shaken.

Land Damages from the Operation of Driven Wells.

Attention has been called in previous volumes of The Engineering Record to the decision of the State Court of Appeals of New York in the Forbell case, which threatened every city using a ground-water supply with liability for heavy damages to owners of cultivated land in the vicinity of its wells. Fortunately the courts have seen fit to temper justice with mercy, and, while awarding damages to such property owners, in accordance with the law, have made the sum of the awards so small as to render the litigation an expensive luxury to those endeavoring to plunder the public treasury. The latest decision of the sort was made by Judge Marean in Reisert v. City of New York, 71 N. Y. Sup. 965. Reisert was endeavoring in this case to obtain heavy damages for the alleged abstraction of ground water from his property by one of the driven-well systems of Brooklyn.

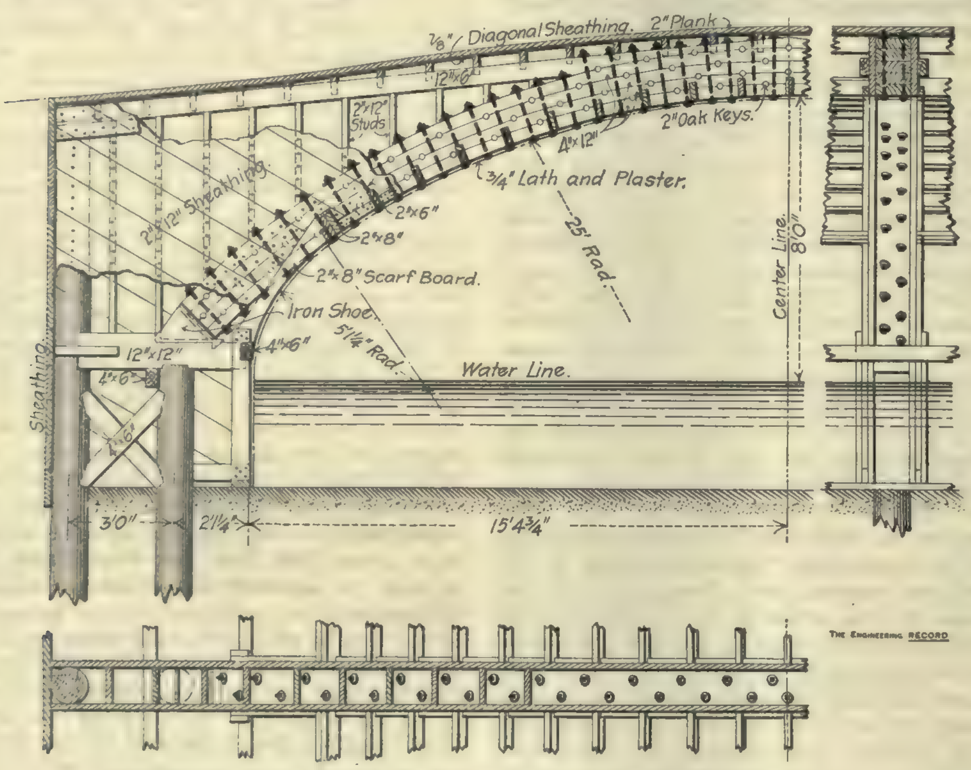
The true measure of damage in such cases, Judge Marean states, is the difference between what the use of the land is reasonably worth deprived of its natural water and with such water. After a well supply system has been established, each agricultural year opens with a practical certainty that the injury is to continue during that year, and a landholder has no right to purposely incur special damages by planting crops and expect the city to pay for them. If he cultivates his land under such circumstances and the returns are insufficient to meet his labor and expenses and also the value of the use of the land, he owes his loss to his folly. This is particularly true in the Reisert case, where about ten years elapsed after pumping began, prior to the first year for which the right to damages was not barred by limitation.

The selling price of land is the safest basis for a judgment as to the amount of general damage. On Long Island, where Reisert's farm lies, no land has an annual worth of more than 5 or less than 3 per cent. of its sale value in addition to taxes, owing to the investment rates in that district. All in excess of 5 per cent. and taxes which it may be made to produce is the fruit of the farmer's labor and skill. If the land can be sold at all, its use for a year is worth at least 3 per cent. of its sale value, besides taxes, because the purchaser is foregoing at least 3 per cent. interest on his money.

Reisert paid $6,500 for his farm, and offered no testimony to show it had increased in value. Judge Marean holds that $325 plus taxes is all the annual use of the property was worth originally. The suit was for $75,000 damages. "It is impossible to contemplate such a claim," the decision reads, "without that instinctive hostility which every attempt to deceive the court, and by its aid work out a fraud, deserves." So nominal damages, without costs or an injunction against operating the pumps, were all the plaintiff received.

Bridges in the Pan-American Exposition Grounds.

The preparation of the site for the Pan-American Exposition at Buffalo, N. Y., involved the construction of several wide, short-span bridges over the canals and waterways. These bridges were required to harmonize with the architectural motives of the buildings and the features of the landscape engineering in the vicinity, and to be quickly and cheaply constructed. They had to give considerable clearance for pleasure boats, to keep the road grade as low as possible, and to be safe and solid under a heavy live load of pedestrians. Under these conditions a wooden arch design with very simple details was adopted for several 30-foot spans, which were entirely constructed on the spot by carpenters and laborers using ordinary commercial sizes and moderate lengths of pine and hemlock timber, mostly 12 x 4 inches or less in cross-section, bolted together without special forgings or any but a very few of the simplest castings. They were supported on two rows of piles at each end, and had a total height of less than 10 feet from water level to top of roadway.



WOODEN ARCH BRIDGE CONSTRUCTION, PAN-AMERICAN EXPOSITION.

The principal framework consisted of nine arch ribs, spaced 6 feet and 6½ feet on centers, and having solid spandrel bracing to the approximately horizontal longitudinal stringers in their planes, which reached from their crowns to the abutments. The ribs thus resembled pairs of solid triangular girders continuous through the apexes, and having solid end bearings with long, rigid, vertical connections to the abutment piles. The ribs were connected together by the floor joists and floor planks and, at the intrados, by horizontal transverse struts and the sheathing which covered them. A strong and rigid construction was thus secured, which was sufficiently durable for the temporary requirements and was considered satisfactory and economical.

Each rib has a 12-inch square solid cross-section, and the curve of the intrados is approximately a segment of a circle of 25-foot radius, with short tangents at both ends. The intrados has a clear span of 35 feet between skewbacks and a rise of 7 feet. The ends are butted against the inclined surfaces of hollow triangular cast-iron skewback blocks gained and notched into a longitudinal oak cap which is mortised on top of one pile and secured to another one by a pair of fish planks spiked on. Each rib is built up of four 12 x 4-inch planks bolted and keyed together flatways. The straight planks for each rib were assembled on edge on the surface of the ground and bolted together at the center only. Then each end was pulled by four men operating a four-part tackle, springing it in a horizontal plane to the approximate curve established by a group of seven vertical piles driven in the arc of the circle. As fast as the rib assumed the required position, vertical and horizontal holes were bored, and the keys and bolts were driven from the center of the rib to both ends. When the tackles were released the rib sprang back only about 2 inches, an amount for which allowance had been made, so that the desired curve was secured.

A 12 x 6-inch longitudinal stringer was beveled, keyed and bolted to the crown of the rib on each side of the center and supported over the haunches on 2 x 12-inch vertical studs 16 inches apart with full end bearings on the upper side of the rib and the under side of the stringer. The studs, stringer and rib were braced together by continuous 2 x 12-inch diagonal sheathing spiked on both sides. Transverse 2 x 8-inch floor joists 16 inches apart were dapped over the stringers and covered with diagonal ⅞-inch sheathing, tarred felt and 2-inch longitudinal floor planks. Single horizontal transverse 2 x 6-inch pieces were fitted between the ribs flush with their intrados, from the crown to a point near the skewbacks, where there were pairs of corresponding 2 x 8-inch pieces to support the upper ends of scarf-boards which were seated at their lower ends on the transverse abutment caps. Laths were nailed to these scarf-boards and horizontal strips, and on them was plastered a vault surface which resembled the masonry soffit of an elliptical arch. Sheathing plank were nailed to the vertical abutment piles to retain the approach fills, and a framework was furred out and plastered to represent masonry abutments, buttresses and walls. The faces of the arch rings and spandrels were covered with staff and plaster to represent voussoirs and coursed masonry, with cornice and parapet above, a sculptured panel in the center and statuary on pedestals at the ends of the span.

The construction of these bridges was detailed and supervised by the staff of the Exposition, Mr. Newcomb Carlton, director of works; Gen. S. J. Fields, chief engineer; Mr. Williams Lansing, supervising architect; Mr. J. H. Murphy, superintendent of building construction, and Mr. Harry Weatherwax, chief draftsman.

Recent Sewerage Work in Worcester, Mass.

The work of the Superintendent of Sewers of Worcester, Mass., Mr. Harrison P. Eddy, has been particularly interesting for a number of years because of the serious problems imposed upon him by the difficulties attending the disposal of the sewage. Years ago, before any sewers had been built, there was a brook or river of some size running north and south through the central part of the city. This was called Mill Brook, and was largely fed by a watershed lying north of the built-up part of the town, although numerous small brooks entered the stream during its course through the city. The natural outlet for sewers was into this stream and its tributaries, and the early sewers ran directly to it. This procedure was authorized by the Legislature in 1867, which also gave the city permission to use the stream itself and its tributaries as common sewers, with a stipulation that they might be improved, as was deemed necessary, by straightening, walling and covering, and with a provision for acquiring certain water privileges.

Mill Brook discharges into the Blackstone River, and in the course of time the owners of riparian property below the mouth of the brook forced the city authorities to construct works for treating the sewage chemically before its discharge into the river. When the problem of sewage purification was taken up, it was found that the volume of water to be treated consisted not only of the sewage proper, but also of the entire drainage of the watershed contributary to the brook and its many little feeders. This proved a serious obstacle to effective treatment, and it was recognized from the first that the separation of this surface water from the sewage was not only desirable but necessary.

In 1897, under instructions from the Supreme Court of the Commonwealth, the city submitted to the court a scheme for preventing more effectively the discharge of untreated sewage into the Blackstone River. The plan provided for a single conduit running for some distance along one side of the walled and arched channel of Mill Brook from a point near the disposal works to a connection with two interceptors, one on each side of the brook. The construction of these interceptors was all that an engineering board recommended the city to undertake for the present, although it advised a gradual change from the existing combined system of sewerage to the separate system. This change was to be made by instalments at such times as the amount of sewage reaching the river threatened to cause serious pollution. When the plans were worked out in detail, under the direction of City Engineer F. A. McClure, it was found that the construction of the conduit inside the channel of Mill Brook would so reduce the capacity of the waterway that it would be in danger of surcharge during freshets. It was accordingly determined to begin at once the construction of a duplicate sewerage system in a portion of the city, by which part of the storm water then reaching the brook would be kept out of it. These detailed studies also showed that the topographical conditions made it imperative to resewer some sections of the city so that the sewage would flow into the interceptors.

The history of these various changes forced upon the city by the courts or recommended by its engineering counsel are full of instructive lessons to the municipal engineer, for it has rarely happened that such a large city as Worcester has had to struggle against so many obstacles in its endeavor to obtain a satisfactory sewerage system. Very few critics of its work—and criticisms have been many—fully appreciate the topographical, legal and historical conditions involved in the complete view of the subject, or recognize the difficulties inherent in completely changing such an extensive system of sewers. It might be added in passing that another interesting lesson taught by the Worcester sewerage system is the importance of making ample provision for caring for rain-water in any combined system. These sewers are so small in some localities that they frequently caused a flooding of cellars. For some years the Sewer Department has been carrying on careful rainfall studies, which have already yielded many useful data, given in commendable detail in the annual reports. With the information which is being collected in this manner, it is safe to expect eventually some important deductions concerning the probable run-off from various classes of city territory during and after rainfalls of various rates and durations.

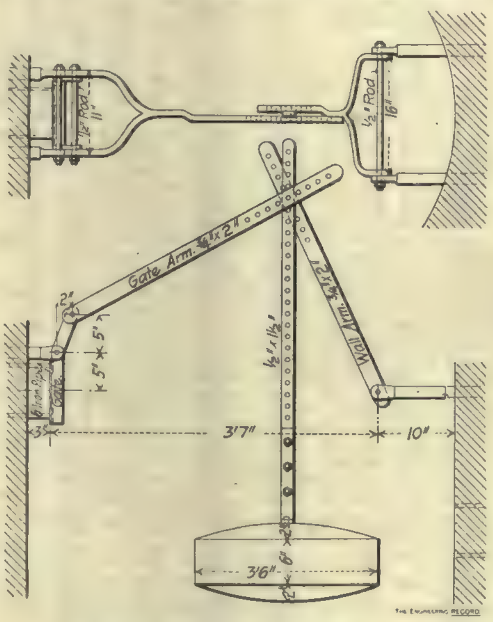
The actual sewerage construction during 1900 did not present so many interesting features as in some previous years, but there were nevertheless a number of works deserving mention. One case was the reconstruction of a private drain which had settled so badly on account of a poor foundation that it eventually failed to operate, and was replaced at public expense on a pile foundation. Borings showed that peat extended to a depth of 18 feet below the surface, and then came 40 feet of very fine sand, through which piles could be driven easily to a footing in a bed of firm, coarse sand. Piles were driven over 70 feet on some parts of the work, and in no case were much less than 60 feet long. They were driven in pairs, 22 inches apart on centers, and the pairs were 3 feet on centers. They were capped by 6 x 6-inch spruce timbers running parallel with the trench, and 6 x 6-inch spreader blocks were driven between the caps every 6 feet, with a ⅞-inch iron tie rod near each spreader to hold the caps together. At each pile a ⅞-inch iron pin 18 inches long was driven through the cap into the end of the pile. A bed of Portland cement concrete was placed over and between the caps, and carried up around and over the 12-inch pipe sewer. All the piles were spliced. A 40-foot pile was first driven and its end squared up. An iron ring just a little smaller than the stick was forced on and two 18 x ⅞-inch dowel pins were driven for half their length into the end of the pile. Another pile 20 feet long was then centered on top of the first, after being fitted with an iron ring similar to that on the lower one, and it was driven down over the dowel pins by light blows of the hammer. The driving was continued until the pile reached a suitable footing, when it was capped as described.

The work on the interceptors on either side of Mill Brook required much care in places to prevent settlement. At one point a 23-foot trench had to be cut through fine sand, where heavy, close sheathing and bracing was needed. The sheathing was driven several feet ahead of the work by steam plank-driving hammers. The material excavated was of the most treacherous character and the street is lined on both sides with brick buildings, yet by leaving much of the lumber in the ground, there was no settlement of the buildings or fracture of the various conduits buried in the street. At another point, the trench, 20 feet deep, passed within 6 feet of a five-story brick building, but by taking special pains with the bracing, no crack or settlement resulted from the work.

The connections between the interceptors and the old sewerage system are through regulators designed under the direction of Mr. McClure. The larger sizes are much like the familiar types employed in Providence, on the Metropolitan sewerage system of the Boston district and elsewhere, while the smaller type is shown in the accompanying illustrations. The interceptors are not large enough to carry much storm water. When surface water is running in the old combined sewers it is received by the interceptors until they become full. Then the gates in the regulators partially close and the excess of storm water and sewage is diverted into Mill Brook.

The first effort to purify the Worcester sewage was made in 1890, the plant being started on June 25. The treatment has continued for more than ten years, and Mr. Eddy's latest report on the results is a document of so much importance it is reprinted here practically in full. Mr. Eddy was for some years the chief chemist of the disposal works, and since his promotion to the general management of the sewer department he has taken pains that the chemical and bacterial work should be carried forward with the same energy as the other branches. On this account, as well as because of the large extent of the Worcester plant and the wide range of experimental work there carried on, the published results are of more than usual importance.

From time to time, improvements and enlargements have made it possible to accomplish a much larger amount of work, and that of a materially better quality. This has been done at considerably less cost than was possible during the first few years. Table 1 gives the quantities of sewage treated each year since the plant was started. The costs given are strictly maintenance charges, and do not include interest on money invested. They do, however, in several years, include cost of work which was more properly construction than maintenance, but which cannot now be separated because the expense was all charged to one account.



Details of Small Regulator.

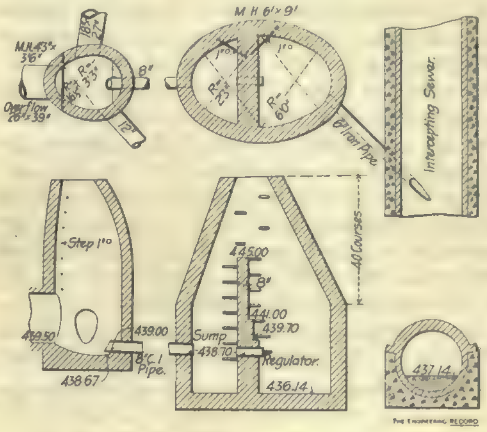
Table 1—Cost of Maintaining Sewage Disposal Works.

Date.	Amount treated, gallons.	Cost.	Cost per million gallons.	Population.	Cost per capita.
1890......	391,000,000	$47,919.60	$122.55	84,655	$0.56
1891......	1,398,000,000	27,761.95	19.86	87,547	0.32
1892......	842,000,000	27,575.24	32.74	90,439	0.30
1893......	1,795,000,000	24,103.23	13.43	93,138	0.26
1894......	4,562,000,000	25,145.21	5.51	95,982	0.26
1895......	5,730,000,000	46,847.46	8.17	98,767	0.47
1896......	5,840,000,000	43,264.23	7.41	102,698	0.42
1897......	6,206,000,000	69,165.64	11.14	106,629	0.65
1898......	6,460,000,000	64,440.83	9.97	110,560	0.58
1899......	6,241,000,000	84,694.98	13.57	114,492	0.74
1900......	4,781,000,000	50,073.34	10.47	118,421	0.41

Note.—The costs for 1895-1899 include considerable money spent on construction, but which cannot be separated from maintenance charges because both items were kept in the same account. This is also true of the figures given for 1890,

It is interesting to note that the cost per capita in 1891 was $0.32, and in 1900, ten years later, $0.41. The latter figure includes the cost of pressing and disposing of the sludge, while that of 1891 included only the cost of pumping it directly on to adjacent fields, an extremely unsatisfactory method of disposal.

There is a prevalent feeling that the work is largely experimental, and that there is some doubt as to the successful outcome of the effort to sufficiently purify the sewage that it may be discharged into the river without adding to the amount of impurity already carried by the stream. It is true that much experimental work has been done upon the subject of sewage treatment, but there is not the remotest chance of a failure of the general principles adopted to be completely successful in accomplishing a satisfactory purification of the sewage. Experiments are being carried out to ascertain the most practical and economical methods of applying these principles. There are indications that methods which would be adopted to-day would differ materially from those which would have been adopted several years ago. The results of the older methods were just as satisfactory as far as the work was concerned, but the newer plans give promise of greater practicability and economy, and contain less objectionable and doubtful features. The older schemes may yet prove the most practical, but it would be very unwise to adopt them without giving the more recent discoveries a careful investigation.



Regulator Manhole Connections.

It is not surprising that there is a feeling of doubt expressed when the very large sums of money expended by this department are considered. It is also very natural to attribute these large expenditures directly to the problem of purification. While there is an intimate connection between the separating system and the treatment of the sewage, yet it is not reasonable to condemn the latter because the former is necessary. No scheme has been proposed, by anyone familiar with the subject, which would accomplish the results without the separation of the waters of Mill Brook from the sewage. There has always been a popular feeling that the sewage should be discharged into tide-water. Were this to be done, the very first step to be taken toward its accomplishment would be to separate surface water from the sewage, and to do it much more completely and at vastly greater expense than is believed to be necessary, for the present, at least, if the plan for local treatment is retained.

The cost of the separating system to date is $749,069.16, and it will cost about $200,000 to complete the east main carrier. While this expenditure is in direct compliance with the act prohibiting the discharge of sewage into the Blackstone River, it is made necessary no more by the plan adopted for local treatment than would it be for any other reasonable plan; in fact, not one of the many experts who have been engaged, either by the city or by the towns opposing the city to study this problem, has considered any other plan as being reasonable.

The expenditure to date for construction of the purification works is $464,410.45. This, considered as capital invested, would, at 3½ per cent., add $16,254.36 to the annual running expenses. For 1900 this would make the total operating expenses $66,327.70, or $0.56 per capita. This amount adds $0.59 to the tax rate for 1900. While it is unfortunate that any money must be raised for the disposal of the wastes of the city, yet it is one of the necessities of nearly every city, and the amount doesn't seem unreasonable.

The average daily quantity of sewage treated this year is 13.1 million gallons. Of this, 3,000,000 gallons have been treated by filtration after flowing through three of the settling basins to remove as large an amount of the floating matter as possible. Of the effluent from the chemical treatment an average of .66 million gallons daily have been filtered, so that the total amount of effluent from the filter beds running into the river has been 3.66 million gallons per day.

The total cost of running the purification plant has been $51,160.28. This item, however, includes some bills for stock used in 1899, and the amount of coal and lime on hand paid for before December 1, 1900. It does not include discounts retained on contract bill, and which cannot be paid until 1901. The actual net cost of maintenance of this work was $50,073.34.

No material changes have been made during the year in the method of chemical treatment. Lime alone is added to the sewage, and this, together with the iron salts in the sewage, has produced a very satisfactory effluent. The results of the chemical treatment are shown in Table 2, the monthly averages of the daily analysis being given.

The results of the chemical treatment in 1900 compare very closely with those of former years. This treatment has required the use of 1,230 pounds of lime per million gallons of sewage treated.

The net cost of the chemical treatment has been $19,232.15, which would make the cost per million gallons treated $5.22. To this should be added the cost per million gallons sewage treated for disposing of the sludge, $6.48, making a total of $11.69.

The method and process of disposing of the sludge from the chemical treatment have been more satisfactory than in any previous year. The total amount of sludge pumped from the settling basins was 41.5 million gallons, of which only 2,000,000 gallons were run on to the sludge beds, and this in cold weather. These 2,000,000 gallons of sludge not pressed were mostly removed from crude sewage without chemicals, the effluent being run on to the filter beds.

Table 5 gives some of the more interesting statistics in connection with this work. It will be noticed that the cost of pressing has been reduced from $4.64 in 1899 to $3.15 per ton of solids.

The reduction in cost of sludge pressing in 1900 over that of last year was nearly 20 per cent.

The pressed sludge cake has been carried to a piece of land leased for the purpose, and used for filling. This makes a final disposition of this material, and there is room enough to last for several years.

The fourteen filter beds built in 1899 have been in operation throughout the year, and have given very good results. Table 3 gives results of analyses of sewage and effluent from this part of the plant.

An average of 3.66 million gallons of water

Table 2—Results of the Chemical Precipitation of the Sewage. Monthly Averages of Analyses of Sewage and Effluent. [Parts per 100,000.]

Date of Collection.	Free Ammonia.	Albuminoid Ammonia: Total.	Albuminoid Ammonia: Dissolved.	Albuminoid Ammonia: Suspended.	Oxygen consumed: Unfiltered.	Oxygen consumed: Filtered.	Chlorine.	Aver. flow per day in mill. gals.
Sewage, December, 1899	2.266	.766	.384	.382	9.62	6.35	8.53	8.1
Effluent, December, 1899	1.765	.335	.332	.003	4.92	4.92	8.62	
Per cent. removed	22.11	56.27	13.54	99.15	48.85	22.52	-1.05	
Sewage, January, 1900	1.589	.539	.262	.277	7.61	6.59	7.89	9.0
Effluent, January, 1900	1.246	.239	.234	.005	5.07	5.07	8.03	
Per cent. removed	21.58	55.65	10.69	98.19	33.37	23.06	-1.77	
Sewage, February, 1900	1.100	.544	.269	.275	7.32	4.48	5.24	6.6
Effluent, February, 1900	.806	.231	.222	.009	3.84	3.84	5.20	
Per cent. removed	26.73	56.43	17.47	96.67	59.85	14.29	0.76	
Sewage, March, 1900	.639	.403	.172	.231	4.87	3.13	4.70	7.7
Effluent, March, 1900	.596	.177	.168	.009	2.39	2.39	4.53	
Per cent. removed	6.73	56.08	.233	96.12	50.93	23.64	3.62	
Sewage, April, 1900	.905	.507	.265	.242	6.02	3.34	5.48	10.4
Effluent, April, 1900	.795	.251	.245	.006	3.13	3.13	5.40	
Per cent. removed	12.15	50.49	7.55	97.52	48.00	6.29	1.46	
Sewage, May, 1900	.775	.385	.202	.183	5.55	3.18	5.28	11.0
Effluent, May, 1900	.750	.173	.170	.003	2.72	2.72	5.22	
Per cent. removed	3.23	55.05	15.84	98.35	50.99	14.45	1.14	
Sewage, June, 1900	.906	.456	.238	.218	5.84	3.32	6.25	10.3
Effluent, June, 1900	1.006	.231	.213	.018	2.96	2.96	6.45	
Per cent. removed	-11.04	49.34	10.50	91.73	49.32	10.84	-3.20	
Sewage, July, 1900	1.538	.559	.309	.250	7.20	4.38	8.08	12.2
Effluent, July, 1900	1.469	.328	.281	.047	3.77	3.77	8.22	
Per cent. removed	4.49	41.32	9.06	81.21	47.64	13.93	-1.73	
Sewage, August, 1900	1.331	.465	.202	.263	7.27	4.94	7.63	11.8
Effluent, August, 1900	1.238	.258	.249	.009	3.42	3.42	7.98	
Per cent. removed	6.99	44.51	-23.27	96.56	52.97	30.77	-4.59	
Sewage, September, 1900	1.344	.608	.220	.388	7.75	5.49	7.60	11.8
Effluent, September, 1900	1.281	.286	.272	.014	3.95	3.95	7.65	
Per cent. removed	4.69	52.97	-23.60	96.40	49.00	28.05	-0.66	
Sewage, October, 1900	1.655	.698	.222	.476	8.81	6.78	6.46	12.4
Effluent, October, 1900	1.445	.296	.288	.008	3.65	3.65	7.02	
Per cent. removed	12.69	57.58	-29.73	98.32	58.56	46.16	-8.67	
Sewage, November, 1900	1.394	.700	.214	.486	7.87	5.62	6.10	10.1
Effluent, November, 1900	1.300	.315	.305	.010	4.13	4.13	5.92	
Per cent. removed	6.74	55.00	-42.52	97.95	47.52	26.52	2.95	
Sewage for year ending Dec. 1, 1900	1.292	.551	.244	.306	7.18	4.82	6.64	10.1
Effluent for year ending Dec. 1, 1900	1.137	.258	.247	.011	3.65	3.65	6.70	
Per cent. removed	11.99	53.18	-1.23	96.40	49.17	24.28	-0.90	

Note.—Monthly averages are made from daily analyses of sewage and effluent. The daily sewage samples consist of forty-eight portions taken half-hourly. Sewage samples are taken as nearly as possible in proportion to the amount of sewage being received at the time of the sampling. Effluent samples consist of twenty-four portions taken hourly. The figures for average flow per day represent sewage chemically treated.

Table 3—Results of Filtration of the Sewage. Monthly Averages of Analyses of Sewage and Filtrate. [Parts per 100,000.]

Date of Collection.	Free Ammonia.	Albuminoid Ammonia: Total.	Albuminoid Ammonia: Dissolved.	Albuminoid Ammonia: Suspended.	Oxygen Consumed: Unfiltered.	Oxygen Consumed: Filtered.	Chlorine.	Aver. flow per day in mill. gals.
Sewage, December, 1899	1.630	.647	.323	.324	8.65	7.00	8.23	2.3
Effluent, December, 1899	1.827	.052	.052	.000	2.10	2.10	7.97	
Per cent. removed	-12.09	91.96	83.90	100.00	75.71	70.00	3.16	
Sewage, January, 1900	1.415	.538	.258	.280	9.55	7.42	8.42	3.7
Effluent, January, 1900	1.677	.038	.038	.000	2.39	2.39	8.14	
Per cent. removed	-1.85	92.94	85.27	100.00	74.98	67.79	3.33	
Sewage, February, 1900	.867	.392	.183	.209	5.32	3.17	5.23	3.8
Effluent, February, 1900	1.108	.058	.058	.000	1.24	1.24	5.17	
Per cent. removed	-27.80	85.19	68.29	100.00	76.67	60.88	1.15	
Sewage, March, 1900	.590	.258	.145	.113	3.23	2.58	3.98	3.6
Effluent, March, 1900	.910	.046	.046	.000	0.41	0.41	3.65	
Per cent. removed	-54.23	82.17	68.26	100.00	87.30	84.12	8.29	
Sewage, April, 1900	.862	.257	.155	.102	4.04	3.34	4.91	4.3
Effluent, April, 1900	1.391	.030	.030	.000	0.80	0.80	4.95	
Per cent. removed	-61.38	88.33	80.65	100.00	80.19	76.05	-0.81	
Sewage, May, 1900	1.019	.279	.143	.136	4.53	3.77	5.58	4.3
Effluent, May, 1900	1.340	.043	.043	.000	0.68	0.68	5.11	
Per cent. removed	-31.52	84.59	69.93	100.00	85.00	81.98	8.42	
Sewage, June, 1900	1.581	.694	.313	.381	6.60	5.43	7.25	3.7
Effluent, June, 1900	2.486	.092	.092	.000	1.81	1.81	6.32	
Per cent. removed	-36.39	86.74	70.62	100.00	72.57	66.74	12.83	
Sewage, July, 1900	2.381	.686	.269	.417	8.03	4.46	9.19	1.0
Effluent, July, 1900	4.011	.110	.110	.000	1.18	1.18	8.79	
Per cent. removed	-40.39	83.97	59.10	100.00	85.31	73.55	4.04	
Sewage, August, 1900	2.155	.426	.213	.213	6.26	3.74	9.42	2.5
Effluent, August, 1900	2.544	.089	.089	.000	0.67	0.67	9.08	
Per cent. removed	-15.29	79.11	58.21	100.00	89.30	82.08	3.61	
Sewage, September, 1900	2.347	.740	.220	.520	8.13	4.96	8.96	3.8
Effluent, September, 1900	2.205	.100	.100	.000	0.65	0.65	8.63	
Per cent. removed	6.05	86.50	54.55	100.00	92.00	86.90	3.68	
Sewage, October, 1900	2.188	.719	.249	.470	7.22	4.73	7.78	1.7
Effluent, October, 1900	2.265	.090	.090	.000	0.95	0.95	7.90	
Per cent. removed	-3.16	87.50	63.86	100.00	86.86	79.91	-1.54	
Sewage, November, 1900	1.900	.545	.263	.282	6.70	5.32	7.06	2.8
Effluent, November, 1900	2.390	.077	.077	.000	0.84	0.84	6.89	
Per cent. removed	-25.78	85.86	70.71	100.00	87.44	84.24	2.41	
Sewage for year ending Dec. 1, 1900	1.624	.447	.226	.221	6.32	4.53	7.11	3.0
Effluent for year ending Dec. 1, 1900	1.892	.065	.065	.000	1.17	1.17	6.80	
Per cent. removed	-16.50	85.47	71.24	100.00	81.49	74.16	4.36	

Note.—The figures for average flow per day represent sewage treated on filter beds.

Table 5—Results of Sludge Pressing.

Months.	Sludge Pumped. (Million gals.): To filter presses.	Sludge Pumped. (Million gals.): To sludge beds.	Sludge Pumped. (Million gals.): Per cent. solids in wet sl'ge	Tons Solid: In pressed cake.	Tons Solid: On sludge beds.	Tons Cake: Pressed.	Tons Cake: Sludge on beds.	Tons Cake: Per cent. solids in cake.	Tons Cake: Lbs. lime added to sludge.	Tons Cake: Cost per ton of solids.
December	3.993	0.660	3.27	544	90	1,975	330	27.5	75,800	$6.44
January	2.973	0.553	3.79	470	87	1,637	302	28.7	62,400	6.79
February	1.605	0.142	5.00	334	30	1,006	262	28.7	39,650	4.51
March	1.550	0.118	6.30	407	31	1,214	93	33.5	46,750	3.64
April	2.443	0.087	5.33	542	20	1,828	253	27.0	62,000	3.09
May	2.805	0.459	5.02	587	96	1,323	399	29.4	95,000	2.67
June	3.092	.....	5.16	665	..	1,991	...	33.4	85,500	1.83
July	4.823	.....	4.37	878	..	3,113	...	28.3	57,900	2.53
August	4.713	.....	4.26	837	..	2,978	...	28.2	49,500	2.18
September	4.232	.....	3.91	690	..	2,654	...	26.0	83,500	3.04
October	4.667	.....	4.34	849	..	3,381	...	25.0	110,900	3.03
November	2.591	.....	4.59	496	..	1,947	...	25.5	66,500	4.10
Total	39.487	2.019	4.42	7,299	354	25,647	1,639	28.0	835,400	$3.43

have been turned on to the filters. Two beds have been used for filtering chemical effluent. They have received an average of 330,000 gallons per acre per day, and have given very satisfactory results. One filter has received sewage from the septic tank, and the other eleven have received sewage. Before being run onto the filters the sewage has been allowed to flow through three of the settling basins, each receiving its proportional part. The current through the tanks has been so rapid that the precipitation of solids was not as complete as was desired. It was impossible, however, to devote more basins to this work and maintain the efficiency of the other treatment.

The effluent from the filters has shown a fairly good degree of purification, although the nitrification has been low.

The cost of filtering the sewage has been $6.36 per million gallons, not including the cost of disposing of the sludge removed by subsidence.

In May one of the basins at the purification works was put into operation as a septic tank. Sewage at the rate of 300,000 gallons a day, one filling of the tank, was allowed to flow slowly through it. This was continued during the year, and there was substantially no more sludge in the basin than there was six weeks after it was started. Some of the time there was a scum on the surface of the water, but a heavy shower or a high wind liberates the gas, and the floating matter settles to the bottom again.

The effluent from the basin has at all times been very dark colored, and has contained very fine suspended matter. The suspended matter observed in the fresh sewage does not appear in the effluent. Analysis of the effluent shows that much organic matter has been decomposed.

The odor arising from the effluent, as well as from the tank itself, is offensive in the extreme. When the filters receiving this water are wet, the odor from them is very marked. A subject for further investigation is here presented, and if it is found impossible to prevent these disagreeable evidences of putrefaction, the adoption of the scheme on a large scale will be a subject for serious consideration.

Table 4—Results of Chemical Precipitation and Filtration of the Sewage. Monthly Averages of Analyses of Sewage and Effluent from Chemical Precipitation and Filtration Combined.
[Parts per 100,000.]

Date of Collection.	Free Ammonia.	Albuminoid Ammonia Total.	Albuminoid Ammonia Dissolved.	Albuminoid Ammonia Suspended.	Oxygen consumed. Unfiltered.	Oxygen consumed. Filtered.	Chlorine.	Aver. flow per day in mill. gals.
Sewage, December, 1899	2.122	.740	.370	.370	9.41	6.43	8.46	10.4
Effluent, December, 1899	1.779	.273	.270	.003	4.30	4.30	8.48	
Per cent. removed	16.16	63.11	27.03	99.19	53.07	33.13	-0.23	
Sewage, January, 1900	1.538	.547	.261	.286	8.19	6.83	8.05	12.7
Effluent, January, 1900	1.371	.181	.177	.004	4.29	4.29	8.06	
Per cent. removed	11.11	66.91	32.19	98.58	47.62	31.19	-0.12	
Sewage, February, 1900	1.015	.488	.238	.250	6.59	4.00	5.23	10.4
Effluent, February, 1900	.916	.169	.159	.010	2.89	2.89	5.19	
Per cent. removed	9.76	65.37	33.19	96.01	56.14	27.74	0.76	
Sewage, March, 1900	1.207	.357	.163	.194	4.35	2.95	4.47	11.3
Effluent, March, 1900	.696	.135	.130	.005	1.76	1.76	4.24	
Per cent. removed	42.35	62.19	20.24	97.43	59.54	40.33	5.15	
Sewage, April, 1900	.892	.434	.233	.201	5.44	3.34	5.31	14.7
Effluent, April, 1900	.969	.186	.182	.004	2.45	2.45	5.27	
Per cent. removed	-8.63	57.15	21.89	98.02	54.96	26.65	0.75	
Sewage, May, 1900	.830	.355	.184	.171	5.10	2.80	5.36	15.3
Effluent, May, 1900	.915	.137	.134	.003	2.15	2.15	5.19	
Per cent. removed	-10.24	61.42	27.17	98.24	57.84	23.21	3.18	
Sewage, June, 1900	1.323	.519	.258	.261	6.04	2.87	6.51	14.0
Effluent, June, 1900	1.397	.194	.181	.013	2.66	2.66	6.31	
Per cent. removed	-5.74	62.62	29.85	95.04	55.97	7.32	3.07	
Sewage, July, 1900	1.601	.569	.306	.263	7.26	4.38	8.16	13.2
Effluent, July, 1900	1.662	.312	.268	.044	2.86	2.86	8.26	
Per cent. removed	-3.80	47.30	12.41	83.26	60.61	34.69	-1.22	
Sewage, August, 1900	1.542	.458	.204	.254	7.92	4.73	7.94	14.3
Effluent, August, 1900	1.467	.228	.222	.006	2.94	2.94	8.18	
Per cent. removed	4.86	50.21	-8.11	97.25	62.88	37.84	-3.02	
Sewage, September, 1900	1.697	.684	.235	.249	8.38	5.72	8.47	14.6
Effluent, September, 1900	1.609	.257	.246	.011	3.36	3.36	8.43	
Per cent. removed	5.19	62.41	-4.68	95.59	59.91	41.26	0.47	
Sewage, October, 1900	1.489	.700	.225	.475	8.62	6.53	7.22	14.1
Effluent, October, 1900	1.547	.271	.264	.007	3.32	3.32	7.43	
Per cent. removed	-3.89	61.30	-17.34	98.51	61.49	49.16	-2.91	
Sewage, November, 1900	1.505	.666	.225	.441	7.62	5.55	6.31	12.9
Effluent, November, 1900	1.537	.263	.256	.007	3.42	3.42	6.13	
Per cent. removed	-2.13	60.50	-13.78	98.42	55.11	38.38	2.85	
Sewage for year ending Dec. 1, 1900	1.368	.527	.240	.287	6.99	4.75	6.78	13.1
Effluent for year ending Dec. 1, 1900	1.309	.214	.205	.009	3.08	3.08	6.72	
Per cent. removed	4.17	59.39	15.92	96.85	55.94	35.16	0.89	

Note—The figures for average flow per day represent sewage treated both chemically and on filter beds

Refuse Destructors in Combination With Electric Power Stations.

Extracts from a paper by J. S. Highfield, electrical engineer of St. Helens, England.

The site for a destructor must be chosen so that the cartage is through streets other than main or residential streets, and also so that the average distance to be traversed is as short as possible. In towns having 100,000 inhabitants or more, it will generally be more economical to have two sites, and in very large towns more than two sites, as any saving that can be made by burning all the refuse in one large central destructor is more than counterbalanced by the extra cost of carting. In St. Helens there are two destructors; the cost per ton of carting to each is 61 cents; if all the refuse were carted to one of them, the cost per ton would be 70 cents. In considering the site, where two or more destructors are necessary and no power station already exists, it is advisable to place the largest destructor on a site also suitable for the power station, and to choose this site so that the cartage shall not be very heavy from the districts where the refuse having the best fuel value is obtained.

Without the addition of boilers there are certain points that should obtain in any really first-class destructor. These are: (1), Forced draught, preferably provided by a blowing engine, as being more economical than a steam jet. (2), A suitable arrangement of duplicate flues, so that one set can be cleaned while the other set is working. (3), Charging appliances so that the refuse can be quickly transferred from the carts to the furnace without unnecessary handling. (4), Baffling chambers or other devices to prevent dust entering the chimney. (5), Arrangements for quickly and cheaply removing the clinker.

If, in addition to the destruction of the refuse, steam raising on a serious scale is contemplated, it is further necessary to provide: (1), A high-pressure boiler in connection with each furnace, of which there must be at least two, one as a stand-by. (2), Each furnace must have two divisions or cells, one of which must always be in full blast when the other is being clinkered or charged. (3), By-pass flues, so that any surplus heat can be sent direct to the chimney. (4), Arrangements to prevent cold air getting to the boiler during charging and clinkering operations. (5), Duplicate flues to enable the furnaces to be worked continuously from week to week, one set of flues being cooled down for the necessary periodical cleaning operations.

Generally, when a destructor is used as an adjunct to an electric power station, a separate grate is provided, so that coal can be burnt under the boiler. This is only necessary when it is contemplated to steam the boilers without refuse; that is, with coal only, or when the refuse is of extremely variable quality. The writer has never yet used coal to help out the destructor fires, but occasionally the refuse is of poor quality, and then it is necessary to help the destructor with steam from other boilers. He has found it a good plan to burn the clinker and ashes from the electric works boilers in the destructor when the refuse consists largely of fish or paper; by this means he burns these substances in a better manner, and gets more steam, and also gets rid of a waste product in an economical way.

Referring to the details above mentioned, the most important so far as steam production is concerned, is a rapid means of charging and clinkering the furnaces; with regard to the latter, some form of chain grate seems to promise the best station; with regard to the former, the sloping platform is exceedingly simple, but it involves much labor in raking the refuse into the furnace doors. The arrangement the writer is now using consists of a platform on to which the carts are tipped, and which can be tilted to an angle of about 45 degrees by means of winding tackle, operated by an electric motor. The refuse slides or is easily raked over the charging doors and against a screen; the doors can be racked open and the refuse falls and is raked into the furnace. This gear works well, and enables more refuse to be burnt in the same furnace than could be done by the former method.

The plant of which the writer has charge consists of two Beamen & Deas furnaces, each divided into two cells, each furnace serving to steam to its full capacity a Babcock boiler with 1,470 square feet of heating surface. The forced draught is provided by an 18-horse-power motor-driven fan, the average pressure in the closed ash-pits being 3 inches on the water gauge. The plant at the power station consists of five steam generators of a total output of 1,000 kilowatts. In addition to the steam from the destructor boilers, steam is supplied from a battery of four 30 x 8-foot Lancashire boilers. The steam ranges are designed so that two steam sets, each of 125-kilowatt capacity, can be run from the destructor independently of the other boilers, or the destructor boilers and Lancashire boilers can supply the whole range in parallel; in each machine circuit a watt-hour recording meter is fixed to meter the output from the generator. The usual practice is to drive one or both of the 125-kilowatt sets from the destructors only, for a part of the day, and later on, when more plant is required, to parallel both sets of boilers on the whole load.

The working has been somewhat interfered with from the causes incident to any new installation; a considerable amount of alteration and reconstruction has been done, which has prevented the fullest efficiency of working being attained; the figures given in the table show the results of the first year's working of a new plant, and give a fair idea of the actual value of a small destructor station in a town where the refuse has a good calorific value.

It was found that the calorific value of the fuel was distinctly better in the summer than in the winter. The refuse varies somewhat from day to day, and therefore, if no other boilers were available, it would be necessary occasionally to use coal under the destructor boilers, or to hold a reserve of boiler ashes and clinker to use when the calorific value of the refuse was poor.

Figures for Working of a Two-Furnace Refuse Destructor from March 31, 1900, to March 31, 1901.

	Total for year.	Average per week.
Weight of refuse burned, tons....	9,778	188
Electric energy used to drive fan and other motors, units..........	70,000	1,346
Units generated by steam.........	365,000	7,019
Wages on burning..................	$3,653	$70.22
Wages on repairs.....................	$419	$8.01
Weight of clinker produced, tons	3,900	75
Value of mortar sold..............	$1,079	$20.72
Value of electric units generated at 0.6 cent per unit...............	$2,192	$42.10

Averages per Ton of Refuse Burnt.

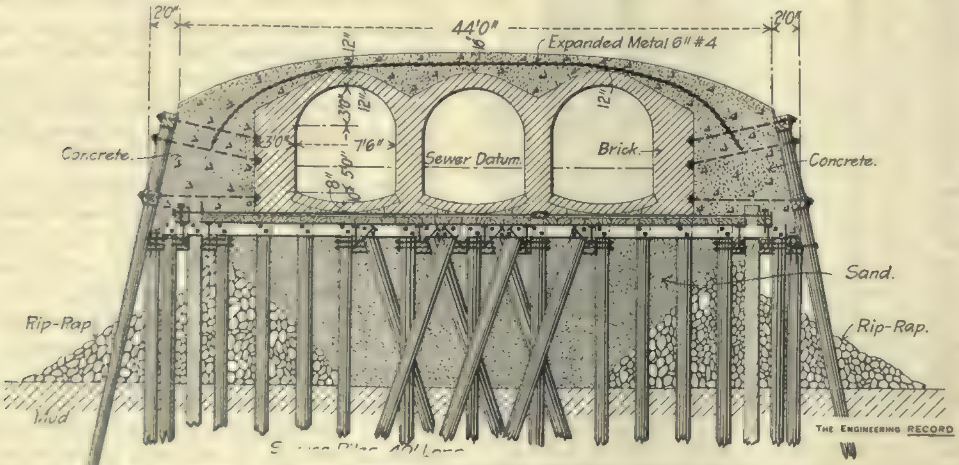
Units generated..............................	37.3
Units used on works........................	7.1
Cost of burning, including wages, light and power....................................	44.2 cents
Cost of repairs (wages and stores)......	6.0 "
Cost of removing clinker not otherwise used	11.0 "

From the above figures it will be seen the net saving to the destructor department due to combining the electric works and the destructor works is $2,192, less $244 on boiler repairs, and less the interest and sinking fund charges on $7,305 (which represents the extra capital cost on the boiler plant above what would have been necessary for smaller boiler plant for working the mortar mills, the blowing fan and other plant on the works), which may be taken as $438, leaving $1,510, or 41 per cent., of the total wage bill. The cost of cremating the refuse and removing the clinker is therefore reduced from 61 to 46 cents per ton.

It should be noted here, that in addition to supplying steam to the electric works, the destructor also supplies steam to drive two mortar mills and a steam winch.

Considerable care was taken to prevent dust from the destructor getting into the power station; it is almost impossible to do this quite successfully, but no serious harm was done by the small amount that did enter.

In conclusion the writer would say that in certain cases where a suitable site for destructor and electric works exists, and where the works are not very large, the combination can be usefully made, when a traction or other good all-day load exists. For a very large works, or for a station which only drives a lighting load, there are not many instances where there is any economical value in the combination. Without desiring to generalize, the writer thinks that in these cases it is better to use the destructor furnaces to provide steam for driving mortar mills or other machinery, on which the calls are not so exacting as on an electric-power plant.



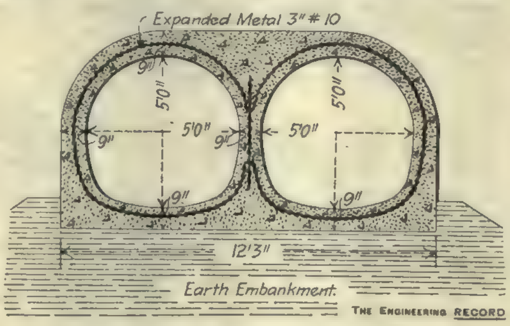
CROSS-SECTION OF OUTFALL SEWER, BROOKLYN. N. Y.

Some Examples of Concrete and Expanded Metal in Municipal Structures.

The rapid extension of uses for concrete and expanded metal in municipal works has been a noteworthy feature of city engineering during the past year, and a number of large undertakings are now under contract in which interesting details are to be found. Some of them were described by Mr. Merrill Watson at the last convention of the League of American Municipalities, and from information furnished by him and by the engineers in charge of the works mentioned, the following notes have been prepared.

Probably the most surprising of these new uses of concrete-steel construction was made in the foundations of some Chicago pavements. As this experience was doubtless unique, the following description of it is given in the language of the Barber Asphalt Paving Company:

"The following is, I think, an accurate statement of the use of expanded metal in the foundation of street pavements of this city: On South Park Avenue, from 24th to 35th Street, being one and one-eighth miles; on Cottage Grove Avenue, from 22d to 39th Street, being one and one-half miles; on North Clark Street, from Kinzie to Division Street, being one mile; on South Park Avenue, from 63d to 67th Street, being one-half mile; Evans Avenue, between same points, one-half mile; Clifton Park Avenue, Douglas Boulevard to Ogden Avenue, one-half mile. Except on Cottage Grove Avenue and North Clark Street, the specifications called for 4 inches of natural cement concrete. One inch of concrete was laid first, then the expanded metal carefully fitted at the joints was laid upon this, and then the remaining concrete was tamped down.



CONDUITS AT CEDAR GROVE RESERVOIR.

"Since the adoption of specifications by the city requiring the use of Portland cement concrete 6 inches thick in all cases, no more expanded metal has been used. The utility of its use was clearly brought out in several instances, notably on North Clark Street. The contract for this mile of pavement was signed in October and the work completed that year. In advance of laying the pavement six trenches were dug the entire length of the street, two for gas mains, two for electric conduits, one for a water main, and one for a sewer. From each of these, laterals were cut to the curb line. It rained that fall and we were compelled to lay the concrete upon a mass of soft, spongy earth 6 feet in depth, and yet the pavement has stood remarkably well. No one familiar with natural cement concrete would expect it to stand under such conditions, and I am satisfied that only the expanded metal saved the pavement.

"The Evans Avenue pavement was laid upon a sand foundation. Through a broken sewer pipe this sand sifted into the sewer and was washed away, leaving the empty space like an inverted cone with the base at the bottom of the pavement and the apex at the hole in the sewer pipe, the base of the cone being 10 feet and the perpendicular 8 feet. How long this had been there is not known. It was finally broken through by a heavily loaded wagon, the wheels of which, however, were held by the expanded metal and the wagon drawn out without injury.

"I have heard no complaints from plumbers as to difficulty in cutting through pavements of this character, and we have been able to replace the cuts in as good condition as before."

The second example of the use of expanded metal in concrete is found in the conduits which Mr. Morris R. Sherrerd has designed to be built along the bottom of the new Cedar Grove reservoir of the Newark, N. J., water-works. The accompanying cut shows a typical cross-section of a double conduit, and a single conduit of the same type will also be built. The concrete employed for this work will be mixed in the proportion of one part of Portland cement, two of sand and five of broken stone. None of the stone is to be larger than 1½ inches in maximum dimension, and the size is to be graded down to ¼ inch in such a manner that the total aggregate shall have a minimum amount of void space. The interior of the conduits will be carefully scraped smooth, the depressions filled with a 1:1 Portland cement mortar and the entire surface then given a thick coat of Portland grout. The expanded metal used on this work is the 3-inch No. 10 steel grade.

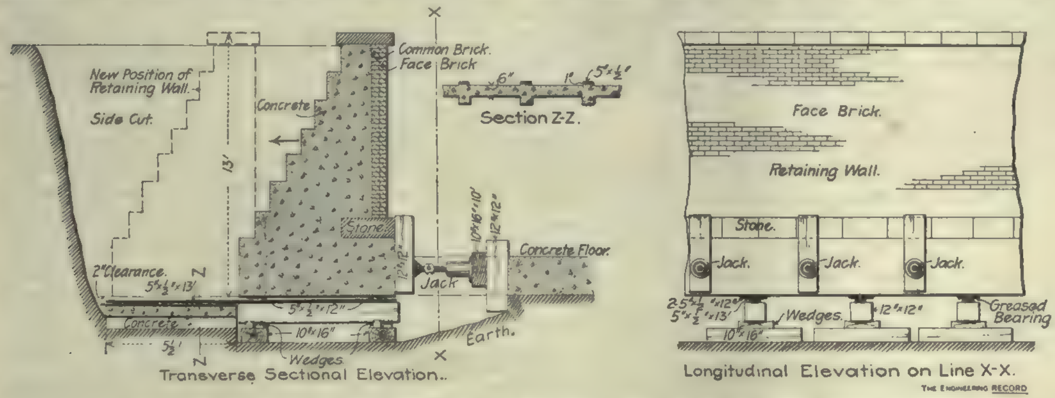
In connection with these conduits it may be of interest to refer to some tests of another type of aqueduct designed by Mr. E. W. Harrison for the Jersey City Water Supply Company, and described in The Engineering Record of July 21, 1900. His first all-concrete design was elliptic in cross-section and 8 feet 6 inches in diameter, requiring 2 cubic yards of concrete per lineal foot. A section 10 feet in length of the same load-carrying capacity and practically the same shape was constructed of concrete-steel, about 1 cubic yard of concrete being used per foot of conduit. When tested in the manner described in the article referred to, it was found to have double the strength of the section originally designed, while costing $5.40 per foot less.

The third example of this system of construction is offered by an outfall sewer in the Borough of Brooklyn, running out from the shore several hundred feet into New York Bay. It is shown in cross-section in the accompanying cut, and was designed under the direction of Mr Henry R. Asserson, chief engineer of the Brooklyn Sewer Department. The sewer is carried on a heavy platform, supported on bearing and spur piles, driven with a water jet, if necessary, until a 40-foot length can be obtained below the point of cut-off. Under each edge of the platform is a line of 12 x 12-inch tongue-and-groove sheet piling, which is protected by riprap on each side. Inside this sheet piling there is a filling of sand. Outside the sewer there are large oak fender piles every 8 feet.

The main mass of concrete is mixed in the proportion of one part of Portland cement, two of sand and four of broken stone, while that for the 8-inch face on the outside of the spandrel walls and the 6-inch face on the extrados of the arch is mixed in the proportion of one part of Portland cement, one-half part of sand, and one and a half parts of granite dust or powder. No concrete is allowed to be laid except when the platform is clear of water, until an elevation is reached at which the engineer judges it safe to permit continuous work to begin. At all times the concrete must have an hour for setting before the tide washes over it. No part of the wall can be laid between the high and low-water levels, a distance of 4½ feet, except on ebb tide. Tongue-and-groove shutters are to be used in forming the wooden mold in which the concrete walls between high and low water levels will be built, in order to prevent washing by the tide.

The arch is reinforced by strips of 6-inch No. 4 expanded metal. The sheets are 8 feet long and 6 feet wide, and are laid with their length transverse to the axis of the sewer. They are to be placed so as to overlap half a mesh and are to be tied together during construction with No. 16 wire.

Moving a Long Brick Wall.



METHOD OF MOVING RETAINING WALLS ON NEW YORK RAPID TRANSIT SUBWAY.

The first portion of the New York Rapid Transit Railway structure which was completed ready for the track rails was a section a few hundred feet long on Broadway, north of West 135th Street, in section 13. It was built by L. B. McCabe & Brother, sub-contractors for sections 12 and 14, and was finished nearly a year ago. It was constructed of the standard dimensions and design for two tracks, but as recent developments have made it desirable to have three tracks at this point for the operation of the railway, the Rapid Transit Commission authorized the contractors to change it to a three-track structure, and this work is now in progress. At about One Hundred and Thirty-fifth Street the tracks begin to descend northwardly from the surface of the ground to enter the underground section, and there is an inclined entrance in open cut to the beam-construction subway. The bottom of the cut had a solid concrete floor, continuous with the footings of the retaining walls on each side. It was decided to cut through this floor parallel, and adjacent to, the face of each wall, and to move each wall backward parallel to its original position 5½ feet farther away from the center line, to permanently seat them in their new positions, and to restore and extend the concrete floor between them, so as to secure the wider structure without destroying the original masonry.

The retaining walls are about 196 feet long, from 4 feet high at the south end to 13 feet high at the north end and 3 feet thick on top, battering with irregular offsets on the rear to a maximum bottom thickness of 8 feet. They are faced with 9 inches of brickwork, built with one course of pressed brick and one of red brick, and have a line of footing stones built into the concrete base under the brickwork at floor-level. After removing the concrete floor close to the wall, and making, on the opposite side, an excavation about 6 feet wide at the bottom, small holes were worked through the earth under the footing and 12 x 12-inch transverse timbers, about 8 feet long, were set in them from 3 to 5 feet apart, according to the height of the wall. A 5 x ½-inch steel track-plate, 13 feet long, was laid on top of each timber, and 5 x ½-inch sliding pieces, 12 inches long, were laid across them longitudinally, under the front and rear edges of the footing. A 10 x 16-inch longitudinal sill was laid flat under each end of the transverse timber, and the latter was given bearing on them by driving a pair of thin oak wedges side by side on top of each sill. The sills were so long that their ends nearly touched in the middles of the spaces between the transverse timbers, and practically formed two continuous bearings, each 16 inches wide, under the wall. Back of the wall a concrete footing, 5½ feet wide and 6 inches in minimum thickness, was laid with deeper transverse ribs on the center line of the track-plates, which were 1 inch above its upper surface, and bedded in cement mortar. The oak wedges were driven until the wall was slightly raised, and after the concrete footings had set a week or more, jack screws were placed horizontally from 3 to 6 feet apart against bearing pieces on the foot of the wall and on the edge of the concrete floor, and, being simultaneously operated, in a few hours pushed the whole length of the wall 5½ feet transversely to bearing above the new footing.

The screws were turned at given signals, and great care was taken to keep the wall lined in, so that no transverse strains or distortions were developed. A transit was set up and a sight taken parallel to the axis of the wall, a few inches from the required position of its face, and offsets were taken from it to make sure that the wall should not be moved too far, and to check its position. At the end of the moving the wall was found to be less than 1/16 inch out of line or level, and no cracks or injuries could be discovered. Where the wall was highest the blocking had settled a little and given the sliding plates a slight upward inclination, and the face of the wall had to be raised slightly to plumb it. The space of about 1½ inches between the top of the new concrete footing and the bottom of the old wall, which was left between the sliding plates for clearance of the irregularities of the concrete, was grouted, the timber removed, the steel track-plates cut off flush with the face of the wall, the excavation backfilled, and concrete put in to restore and extend the floor. The estimated weight of the wall was about 200 tons, and the preparatory work and moving was accomplished in ten days by twenty men under the direction of the Terry & Tench Construction Company.

The Flow of Steam Through Orifices.

It has been known for a long time that the flow of steam through orifices is dependent only (for the one orifice) on the initial pressure so long as the subsequent pressure, that against which the flowing steam expands, is never greater than 0.58 of the initial pressure. A large number of investigations, also, have been made toward determining the quantity of flow under this relation of pressures, but, in general, these have all been based on the weight of steam which is condensed in a surface condenser. In view of the growing use of steam turbines, the calculation of which requires a knowledge of the laws of the escape of steam through converging or converging-diverging orifices, Mr. A. Rateau, of Paris, undertook in 1895-6, at St. Etienne, a series of experiments on the subject, according to a method which he considers gives very great precision. From 140 sets of observations he deduced a formula for the amount of flow, which formula, he says, furnishes the consumption very exactly. The orifices were chosen large enough to deliver 900 kilograms (2,000 pounds) and more of steam per hour. The results of these tests he embodied in a paper read before the recent International Engineering Congress at Glasgow.

The method by which he contends highly accurate results were obtained is to condense the steam in a stream of water with the use of an ejector condenser and measure the total yield of water together with the initial and final temperatures of the stream—the amount of water being determined by discharge through a previously calibrated water orifice and the whole arrangement permitting the experimenter to make all readings at the same moment, as soon as constant conditions are obtained, whereas with the more common method referred to, the weighing of water from the surface condenser is required after a sufficiently long period of operation. Each experiment did not last more than one or two minutes, which he pointed out had at least the advantage over the other method that the period was not long enough for any material variation to take place in initial steam pressure.

The supply of steam is received through a pipe 1.97 inches in diameter and passes through the orifice into a pipe of 4.72 inches diameter. Precautions were taken to separate water from the steam, to the extent, the author asserted, that the quantity of water never exceeded two or three thousandths. Valves were arranged to regulate the pressure both in front of and behind the orifice, and a range of pressures, from 1.4 to 170 pounds per square inch, was obtained. The three converging nozzles had diameters at the narrowest parts, as follows: 0.41, 0.59 and 0.95 inch. The formula for the total flow is as follows:

$$W = 3.6\ P\ (16.3 - 0.96\ \log.\ P),$$

where W is the number of pounds discharged per hour per square inch of the area of the orifice and P is the initial pressure in pounds per square inch, the logarithm being that referring to the common base, 10.

The Friction Loss Through Shafting and Gearing amounts to 42 per cent. of the brake horse-power of the engine, according to Mr. W. A. Kerr, in a paper before the Liverpool Engineering Society, this figure being the average from 17 workshops. He believes that electricity is particularly adapted to shops with fluctuating loads, where the average power demand is only 60 per cent. of the maximum.

The Central States Water-Works Convention.

The fifth annual convention of the Central States Water-Works Association was held on October 1-3, at Evansville, Ind., where a new system of water-works, designed by Mr. Charles Hermany, M. Am. Soc. C. E., has just been completed. The city is particularly proud of its pumping station, with three vertical triple-expansion 14,000,000-gallon Holly engines and three 250-horse-power Stirling water-tube boilers, and an opportunity was given for inspecting all its features. It is worth noting that several cities, Dayton, Toledo, Lima and Cincinnati, sufficiently appreciate the value of these conventions to send special representatives to them, in this way showing that they have as broad a spirit as the companies engaged in electric lighting and railway work, which often send large delegations to the meetings of the societies covering their respective fields.

One of the most important papers presented was by Edwin P. Matthews, Esq., city solicitor of Dayton, on the electrolysis of water and gas pipe. The author is in charge of the city's suit against the electric street railway, looking to the recovery of damages and enforcing preventative measures against further injury. The same subject was discussed in a paper by Mr. L. C. Anderson, of Franklin, Ohio, describing the suit of that village against the Southern Ohio Traction Company, operating a single-trolley line between Dayton and College Hill, for damages to service pipes by electrolysis. The jury failed to agree, the court having instructed them that, as the ordinance granting the franchise prescribed the manner in which the road should be built and operated, the village authorities were chargeable with contributory negligence, which would estop the claims for damages. Both papers were well discussed, as the subject has proved as important to water-works managers in the Central States as elsewhere. The Committee on Electrolysis, Messrs. F. A. W. Davis, Indianapolis; Chas. E. Rowe, Dayton; Quince Walling, Muncie; A. L. Holmes, Grand Rapids, and J. J. Pater, Hamilton, was continued for another year and its report, which was not read, was ordered printed, together with a synopsis of court rulings on the subject.

Among the other papers read was one on the water supply of Dayton, by Mr. Rowe, and one on hot-water heating from a central station, by Mr. C. W. Wiles, of Delaware, Ohio. The Committee on a Uniform System of Municipal Accounting submitted a report which was ordered printed, and Messrs. J. J. Pater, W. A. Veach and A. J. Pray were appointed a committee to investigate the matter of association emblems and certificates.

The following candidates for admission were elected: Members: William Lieber, Henderson, Ky.; S. F. Tompkins, Joliet, Ill.; Henry Burton, Port Huron, Mich.; D. E. Thompson, Greenville, Ohio; James Forbes, Dennison, Ohio; E. M. Boggs, Los Angeles, Cal.; T. H. Morton, Nashville, Tenn. Associate Members: I. A. Worch, Ft. Wayne, Ind.; A. P. Briggs, Cambridgeport, Mass; H. W. Collins, Michigan Brass Works, Detroit, Mich.

The officers elected for the next year were J. J. Pater, Hamilton, Ohio, president; J. T. Blair, Cincinnati; Geo. McIlhenny, Evansville; W. H. Glore, Covington; T. H Morton, Nashville; Henry Burton, Port Huron; S. F. Thompkins, Joliet; Clarke Howell, Charleston, vice-presidents; Wm. Allen Veach, Newark, secretary; Charles E. Rowe, Dayton, treasurer; C. W. Wiles, Delaware; A. W. Evans, Zanesville, W. H. Stephens, Lima, executive committee; T. R. Cook, Toledo; John Lanagan, Tipton; A. W. Inman, Massillon, finance committee; Lehman B. Hoit, editor. It was voted to hold the next convention at Indianapolis.

Changes in the Management of Public Works, New York City.

Extracts from a report to the American Society of Municipal Engineers, by Mr. Nelson P. Lewis, M. Am. Soc. C. E., Engineer of Highways, Brooklyn, N. Y.

The changes which have taken place [in the past year] in the laws governing our cities equal, if they do not exceed, in importance the work actually done. Probably the most conspicuous of these changes is that in the charter of the Greater New York, which takes effect on January 1, 1902. The original charter, which went into effect at the time of consolidation, at the beginning of 1898, provided a highly centralized form of government for a city of three and a half millions of people. The city was divided by natural boundaries into five boroughs, of greatly varying size and population. Each one of these elected a borough president. The entire city was divided into 22 local improvement districts indicated by numbers. The members of the Municipal Assembly resident in each of these districts constituted the "local board" of the district. All petitions for local improvements were and are now presented to the borough president, who is a member of all the local boards in his borough and who calls the proper board together to consider the matter, the department which would have charge of the improvement having, at the president's request, submitted a report with a detailed estimate of cost. These local boards have power only to recommend important improvements to the Board of Public Improvements, though they can direct the flagging of sidewalks, fencing vacant lots, and a few other unimportant things, but even in such cases the Board of Public Improvements must approve of their order before any work can be done.

The Board of Public Improvements consists of a president, appointed by the mayor, the corporation counsel, the comptroller, the commissioners of the departments of water supply, highways, sewers, bridges, street cleaning and of public buildings, lighting and supplies, together with the five borough presidents, none of whom, however, has a vote, except upon matters relating to his own borough. All surface improvements of streets after being authorized by this board must receive the approval of both branches of the Municipal Assembly before any contract can be made.

Each of the departments is presided over by a commissioner, and while there are deputy commissioners in each borough, these deputies have little, if any, power, so that notwithstanding the elaborate machinery and the apparent desire of the framers of the charter to provide a certain measure of borough home rule, the result has only been to furnish a large amount of red tape, resulting in delays which have greatly exasperated the people who wanted improvements and were willing to pay for them, while their own borough officers were unable to help them.

In response to demands for a change in the law a charter revision commission was appointed by the Governor in 1900, and their recommendations were, in 1901, enacted into a law which will take effect at the beginning of the next year. It is confidently expected that the revised charter will furnish a fair degree of borough autonomy. The borough presidents, instead of useless ornaments, will become officers of great power and responsibility, as they will combine many of the executive duties of the former mayors with the administrative functions of the usual commissioners of public works. While a borough president may appoint commissioners or superintendents having charge of highways, sewers, public buildings and supplies, and of a department of buildings, such appointees act only in his name and can be removed at pleasure, thus enabling him to keep absolute control of the work. He will also be a member of the board of estimate and apportionment, and a member of the Board of Aldermen, with a vote. The number of local improvement districts is increased to 25, and instead of being designated by numbers, old local names are revived to describe them. The Board of Public Improvements is abolished, and most of its functions devolve upon the Board of Estimate and Apportionment. This board is to consist of the mayor, comptroller, president of the Board of Aldermen and the five borough presidents, all of whom are elected by the people. The three first named, elected by the city at large, have three votes each, the presidents of the boroughs of Manhattan and Brooklyn two votes each, and the presidents of the smaller boroughs one vote each, a total of 16 votes, of which the three officers representing the whole city have a majority. The departments of water supply, bridges, street cleaning, parks, police and fire remain highly centralized as before. It is confidently expected that the changes outlined above will be of great benefit to the different boroughs.

The revised charter deals with the question of the authorizing of bond issues by the Board of Aldermen in a radical and effective manner. Much delay and no little scandal has been caused by the failure of the Municipal Assembly to authorize bond issues, such authorization requiring the affirmative vote of three-fourths of the members elected to each house. The revised charter provides that when a bond issue shall have been authorized by the Board of Estimate and Apportionment a copy of such resolution shall be sent to the Board of Aldermen, which board shall appoint a day not less than one nor more than two weeks later for its consideration. They may adjourn such consideration from time to time, but must take a final vote within six weeks of the receipt of the resolution. If a majority of all the members shall vote against it, the bond issue shall be rejected, but if a majority shall not vote against it within the six weeks allowed, the bond issue shall be considered approved. This gives no opportunity for a member to kill a bond issue without going on record, by the simple expedient of absenting himself from meetings.

The Talla Aqueduct of the Edinburgh and District Water-Works has developed slight defects in a portion about 400 feet long. The trouble occurred in a tunnel section built about two years, and consists of cracks running diagonally from the bottom up the side of the masonry lining, accompanied by an inward bulging of the bottom of the wall on one side. According to "Engineering," the trouble is ascribed to the delay in putting in the invert when the remainder of the work was done, thereby allowing the water to collect and flow in the unprotected bottom.

A Permanent Water Rheostat is one of the features of the Neptune Bank power station, near Newcastle-on-Tyne, the cooling pond and sprinklers for which were mentioned in the issue of September 28. It consists of a brick-lined pit near the engine house, filled with water, and a wooden staging above the pit with three pulleys, over which pass ropes carrying three plates placed at equal distances apart. These can be raised and lowered by windlasses and can be connected by overhead cables to terminals on the switchboard gallery. For 5,500 volts, according to "The Engineer," plain water is used; for 440 to 550 volts, acid is added.

Building Construction under the Tarsney Act and Suggestions for Modifying It.

A paper read before the American Institute of Architects by Mr. Wm. A. Boring.

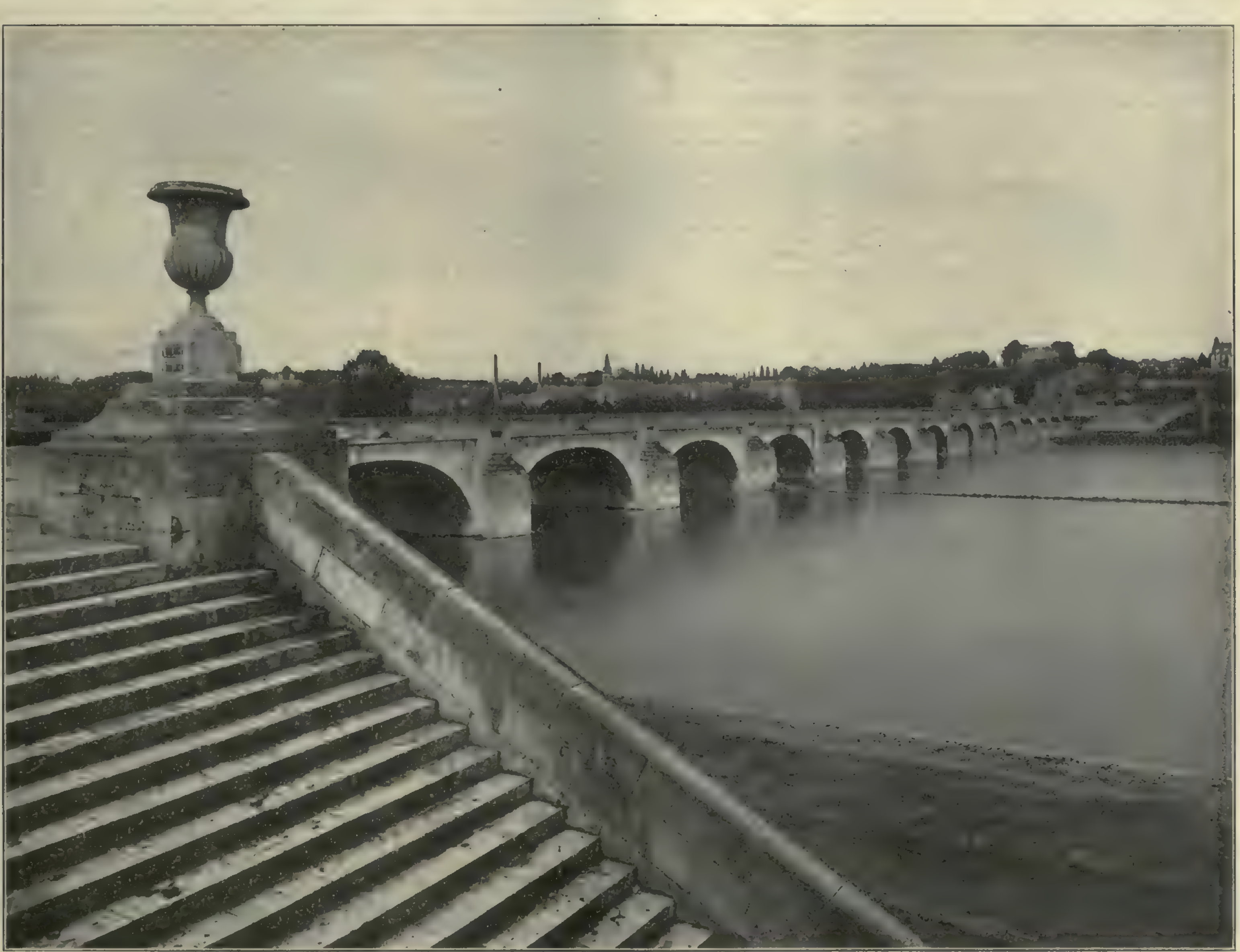
The object of this paper is to present briefly the practical workings of the Tarsney act in building construction, and to offer a few suggestions for its improvement. But, first, I wish to state that no criticism is intended upon the acts nor the attitude of the present officers of the Government, under whom the act has first been made operative. They have shown the greatest courtesy to our profession, and have spared no pains to give the system a fair trial, and it is very fortunate that the act has been put in operation and the first building constructed during the administration of the gentlemen now in office.

This discussion is limited to an exposition of the actual workings of the statute, based upon personal experience. Broadly speaking, the Tarsney act is eminently successful, and if incapable builders could be eliminated, there would be no reason for criticism.

The practical application of the act ensures the best work of a well-trained practitioner for every building of importance, from its inception to its finish, while it still remains under the control of the Government in every detail. The Secretary of the Treasury is the executive officer who is responsible for the operation of the act in question. He determines the regulations under which the work shall be done according to the statute. He holds the architect responsible for a completed building of superior design and good construction, and since he must pass upon all business involving the expenditure of money, he has the right to abrogate the contract with an architect at any time for cause.

The act also provides for a superintendent of construction to be constantly at the building during building operations, in addition to the special inspectors for the various trades which the Government properly maintains for all works being executed under contract. The business of the superintendent of construction is limited to the keeping of complete record of results, but he has no authority to direct the work in any way. He is selected by the architect from a list of six men furnished by the Government. It was apparently designed to provide the correct relation between the superintendent of construction and his superior, who would then be the architect. It does not, however, insure this result, since the men are appointed from continuous positions in the Government service; that is, they are really only transferred.

The architect not having any definite knowledge of the candidates' ability, seeks the advice of the Government officials, and endeavors by that procedure to appoint the best man. The superintendent of construction is, therefore, indirectly an appointee of the Government and not of the architect. The latter cannot discharge him for non-performance of duty. He can prefer charges and cause a removal, but even this may only effect a transfer of the superintendent to another position, and he has, therefore, no reason to be loyal to the architect. In fact, he, as a Government official, looks with jealousy upon the architect, as somewhat of an intruder upon his province, and if he does not act as a subordinate, and work in the interest of his superior, the architect, but makes



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XXXIX, TOURS, STONE BRIDGE.

A pleasing structure, refined in design and satisfactory in mass. The flat elliptical arches give an unpleasant sense of weakness. Built in 1765-77 from the plans of Bayeux official reports to the appointing power above his immediate superior, he is necessarily in a position to warp facts, make half-true reports, and in general make much mischief, even though not always intentional. The Government does not hold the superintendent of construction responsible, but holds the architect; and the superintendent does not hold himself responsible to the architect, so that he really has no responsibility except to keep the records exact.

The total result of all this is that the business of the superintendent of construction serves only as a check upon the operations. He reports to the department independently, and does not direct the work, or even stop it when it is proceeding wrong.

The position taken by the Secretary is that the architect is in charge of the building, and is wholly responsible, whereas, actually, the architect is in charge only in a negative way. He is not in a position to enforce the carrying out of the contract in the manner and with the authority given him in private practice. He can only recommend, and the action must come from the secretary.

The Government is disposed to deal fairly and honorably with all men, and while the men who attend to official business in detail must look upon all affairs of the Government from a strictly technical point of view, the heads of departments are inclined to take a liberal view of controversies, preferring to waive small points of vantage in order to do injustice to no one and to preserve the Government's good name. The supervising architect's office has had a wide experience in handling controversies relating to building construction and in taking care of emergencies which usually arise, and the officers understand the grievances which come before the architect. They are actuated by a spirit of fairness which does much to keep the architect inspired to get good work out of poor contractors.

The architect prepares designs for a building, and in his imagination there exists a beautiful well-finished structure. He writes the specifications describing the construction, which to him represents perfection in solidity, form, texture and finish, and describes in unmistakable terms his ideal. The builder who puts in the lowest bid reads this specification and checks it off line for line to discover how he can build to come just under the exact wording of the specification and yet omit the necessary expense incident to carrying it out in the spirit in which it was conceived, and submits a proposal accordingly. The Government, in accordance with the law, which is really mandatory, lets to the lowest bidder, not to the best bidder. Bidders for Government work usually base their figures upon the execution of such work as will pass inspection and be accepted, and not upon the character of work which is ideal. Perfect drawings, specifications and documents cannot ensure a perfect building. An incompetent builder cannot, and a dishonest builder will not, do good work, even with excellent supervision and first-class documents. The chief difficulty in obtaining a good building is the system which accepts the lowest bid, regardless of the contractor's training or ability, or his reputation for doing good work, the only provision being that he must be able to give suitable security and show a financial responsibility.

If we start with the proposition that the building is to be a first-class construction, only the highest type of contractors should be permitted to bid. It is well known that an incompetent builder or a dishonest builder will not produce, and cannot by any means produce, a proper building, and it is also known that all drawings and specifications of good architects call for good construction, so that the real responsibility for bad construction lies with the builder. The trouble is not with the documents, it is not with the superintendent; it is with the builder.

The question is where is the system weak touching this view of the case, and how can it be strengthened?

I think I can safely say that there is no architect who would be awarded the commission of a public building who would not be willing to change and modify and perfect his plans to almost any extent, were criticism made on them by the Secretary of the Treasury or the supervising architect. He would endeavor by all means to please and to produce the very best that was in his power. The builder, however, does not assume this attitude.

The faults in plans and specifications that are found in a building are very rare. The real difficulties in the construction of a building are: 1. The incompetency of the builder and his organization. 2. The attempts by the builder to vary from the specifications by supplying work or materials which are less expensive and give greater profit to him.

If it were a fact that the plans and specifications were really to be followed out to the letter, first-class builders could do the work cheaper than the men who bid below them, and the incompetent and dishonest men would soon be driven to the wall.

Under the system of the lowest bidder, when work is improperly done the proper procedure is to take the work away from the unreliable builder and award it to a better one at a higher price, taking the difference in price from the bondsmen of the first builder, and nothing short of this will cure the evil, but the Government is loath to do this. Work poorly done can never be made quite right, and delays are too expensive to allow of tearing out and replacing the work improperly done. There is no way provided by the act for the architect to absolutely stop improper work. It may be ordered stopped, but the builder can proceed with it. The architect has not material power to stop him. The monthly payments cannot be stopped by the architect under the present rule simply because imperfect work is being done. It is useless to order the work stopped when monthly payments are made by the department regardless of improper work being done. The superintendent of construction furnished by the Government is not effective in this regard. His instructions are, and his duties are, to keep a record of events, but he is not held responsible for the execution of the work.

Payments are made regardless of the fact that defective work is being done, the Government holding that a monthly payment must be made for all work satisfactorily executed, no matter how great an amount of improper work has been done; the only provision being that the improper work is not paid for. The position taken by the Government is that when a contractor is notified in writing that unsatisfactory work is being done and is rejected, he can then be permitted to proceed, but at his own risk. The final settlement is supposed to inflict punishment on him in the shape of deduction from the contract price for the loss to the Government sustained in having defective work done on the building. The contractor can do work in any amount which is not right if he takes the risk of deductions on account of this, and he can demand a monthly payment on any and all work done in connection therewith which is according to the contract.

I have known of a contractor telling a Government superintendent that he would do certain work his own way; that he would not be stopped by the superintendent, and that the Government could only deduct a reasonable amount from his contract for the variation.

The fault lies not in a want of harmony between the department and the architect, but because the architect has not complete control over work which is being done by men who are constantly trying to evade the contract. The architect should have the power to stop payments, to stop the bad work, and to replace it with work in accordance with the contract.

A suggestion has been made to try the experiment of purchasing the plans and specifications from the designing architect, and to have the superintendence of the construction done by the usual method employed in the supervising architect's office, but this would not remedy the evil. The class of buildings which the Tarsney act has embraced are generally of a monumental character, and require the careful assistance of the office in which they are designed, during construction. All sorts of constructive diagrams and interpretations and modifications are required as the work proceeds, and these can properly be made only under the same guidance as was the original design. I consider the class of superintendents employed continuously by the department incapable of carrying on the construction of a building according to a set of plans and specifications made by a private practitioner, without the guidance throughout the operation of that private practitioner

When an important building is to be erected at a distance, it is not an uncommon thing for the Government to appoint as the superintendent of construction a practicing architect in the vicinity of the place where the building is to be built, it being evidently recognized that an architect of reputation will be a safer man to entrust with the work than an inspector or a superintendent who is a non-professional and who is usually a person rising from the ranks of skilled mechanics. An architect appreciates architectural qualities which entirely escape a superintendent, and is capable of dealing with structural emergencies and the various difficulties and controversies which arise in the construction of a building in an effective manner.

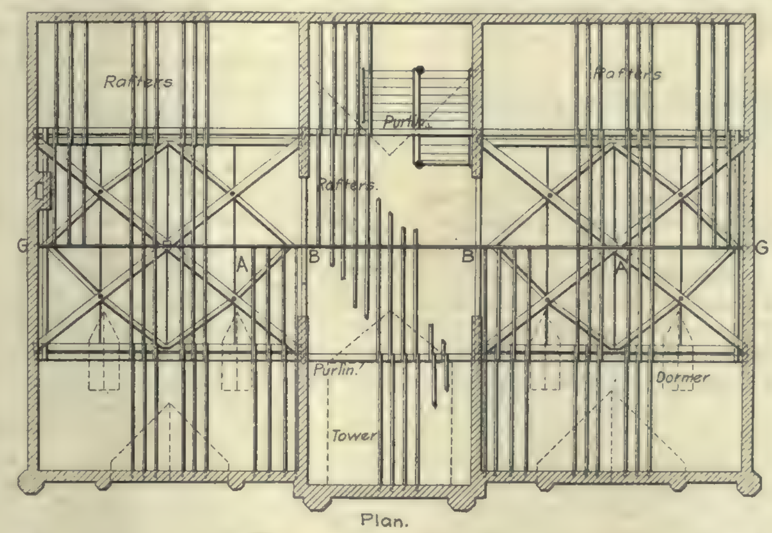
The supervising architect, if he should take the responsibility of executing the design, would have to refer all questions of construction and controversy to the different departments under his charge. His office not being intimately acquainted with all of the details, even with the best intentions, would have to make adjustments without having all the information bearing on the subject, and I consider that the design would suffer seriously in execution, and that the value of the Tarsney act would thus be greatly diminished. In cases or extreme difficulty the architect would probably be called in conference. He would then be in the impossible position of censor upon the Government's conduct of the work.

The idea of the Government purchasing designs grew out of the laudable efforts to harmonize the disturbing elements now existing in executing the work after designs were perfected, but it does not appear to me practicable nor right. Now, the prime object of an architect is to secure a perfect building, and this cannot be done by carrying on the business with only negative powers. To secure a perfect building is of more importance than to conduct the business in a way to give the least trouble to those in charge. An architect cannot be held for the act of a contractor, nor can he be responsible for improper work done by a contractor who is not endorsed by him nor selected by a method known to effect a proper selection. He is not expected to discover fraud. He is to give responsible supervision, but cannot be held to obtain from an oversharp and conscienceless contractor a perfect piece of work.

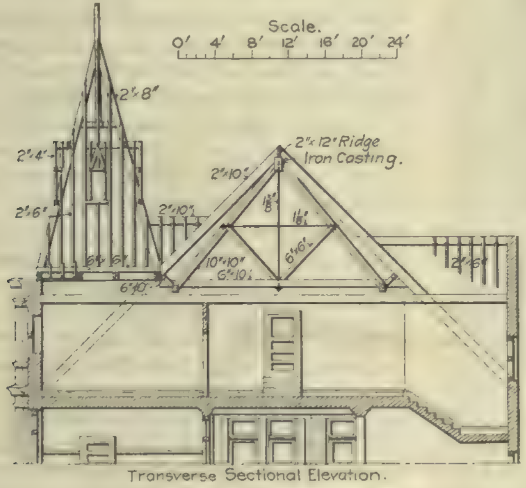
It is useless to talk about the responsibility of a man because he signs a contract and executes a bond. A contract and a bond are one thing, and a first-class, well-finished building is quite a different thing. The best buildings are built where no bonds are given, and I might say that the best buildings are built by men who require the least watching. There would be no difficulty in getting a good building were all contractors sincerely trying to carry out the contract properly.

The Government desires to pay equal value for everything it gets in a building. It should pay good and proper prices for the building, and should get nothing but first-class work. This can be accomplished by letting only men who are competent to carry it out attempt the contract, and by giving the architect in charge proper power to enforce these men to do what their contract requires.

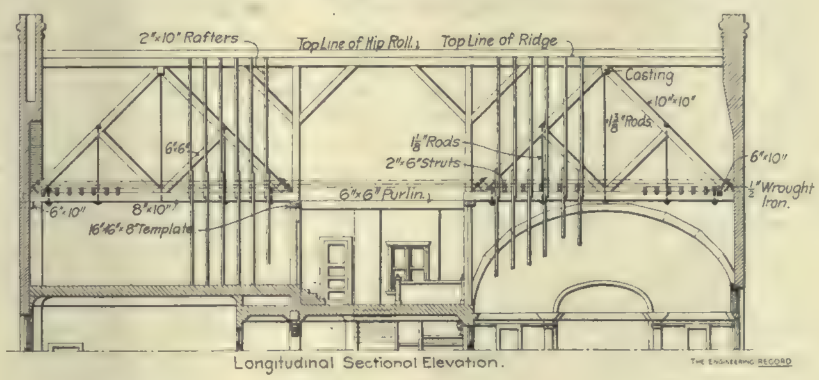
Government contracts are based upon the provision that should the work not be properly done, an eight-day notice will be served upon the contractor, and at the end of the expiration of eight days, should the work not be carried on in proper manner, the Government will proceed to take entire charge of the work, take possession of material, tools, etc., and complete the work at the expense of the contractor and his bondsmen. After the expiration of the eight-day notice, the contractor having refused to proceed, the building must be duly taken control of by the Government, new plans and specifications covering the uncompleted part of the contract must be in a general way arranged, together with a statement of what work has been done; it must then be advertised for a certain length of time, a contract let, and a new organization put in possession. It is such an expensive and destructive proposition that it is seldom resorted to by the Government.



Plan.



Transverse Sectional Elevation.



Longitudinal Sectional Elevation.

ROOF TRUSS DETAILS IN THE EAST ORANGE TOWN HALL.

This process is too long and the penalty too great for a small variation from the contract. It is unwise and ineffective to serve an eight-day notice for a large building upon the contractor when some minor part is defective, and yet this minor part may be a defect. A lighter sentence with a quick and effective method of carrying it out would be much more effective, and would place the responsibility with the architect in charge.

The party in power on a building must have the authority to take the initiative at certain times, and the contractors under his charge must be made to feel from the beginning that he has the power and will exercise it whenever it is necessary. It might be better to give the architect power to proceed with a portion of the work by the day or by private contract, and deduct the expenses incurred from the next payment due to the contractor.

There must be some means of co-operation between the Supervising Architect's Office and the architect in charge to enforce the compliance with the contract and specification.

In conclusion, I wish to state what appear to be the faults of the system, and to suggest modifications that will secure for the Government all the advantages of regular professional services, together with that security and thoroughness which the Supervising Architect's Office affords.

The usual practice of awarding contracts to lowest bidder is not likely to be changed, and these suggestions are made on the basis of present conditions:

1st. There is a division of responsibility in having the architect supervise and the Government representative superintend the work.

I suggest that the architect be given full power; that he employ his own superintendent, who shall be responsible to him; that the Government pay the usual fee for full service; that the Government's representative be an inspector to report to the Supervising Architect, and that he send simultaneously a copy of reports to the architect.

2d. The architect has not power to withhold payment to enforce the contractor to comply with the terms of the contract.

I suggest that monthly payments be under control of architect. That he have discretion to decline payment until existing defects are corrected, and in case of slow progress of work that proper force and materials be provided to his satisfaction before he be required to grant certificate.

3d. The architect has not the control of funds to correct defects at cost of contractor.

I suggest that a sum equal to the ten per cent. retained on all payments be held subject to the joint order of the architect and the Government inspector, which shall be available on short notice to correct defects in construction or to push work which may be behind time, and the amount so expended be deducted from the money due the contractor.

With these modifications I believe that the business of construction of buildings under the Tarsney act will offer no serious difficulty, and that the architects can secure for the Government structures of that high standard that are properly expected by the Secretary of the Treasury.

The East Orange Town Hall Roof.

The East Orange town hall is about 79 x 52 feet outside dimensions, and has a steeply-pitched slate roof, with its ridge in the longitudinal axis of the building, extending from gable to gable. The top of the ridge is 27 feet above the third floor, to the level of which the main rafters slope. Running across each end of the building there is, in the third story, a transverse hall 30 feet wide and 50 feet long in the clear. One of these halls has a vaulted ceiling, with its axis transverse to that of the building, and at the intersection of these two axes is the center of a pyramidal truss which affords intermediate supports to the rafters. The rectangular base of the pyramid is about 30 x 17 feet, and its corners rest on the gable walls and on a transverse partition wall whose center opening of 15½ feet is spanned by it.

Each side of the pyramid is a triangular combination truss in a plane inclined to the vertical, and having its apex in the peak of the roof. Two of the trusses have their parallel horizontal lower chords transverse to the axis of the hall and about 17 feet apart. They are just above the ceiling, and divide the plan into three nearly equal panels, thus diminishing the clear span of the rafters, which are supported from the ridge-pole, the side walls, and intermediately from the lower chords of the pyramid trusses. The ridge-pole is supported on the gable walls and on the tops of the pyramids, and by vertical posts in the planes of the transverse walls. These vertical posts also have corbel braces, so that there are in all eight intermediate supports to the ridge-pole. The rafters are suspended from the ridge-pole and purlin, so that they transmit no horizontal thrust to the side walls which carry their lower ends.

Narrow horizontal wooden beams, 12 inches apart, are supported on the side walls and on the lower chords of the trusses, and to them are nailed vertical strips suspending the wooden frames for the ceiling arch. The roof is supported in the same way by a duplicate pyramidal truss at the other end of the building, but there the ceiling of the hall below is flat instead of arched.

Near the middle of each rafter one purlin is supported from the lower chords of the longitudinal trusses, and spans the middle hall between the pyramids. This arrangement reduces the unsupported lengths of the rafters from 34 to 17 feet. Comparative designs and estimates indicated that this system of pyramidal trusses and numerous long light rafters, with center supports, was as economical as any method which would provide a clear roof span of 50 feet over the whole building. It was easily built, required no special materials, or difficult work in framing or erection, and has proved rigid. The architects were Messrs. Boring & Tilton, New York.

Wooden Pavements at Home and Abroad.

Extracts from a paper by F. A. Kummer before the American Society of Municipal Improvements.

In this country wooden paving has had three distinct phases. The first step was an improvement on the corduroy road. It converted a mudhole into a passable way. The round or hexagonal blocks were not treated, consequently they rotted. They were one-third sap wood, consequently they rounded quickly on the edges. They were highly unsanitary because they absorbed street filth. They sank into ruts and holes because they had no foundation; but they were cheap; they eliminated the mud hole, and in that way served a good purpose.

It occurred to some enterprising genius to improve this pavement by squaring the blocks and dipping them in tar. This form of pavement, generally known as the Nicholson block, was extensively laid in many cities to their great and lasting sorrow. Why anyone should have anticipated success with such a pavement is almost incomprehensible. In the first place, little or no care was taken in the selection of the timber; hard and soft, heart wood and sap, seasoned and unseasoned, all woods looked alike to the promoters of the pavement. A dipping in hot coal tar or pitch served to cover up the defects, and incidentally to seal up within the wood the moisture due to lack of seasoning, thus hastening dry or heart rot as much as possible. The introduction of laths between the blocks served to make large joints, and thereby to admit as much water as possible under the pavement. Sometimes the pavements rolled in billows like the sea. At this stage they were generally thrown away. The use of untreated planks on earth as a foundation was ingenious in its insufficiency. That part of the pavement that was not heaved up by the frost, went down by the rotting of the planks.

As a third phase, creosoted wooden blocks on a proper concrete foundation have begun to be laid in a few places throughout the country. This is really a wooden pavement. The other was wood, but it was not a pavement. A block of well-selected heart pine, preferably the long leaf or Georgia pine, creosoted with not less than 10 pounds of dead oil to the cubic foot, and laid on concrete with a thin sand cushion, if any, and water-tight joints, will make a good and durable pavement, not slippery, not in the least noisy, sanitary because of its antiseptic treatment, durable, easy for horses and pleasant to drive over. It has been largely and very satisfactorily used in several Western and Southern cities, notably Indianapolis, Terre Haute, Galveston and New Orleans. In Indianapolis the experience of six years' service has been highly satisfactory, the pavement showing increased popularity over all other forms of roadway. Over 50,000 yards have been contracted for there this year alone.

Briefly, this constitutes about the history of the three stages of wooden pavements in this country. The pavements recently laid in Boston and other points in the East constitute, in the writer's opinion, the beginning of a fourth stage, which will revive the interest in wooden pavements to such an extent that they will rapidly take the prominent place which they deserve in the estimation of the tax-payers, as well as of the city officials.

The history of wooden pavements abroad is a long one, and within the limits of this paper can only be briefly treated. The two most important cities abroad being London and Paris, perhaps we may as well confine ourselves to those points, although many other cities in England and on the Continent, as well as in Australia, use wood in large quantities. In Germany, however, wood is not so popular as elsewhere on the Continent. In Paris the wooden blocks are all manufactured and laid by the city authorities, the various plants having a capacity of 47,000 blocks per day, or about 1,000 square yards. These blocks are of two depths, 15 centimeters or about 6 inches for the softer varieties of wood, and 10 centimeters or about 4 inches for the harder woods. The amount of wooden paving in that city is somewhat over one and one-half million square yards. The woods used have about the following relative wear: 1, teak; 2, karri; 3, pitch pine; 4, native pines. The last are generally used.

The traffic on the principal streets is enormous. On the Rue de Rivoli, it is over 65,000 teams per day, or 3,400 per yard of width, and over 66,000 teams per day on the Avenue de la Opera, or about 2,000 per yard of width. Fifth Avenue, as counted for the Barber Asphalt Company some few years ago, showed 8,400 teams per day, and Madison Avenue 7,000, about one-eighth of the Paris traffic. Under this traffic the native woods wear on the average 1 centimeter or 0.4 inch per year, and are allowed to wear down until 10 centimeters of the total depth of 15 centimeters have been worn off. They are then removed. This gives under the heaviest traffic in the world, with inferior woods, a life of ten years. The horses are not allowed to have calks on their shoes, which probably makes the wear a little less severe than in this country, but this is counterbalanced many times by the enormously greater volume of the traffic. On the other hand, the absence of the calks proves that the pavements are not slippery, an argument which is sometimes advanced against wood pavement.

It may possibly be said that the wear above noted per year is considerable, although taken in connection with the volume of traffic this is not so. In Paris it is found that the rate of wear under the heaviest traffic, for wood, namely 1 centimeter per year, is exactly the same as the rate of wear for granite throughout the entire city.

In constructing the streets in Paris, the concrete is brought to a true surface by floating it with a grout composed of Portland cement and fine sand. No sand cushion is used. The blocks are laid directly on the smooth concrete surface, and are laid perpendicular to the line of the curb. Laths, afterwards removed, are introduced between the blocks, making a joint of about ⅜ inch, which is grouted with sand and Portland cement. About twelve days suffice to complete any particular portion of a street, from the date of closing it to the date of opening it again to traffic.

Owing to the fact that soft woods are generally used in Paris, the surface of the wood is to some extent spongy, and the practice of spreading a thin layer of sand and fine gravel over the streets every few days is followed, the gravel being crushed and ground into the fiber of the wood, giving the roadway a sandy surface. This, of course, reduces the slipperiness of the pavement. In London, however, this is not frequently done.

Labor employed by the Paris city authorities costs from 80 to 90 cents per day, and the completed pavements cost for wood about $3.10, for granite about $3.40, and for asphalt about $3.12.

A large proportion of the woods used in Paris are treated, creosote being generally employed, but a large quantity of the preservative is not used, generally from eight to ten pounds per cubic foot.

In London there was laid from 1874 to 1884 about one million square yards of wood. There is now about four times as much in that city. The earlier pavements were untreated wood, generally Swedish deal, a wood of fairly good quality. Later it was "pickled," as they call it, by dipping in hot creosote oil after thorough seasoning. About ten years ago the Australian woods, karri and jarrah came into favor, but are not now generally regarded as being so satisfactory as creosoted deal, and pavements laid with them are being taken up and replaced with creosoted Swedish deal. Most of the pavements now being laid consist of Swedish deal on concrete, either creosoted under pressure, or dipped, although untreated wood is used in some sections. The Swedish deal used in London weighs from 3,500 to 3,600 pounds per thousand feet B. M., while our best long-leaf Georgia pine weighs about 900 or 1,000 pounds more per thousand feet, or 4,500 pounds per thousand feet. It is therefore a much harder and more durable wood, having a crushing resistance along the line of the grain greater than that of oak.

Wood on concrete has been used for paving in London for some 27 years, its use having been begun about 1874, although the first London wooden pavements were laid in 1839. The average life, of course, depends upon the nature and volume of the traffic. In the Kensington District, where they use principally creosoted Swedish yellow deal, the average life of the pavement throughout the district is shown by the following extract from the forty-fourth annual report of the Surveyor of the Parish of St. Mary Abbotts, Kensington, for 1900:

"Kensington High Street was paved with dipped blocks laid by the Improved Wood Paving Company in November, 1891, under their maintenance contract, which was then expiring. These dipped blocks had, therefore, lasted a little under eight years. The wood creosoted under pressure had lasted in the other roads about twelve years, with the exception of the section of Kensington Road marked (c), which had been down nine and one-half years. The wood was not worn out, but it had been very much cut up and damaged by the operation of the National Telephone Company, and as the consequent reparation would have involved the making good of a considerable proportion of the entire area, it was deemed advisable to repave the whole surface and thus prevent the necessity of twice interfering with the traffic on this important road."

It should always be borne in mind that figures for wear are entirely relative. The traffic over the streets in London is very heavy, far heavier than on the streets of any of our largest cities, and the constant and very heavy omnibus traffic is particularly damaging to the pavements. Therefore, the same class of street pavement in this country would, beyond question, have a much longer life. If further, we can lay a class of timber much harder and better able to resist wear than the Swedish deal, and add to this a treatment that will make the wood still harder and completely waterproof, we should, under lighter traffic, at least succeed in obtaining double the life obtained on the heavily traveled streets of London or, say, twenty-four years.

A section of long-leaf Georgia pine, known abroad as pitch pine, 756 square yards in area, was laid with cement joints on King's Road, London, some years ago. On the same road were laid sections of plain and creosoted deal, about the same time. The annual wear in the case of the plain deal averaged in depth during five years 0.139 inch, as against 0.055 of an inch for the pitch (Georgia) pine, or about two and one-half times as great. In the case of the cresoted deal on the same street, the average depth of wear was 0.111 or about twice that of the pitch pine. The results of the trial of pitch pine, as summarized in a paper read before the Institute of Civil Engineers in 1883, were to the effect that "practically the plain pitch pine pavement is cheaper than yellow deal, and the ascertained vertical wear promises admirable results." The use of yellow pine, however, in London, in spite of this opinion, has not extended because of the great cost of the best qualities of lumber delivered there.

The dimensions of the blocks used in London are almost invariably 3 x 9 inches on the wearing surface, and 4 to 5 inches in depth. The blocks are often worn in some places to little more than an inch in depth before being removed. Such excessive wear would only be secured in the case of pitch pine, in a period approximately two and one-half times as great as that required for equal wear with the Swedish deal.

With regard to a guarantee for maintenance, the conditions of contract vary in every district. In some districts the authorities employ their own labor, and in such cases the timber merchant simply supplies the blocks under the inspection of the surveyor of the district, and their liability ends with the delivery of the blocks. In other districts where the work is contracted for in its entirety, the contractor has to supply and lay the wood paving to the satisfaction of the surveyor, and his liability ends as soon as the work is completed. In other districts the practice is for the contractor to keep the roadway in perfect condition for a given period, varying from six months to three or more years, either free or at a price per year included in the original bid. Prices thus vary considerably. Throughout the district of Kensington, 43,476 square yards of pavement, laid during the year ending March, 1900, all creosoted deal, part 4 and part 5 inches in depth, cost an average price of about $2.25 per square yard. This embraces no cost for maintenance.

With reference to creosoted blocks, the report of Mr. Weaver, Surveyor, Kensington District, quoted above, says: "The superiority of creosoted blocks over plain wood is demonstrated by the fact that creosoted 5-inch blocks in High Street, Notting Hill, and Fulham Road, lasted twelve years, whereas the previous paving, consisting of 6-inch plain deal blocks, lasted less than nine years under much lighter traffic."

The renewals are made necessary generally by the traffic at the principal points of stoppage, for omnibuses for instance, where the continuous heavy pounding of the horses when starting necessarily wears the pavement away at that one spot more rapidly than at other parts of the street.

Wooden pavements abroad are often sprinkled with sand, as before mentioned, to reduce the tendency to slip. Soft wood blocks, especially those creosoted, have a rather slimy surface, making them probably more slippery when wet than harder blocks having a surface unaffected by moisture. Also there are no calks on the horses' shoes, which renders such sprinkling more necessary. It is an advantage that wood pavements may be so sprinkled and slipping thereby reduced. Asphalt, more slippery than wood in the start, cannot be so sprinkled without injury to its surface.

It has been claimed, against the use of wooden blocks, particularly when untreated, that some of the blocks are softer than others and more porous, and consequently will wear more quickly; but this is remedied by the treatment of the block, especially where the mixture of creosote and rosin, called the creo-resinate process, is adopted, owing to the fact that the softer and more porous blocks take up just that much more of the preservative and hardening mixture, and are therefore all brought to the same degree of resistance. At the same time, where only heart wood is used, with no sap whatever, the difference in density of the wood is very small.

The following extracts from the specification of the city of Boston for laying pavements on several of their streets show the methods employed and the extreme care taken to secure as nearly as possible an absolutely perfect form of construction. These pavements are guaranteed for ten years.

"Creo-Resinate Wood Paving Block.—(1) All lumber is to be of long-leaf Georgia or Florida yellow pine, free from sap, loose or rotten knots or other defects which would be detrimental to the life of the wood. No second growth timber is to be used. (2) Blocks, except as otherwise ordered, are to be not less than 4 inches deep, 4 inches wide and 8 inches long, uniform in depth, width and length, with grain vertical. (3) Blocks are to be treated as follows: The blocks are to be placed in an air-tight cylinder, and when the doors are closed the dry heat is to be raised to 215 degrees Fahrenheit, without pressure, for one hour, for the purpose of getting rid of the moisture. Then the heat is to be increased, pressure is to be applied, and both are to be raised gradually to avoid injury to the fibre, for two hours, until the heat has reached about 285 degrees and the pressure about 90 pounds, and both are to be held there for one hour. The heat is then to be shut off and the tanks are to be allowed to cool gradually for one hour. At the end of this time, the heat is to be reduced to 250 degrees and the pressure to about 40 pounds. The pressure is then to be blown off and the heat still further reduced. Vacuum is then to be applied until about 26 inches is reached, and while under vacuum the creo-resinate mixture is to be run into the cylinders at a temperature of 175 to 200 degrees, and hydraulic pressure is to be applied, reaching 200 pounds per square inch, and kept at this point until 21 to 22 pounds of mixture per cubic foot has been absorbed. The liquid is then to be run off and the wood is to be placed in another cylinder, and milk of lime at a temperature of about 150 degrees is to be run in, and hydraulic pressure of about 200 pounds is to be applied for from one-half to one hour. (4) The blocks are to be laid close, on a cement concrete foundation six inches in depth, as hereinbefore provided, and at such an angle to the curb as directed by the superintendent on a 1-inch cushion of clean-screened sand, and are to be driven as tightly together as possible at every sixth row. (5) The joints are to be filled with dry-screened sand and the pavement rolled with a steam roller, weighing not less than five tons, until the blocks present a firm, uniform and unyielding surface. The joints are then to be filled with paving pitch, creo-resinate mixture heated to 300 degrees Fahrenheit, or Portland cement grout, as required. (6) The surface of the paving when completed is to be covered with ¼-inch deep dressing of clean-screened, sharp sand or crushed stone screenings."

Earlier in this paper the writer has referred to what he considers the ideal wooden pavement. In his opinion this should be about as follows: The concrete foundation—preferably, although not necessarily, of Portland cement—need not be included, as that or its equivalent is a necessity for all permanent pavements. Suffice it to say that its thickness should be in keeping with the traffic over the street and the nature of the sub-grade.

In constructing a perfect wooden pavement, two methods of treating the surface of the concrete may be adopted. It may either be covered with a very thin cushion of clean fine sand, not exceeding one inch in thickness, and thinner if the upper surface of the concrete will admit of it, or it may be floated with a grout of Portland cement and fine sand, mixed thick and brought to a true surface and grade by the use of a template, as in the case of a sand cushion. If the latter method is used, the blocks may either be set in the wet surface of the grout, and lightly tamped or rolled, or the grout may be allowed to harden and its surface be slushed with a coating of pitch or asphaltic cement, such as is often used in grouting joints with brick or granite block. Into this coating, while hot, the blocks should be set, and tamped or lightly rolled, as before. The blocks should be set as closely together as possible, both in the direction of the street and from curb to curb, and rammed tight every few courses. By laying the courses at an angle to the curb line, say thirty degrees, better results will be secured, as there is much less chance for the calks of horses' shoes to round off the edges of the blocks. After being laid the joints should be partially filled with very fine, clean sand, and the pavement rolled. A much heavier roller may be used with advantage where a sand cushion is used. The Boston pavements above referred to were mostly rolled with a 15-ton roller, and no damage whatever was done to the blocks. With bricks this would not have been the case. After rolling the joints should be fully filled with pitch or a good asphaltic cement, composed about as follows, and used at a temperature of 300 degrees Fahr.: 20 parts refined asphalt, 3 parts residuum oil and 100 parts coal tar, generally known at the works as No. 4. Such a grout should be poured over the entire surface of the street and be swept into the joints with a wire broom. The surface of the street, after grouting, should be spread with a coating of fine, sharp sand, making a practically perfect roadway.

As regards the character of the wood to be laid, much may be said. Softer pines, comparable to the deals used abroad, creosoted, will make a good and durable pavement, and the company manufacturing the creo-resinate block also manufactures ordinary creosoted block. But for the maximum of durability the heart long-leaf Georgia pine is the wood of all others. Such wood may be thoroughly creosoted, and under these conditions will not rot. But two points must be considered. Creosoting alone has a tendency to soften the fiber of wood, and its surface becomes spongy. It also, while not soluble in water, may be washed out by the action of water, and some of its constituent parts being volatile, may evaporate. The problem is, therefore, to retain the creosote oil absolutely in the wood, and to so harden the fibers of the wood and fill up its pores that it may become both waterproof and at the same time have an even greater resistance to wear. This may be successfully done by incorporating with the creosote oil used about 50 per cent. of melted rosin, the two forming a perfect mixture when hot, and forcing this compound into the timber under pressure until from 20 to 22 pounds per cubic foot has been driven in. Timber so treated weighs about 5,500 pounds per thousand feet board measure. Untreated pine of the same quality weighs 4,500 pounds; Swedish deal, as used abroad, 3,600 pounds. The blocks so treated are called creo-resinate blocks by the company making them, the United States Wood Preserving Company of New York. There are other steps in the process adopted by this company which need not be mentioned here, as for instance, the complete sterilization of the timber by bringing all its parts up to a temperature of 212 degrees, thereby destroying germ life in the heart of the wood.

In the first piece of pavement laid in Boston, that on Tremont Street, under the continued action of the sun in very hot weather (there are no buildings on the side of Tremont Street next the Common and hence the pavement had no shade from noon until sunset) some of the creoresinate material exuded from the joints, and was spread on the surface of blocks. The pavement was consequently treated with a solution of lime and water, which hardened and solidified the rosin and prevented further trouble on this score. Subsequent streets laid were grouted with paving pitch or, as on Boylston Street, cement grout, and this trouble has not again presented itself.

The question of expansion joints is one which apparently has been given no attention in the above specifications. As a matter of fact, wood is such a poor conductor of heat that expansion to any extent does not occur from this cause. If the wood absorbed moisture, it might swell or be affected by the frost, but being practically waterproof, it is not so affected. Hence the lack of necessity for expansion joints. This has been proven during the past severe winter and summer by the section of pavement on Tremont Street.

The Buildings at the Louisiana Purchase Exposition.

The Louisiana Purchase Exposition in St. Louis in 1903 will be the first in which hills enter into the composition of the main exposition "picture." The natural topography of the site prompted this radical departure. This main picture is to be located entirely within Forest Park, the second largest public park in the United States. The use of the unfinished half of the park was granted to the exposition company by the city as an exposition site. This part contains a level tract of about 400 acres, which formerly supplied space for golf links and a race track. From this level the ground rises on a slope of about 60 degrees to an average height of 60 feet. The main exhibit buildings, the big towers, the lagoons, basins, canals and statuary groups, occupy the lower level. The Art Gallery and its by-buildings, the architectural chef d'oeuvre of the exposition, designed by Mr. Cass Gilbert, and the United States Government Building, designed by Mr. J. Knox Taylor, are to be built on the elevated tract. In the treatment of the intervening slope the commission of architects had scope for originality. The difference of elevation constituted the chief problem with which they had to contend. They solved it by means of hanging gardens and a series of cascades.

The main picture of the exposition is roughly in the shape of a gigantic fan, the ribs of which are the avenues of the exposition. At the apex of this composition stands the Art Building on an eminence. Three great cascades, that issue from the sides of three hills in the form of a crescent, are to course down the hillsides and empty into a large basin. The water effects of the picture, radiating from these three cascades, offer a mile of continuous water circuit. From the roughly semi-circular basin into which the cascades plunge, two streams in imitation of a natural river branch to right and left. As they traverse the avenues their banks assume a regular geometrical outline to their debouchure into the grand basin at its lower end. The beautifully wooded areas on the highest levels of Forest Park are to be occupied by the State and foreign buildings.

The main entrance to the exposition is to be on the side toward the city, where the exposition site abuts on the finished portion of the Forest Park. A monumental entrance design, the work of Chief Architect Isaac S. Taylor, will be located here, and two exhibit buildings immediately within this great portal will be crowned by towers 400 feet high, in order to form a part of the picture of the monumental entrance. The main residence street in St. Louis, Lindell Boulevard, will lead directly to the monumental portal.

The main exposition picture covers over two-thirds of a square mile. The avenue in which lies the Grand Basin is 600 feet wide. The other avenues are 300 feet wide. From the main entrance to the apex of the picture the distance is over three-fourths of a mile. The buildings are on the same large scale. Those in the main picture are:

Building.	Dimensions.	Architect.
Art Building	300 x 900	Cass Gilbert
With two pavilions, each	200 x 300	
Liberal Arts Building	600 x 550	Eames & Young
Manufactures and Liberal Arts Building	600 x 1,200	Carrere & Hastings
Electricity Building	600 x 550	Walker & Kimball
Mines and Metallurgy Building	600 x 1,200	Van Brunt & Howe
Education Building	550 x 750	Theo. C. Link
Social Economy Building	550 x 750	Barnett, Haynes & Barnett
Transportation Building	600 x 1,300	Widmann, Walsh & Boisselier
Government Building, with Fisheries Pavilion and Ordnance Pavilion	400 x 250	J. Knox Taylor

The Agricultural Building, the largest structure in America, 700 x 2,000 feet, to be designed by Chief Architect Taylor, will not be included in the main picture.

Another problem solved by the architects was in the composition of the Art Building. This is to be a fireproof permanent structure, and for that reason cannot be so ornate as the show buildings of staff which form the rest of the main picture. To eliminate a discordant note which might enter in the juxtaposition of a subdued building with the more ornate exhibit buildings, the summit of the hill whence the cascades issue will be crowned by an elaborate colonnade or peristyle, which will close the main picture and exclude from the grand view the more subdued main art galleries. The colonnade will be terminated at either end by the pavilions of the Art Building.

The Development and Defects of the American Patent System.

Extracts from a report by C. H. Duell, Commissioner of Patents.

The century just closed stands out pre-eminently as the century of invention. It is therefore a fitting time briefly to refer to the origin, establishment and development of our patent system, to call to mind the debt the United States owes to inventors, and at the same time to point out the advantages that have followed the far-seeing wisdom of the framers of the Federal Constitution in incorporating in that instrument Paragraph 8 of Section 8 of Article I. of the Constitution, which gave to Congress the power "To promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries."

One hundred years ago the population of the United States was less than six millions and there was not a single city within our borders having a population of 75,000. The population of New York, Philadelphia, Baltimore and Boston was less than the present population of Minneapolis. The latter city and its sister city of St. Paul, Chicago, Omaha and Kansas City were unknown. Not a steam-propelled vessel was in use, nor was there a mile of railroad in the United States. The electric telegraph and telephone were unknown. Our exports consisted of agricultural products. There was scarcely any well-developed line of manufacture and our wants in that line were supplied by imports. It had been the policy of England to suppress manufacturing in its colonies. In 1634 a law was passed in Virginia for the encouragement of textile manufactures, but it was promptly annulled by England. In 1731 she enacted a law prohibiting the carriage of woolen goods and hats from one colony to another. In 1750 a woolen-hat factory in Massachusetts was declared to be a nuisance and suppressed. No carpets were made in the colonies until after 1776, except rag carpets. In 1800 carpets were in this country a luxury. Even up to 1850 there was not a power-loom for carpet-making in the United States.

What is true in the textile art is equally true of most of the other arts. Though the country was an agricultural one, little progress had been made in the manufacture of agricultural implements. It was not until 1819 that an iron plow was produced in this country. The reaper appeared in 1833 and a successful thresher not until 1850. Up to the time of the civil war there is no question but that the country continued to be an agricultural one. It is true that during the first sixty years of the last century our manufactures steadily and rapidly increased in kind and in extent, but our population increased even more rapidly, so that we consumed what we manufactured and were still largely dependent upon the import of manufactured articles. But in the last few years a great reversal, not only in sentiment, but in conditions, has occurred; the commercial relations of the United States with the great trading nations of the world have rapidly changed, so that the excess of imports of manufactured articles has turned into an excess of exports of such articles.

One need not look far for the cause of this. It lies in the economy of manufacture arising from the use of labor-saving devices, mainly the invention of our own people, which has enabled us to compete in many lines of manufacture, notwithstanding the higher scale of wages paid in this country, with similar articles manufactured by any or all nations. To the patent system more than to any other cause are we indebted for the industrial revolution of the century.

President Washington realized the importance of formulating a law to stimulate inventions, and in his first annual message to Congress in 1790 said: "I cannot forbear intimating to you the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad as to the exertion of skill and genius in producing them at home."

Congress was quick to act, and on April 10, 1790, the first law upon the subject was enacted. It constituted the Secretary of State, the Secretary of War, and the Attorney-General a board to consider all applications for patents. Owing to the fires that have destroyed the early records of the Patent Office, some question has arisen as to the number of patents issued under this act; but from the best information obtainable I place the number at fifty-seven. The first patent issued was to Samuel Hopkins, July 31, 1790, for making pot and pearl ashes.

The act of 1793 superseded the act of 1790 and remained in force as amended from time to time until the act of 1836 was passed. The act of 1793 was the only act ever passed in this country which provided for the issuance of letters patent without the requirement of an examination into the novelty and utility of the invention for which the patent was sought.

The act of 1836, with modifications, remained in force until the revision of the patent laws in 1870. This revision was largely a consolidation of the statutes then in force. Under the revision of the statutes of the United States in 1874 the act of 1870 was repealed; but the revision substantially re-enacted the provisions of the act of 1870.

Under the acts of 1790 and 1793 letters patent were granted for a term of fourteen years. There was no provision for extension; but while the act of 1793 was in force Congress extended some thirteen patents.

The act of 1836 provided that letters patent should be granted for a term of fourteen years, and provision was made for an extension for a term of seven years upon due application and upon a proper showing. Until 1848 petitions for extensions were passed upon by a board consisting of the Secretary of State, the Commissioner of Patents and the Solicitor of the Treasury. After that time power was vested solely in the Commissioner of Patents.

The patent act of March 2, 1861 (section 16) provided that all patents thereafter granted should remain in force for a term of seventeen years from the date of issue, and the extension of such patents was prohibited.

The consolidated patent act of 1870, while providing that patents should be granted for a term of seventeen years, also provided that patents granted prior to March 2, 1861, might upon due application and a proper showing be extended by the Commissioner of Patents for a term of seven years from the expiration of the first term.

By the revision of the patent laws in 1874 the prohibition against the extension of patents was dropped, and since that time Congress has had the power to extend letters patent. Congress extended five patents granted under the act of 1836 and in nine instances authorized patentees to apply to the Commissioner of Patents for extension of their patents. So far as I have been able to discover, no patent granted for a term of seventeen years has been extended by Congress.

It was not until in 1842 that the statute was passed authorizing the grant of patents for designs. Under that act design patents were granted for seven years. Subsequently provisions were made for granting them for terms of three and one-half, seven and fourteen years, at the election of the applicant.

By the act of March 2, 1861, the Board of Examiners-in-Chief was established. Prior to that time and during the incumbency of Commissioner Holt, temporary boards of examiners to decide appeals had been appointed by him, and later on he created a permanent board of three examiners who were to decide on appeal rejected cases and submit their decisions to him for approval.

The act of 1870 made the first provisions for an Assistant Commissioner and an Examiner of Interferences. Another provision in that act was the power given the Commissioner, subject to the approval of the Secretary of the Interior, to establish regulations for the conduct of proceedings in the office.

On January 1, 1898, an act passed March 3, 1897, went into force. Some of the provisions of this act were that applications for patents should be completed and prepared for examination within one year after the filing of the application and that the applicant should prosecute the same within one year after an action thereon or it should be regarded as abandoned (prior to that time two years was the limit), that an inventor should be debarred from receiving a patent if his invention had been first patented by him or his legal representatives or assigns in a foreign country, provided the application for the foreign patent had been filed more than seven months prior to the filing of the application in this country, and that if the invention for which a patent was applied for had been patented or described in any printed publication in this or any foreign country for more than two years prior to the application a patent could not issue.

The growth of the Patent Office has kept pace with the remarkable growth of the United States during the last century. The records of the Treasury Department, Register's office, contain a report signed by Joseph Nourse, Register, which would indicate that no salaries were paid to employees of the Patent Office until 1803. It is impossible to determine whether they were paid directly by the inventors, by a system of percentage, allowed to retain a certain portion of the patent fees, or whether they were really employed in some other capacity and simply detailed to attend to the work of the Patent Office. In 1816 the personnel of the Patent Office consisted of a superintendent, a clerk and a messenger, receiving in salaries $1,772. The office force now numbers 679, and the salaries paid during the past year amounted to $761,691.60. While the expenses of the Patent Office have enormously increased, the receipts have more than kept pace with them. The receipts for the past year were upward of $1,350,000, with expenses of about $1,260,000. The receipts from 1836 to the present time have exceeded the disbursements by $5,177,458.55.

The first provision for affording accommodations for the Patent Office was in 1810, when Congress authorized the purchase of a building for the General Post Office and for the office of the Keeper of Patents. The building purchased was known as "Blodgett's Hotel" and stood on the site now occupied by the south front of the building until recently occupied by the Post Office Department and now used by several bureaus of the Interior Department. The east end of this building was used for the records, models, etc., of the Patent Office. This building was destroyed by fire December 13, 1836. On July 4, 1836, an act was passed appropriating $108,000 for the erection of a suitable building for the accommodation of the Patent Office, and within that month the erection of the building was begun. It was the present south front of the Patent Office, excluding the south ends of the east and west wings. In the spring of 1840 the building was completed and the Office moved into it. The sum of $422,011.65 was expended on this building.

By the act of March 3, 1849, the Interior Department was established and the Patent Office attached thereto. This same act appropriated $50,000 out of the patent fund to begin the east or Seventh Street wing, which was completed in 1852 at a cost of $600,000, $250,000 of which was taken from the revenue of the Patent Office. In 1852 the plans for the entire building as it now stands were prepared. The west wing was completed in 1856 and cost $750,000. Work on the north or G Street wing was begun the same year. In 1867 this wing was finished at a cost of $575,000. The entire building cost $2,347,011.65. If this building was devoted solely to the use of the Patent Office it would not satisfy its requirements. Substantially all of the models have been crowded out and are now stored in a rented building.

Since July 28, 1836, 667,173 patents for inventions and since 1842, 34,018 patents for designs have been issued by this Office. Many of these patents are for minor improvements, but among them may be found a very large number covering the most remarkable and valuable inventions, which have added untold sums to the world's wealth, revolutionized the old arts, created new ones, brought old-time luxuries within the reach of all, and made life doubly worth living. These contributions have come from men and women, white and colored. To many inventors more than a hundred patents have been issued. Thomas A. Edison, with 742 to his credit, has received the largest number.

From 1790 to March 1, 1895, some 5,535 patents were granted to women. It is a fair estimate that out of every one thousand patents one is granted to a women. As a rule women take out but one patent, although there are many exceptions. While the majority of patents granted them are for improvements in wearing-apparel and in articles for household use, they have invented and received patents for adding-machines, windmills, horseshoes, agricultural implements and fire-escapes.

To some 165 colored inventors about 400 patents have been issued. Twenty-eight patents have been issued to one and to another twenty-two. So far as the records show, Henry Blair, of Maryland, was the first colored patentee. In 1834 he received a patent for a corn-planter and in 1836 one for a cotton-planter. The character of their inventions follow lines suggested by their employment. Employed in the field and in the house, improvements in agricultural implements and articles of domestic use predominate. The sphere of their inventive effort has widened with the added opportunities afforded them to engage in mechanical avocations. They have made contributions to the electric arts and steam-engineering, and many improvements in railway appliances and paper-bag machines. Before the civil war the master of a slave living in Mississippi made application for a patent, but the Attorney-General held that an invention of a slave, though it be new and useful, could not be patented.

In May, 1802, President Jefferson appointed Dr. William Thornton as a clerk at $1,400 per year to have charge of the issuance of patents. He took the title of superintendent and continued to act in that capacity until his death, March 28, 1828. The last superintendent was Henry L. Ellsworth, who became the first commissioner under the act of 1836 and served until 1845.

Commissioner Fisher (1869-71) was the first to publish his decisions and to have the copies of the specifications and drawings made by photolithography. He also instituted the practice of requiring competitive examinations for entrance to and promotions in the examining force of the Office.

Beginning in 1843 and annually therafter the Patent Office reports were published, which until 1853 contained merely an alphabetical index of the names of the inventors, a list of the expired patents and the claims of the patents granted during the week. In 1853 and afterward small engraved copies of a portion of the drawings were added to the reports to explain the claims.

The act of 1870 authorized the Commissioner to print copies of the claims of the current issues of patents and of such laws, decisions and rules as were necessary for the information of the public. In conforming with this provision there was published weekly a list giving the numbers, titles and claims of the patents issued during the week immediately preceding, together with the names and residences of the patentees. This list was first published under the name of "The Official Gazette of the United States Patent Office" on January 3, 1872. In July, 1872, portions of the drawings were introduced to illustrate the claims in the patented cases. The "Official Gazette" has now become one of the most valuable and important of Government publications. Each Senator and Representative is authorized to designate eight public libraries to receive this publication free. One copy is also furnished free to each member of Congress. It is also sent all over the world in exchange for similar publications by other governments, and its paid subscription list is constantly increasing.

The American patent system is known and spoken of as the "examination system," in contradistinction from the English system, which has been mainly followed by other nations. The examination system is the ideal system, provided the examination can be made with sufficient care to minimize the likelihood of the issue of patents for inventions not of a patentable nature. The field of search, however, yearly increases, and it becomes more and more difficult through lack of time to make a perfect examination.

Something more than two million domestic and foreign patents have been issued, while the number of scientific publications has enormously increased. It is only by means of a perfect classification that this great mass of matter can be so divided as to be conveniently accessible for use in the examination of any individual case.

Of our patent system it has well been said: "It is generally recognized by the most profound students of our institutions, both at home and abroad, that no one thing has contributed more to the pre-eminence of this country in the industrial arts and in manufactures than the encouragement given by our Constitution and laws to inventors and to investors in patent property."

The system is by no means perfect; but it is generally acknowledged that the patent laws of the United States are more liberal than those of any other country and that the examination, imperfect though at times it be, gives a value to a United States patent not possessed by a patent issued by a country not having an examination system. It is undoubtedly true that the practice before the Patent Office lacks stability and uniformity by reason of the frequent changes of Commissioners, which prevents the establishment of definite policies. It is also true that too many appeals are permitted, and interference proceedings are rendered onerous and complicated by the number of motions and appeals provided by the laws and rules. The most serious defect, however, follows from the power to keep applications in the Office for indefinite times through delays in amending the same. The act of March 3, 1897, was intended to prevent or check this evil; but it has failed of its purpose. At the present time about 75 per cent. of the patents granted are issued within one year after being filed, and were it not for the fact that applications are unduly delayed at least 90 per cent. would issue within that time. The rights of the public would be protected and very seldom would an injustice be done to an inventor if a provision was incorporated into the patent laws providing that unless an application became involved in an interference it should not be permitted to remain in the Patent Office more than three years without abridging its life of seventeen years.

The records of the Office show that there are pending 4,829 applications filed prior to January 1, 1898. Three of these applications were filed in 1880, one in 1881, four in 1882, three in 1884, three in 1885, 13 in 1886, seven in 1887, 13 in 1888, 19 in 1889, 23 in 1890, 45 in 1891, 64 in 1892, 103 in 1893, 154 in 1894, 368 in 1895, 992 in 1896 and 3,011 in 1897.

It will be seen, therefore, that an application may be kept alive indefinitely, if it be desired. While the list above given embraces only such applications as were filed under the law as it existed prior to January 1, 1898, yet ten years from now a similar list will undoubtedly be given, provided the statutes are not amended, for the only difference lies in the fact that amendments now have to be made within a year after the official action instead of two years under the prior act. A law which permits this should be corrected.

Ventilation and Heating in the Houses of Parliament, England.

A description of the ventilating and heating apparatus in the Houses of Parliament, in London, was read before a recent meeting in that city of the Sanitary Inspectors' Association by Mr. Prim, lately resident engineer of the plant. To American readers the author's somewhat detailed account will prove quite interesting, and the following is slightly condensed from that portion of his paper relating to the ventilation and heating of these buildings:

The total length of the building is 940 feet; its principal front, that facing the river, is 880 feet in length. The debating-chamber of the House of Peers has a floor area of 4,050 feet, while that of the House of Commons has only 3,060 feet. The total number of persons occupying the chamber during the division which took place after the debate on the second reading of the Government of Ireland Bill, in 1886, was 905, and as the total capacity of the chamber is 165,000 cubic feet, only 182 cubic feet was on that occasion apportioned to each individual; but as really 1,250,000 cubic feet of air passed through the chamber per hour, thereby changing the air every 8¼ minutes, the supply of air per individual was at the rate of 1,326 cubic feet per hour, or 22 cubic feet per minute. The minimum temperature of the chamber was 63 degrees, and the maximum 67 degrees during a sitting of nine hours' duration, while the out-door temperature ranged from 65 degrees at the commencement of the sitting to 59 degrees at the rising of the House.

When, however, the out-of-doors temperature is high then an increased temperature is maintained indoors, whereby a chill consequent on the sudden fall in temperature of some 20 degrees or 25 degrees on entering the building may be avoided.

During protracted sittings the temperature of the air is gradually raised as morning approaches, want of rest and fatigue causing a slower circulation, and consequently chilliness. Relief parties, who have had a night's rest, a bath, a breakfast, and possibly a short walk, on arriving at the House at 8 A.M. do not generally approve of the existing temperature, but they are not entitled to the same consideration as those who have struggled through a long night.

The volume of air supplied to the debating chamber is regulated according to the number of persons present, the minimum quantity being 20 cubic feet per minute for each individual, but on occasions of exceptional crowding and excitement as much as 30,000 cubic feet of air per minute have been passed through the chamber, or not less than 33 cubic feet per head, assuming a full attendance.

The principal source whence the air supply is drawn is from the river front of the building, where, from 35 openings, air ducts are distributed for the service of the libraries, committee-rooms, Commons refreshment and smoking rooms, several offices, and the debating chamber of the House of Commons. The air for the debating chamber is drawn by the action of a fan along a gallery, where, on passing through jets of water converted into fine spray or mist, mechanical impurities, such as soot or dust, are washed out; in hot weather, in addition to the cooling effects of these sprays, the air is also brought into contact with large blocks of ice, and is then drawn through a fan or propeller, the speed of which is regulated according to the external temperature, as well as to the number of persons occupying the chamber. This fan is driven by means of an endless rope from a steam engine, which is placed at a distance so as to avoid both noise and smell.

After leaving the fan, the air which is now being propelled passes through a screen of large area; this screen, which is composed of scrim or canvas of a light, open, and fluffy texture, arrests the further progress of any dust or smut that may have escaped the washing process. The air in its onward course next arrives at the filter, when, should the weather be foggy, the air-ways used in clear weather are closed and the whole of the incoming air is forced successively through two layers of cotton wool, each layer having a thickness of 3 inches and an area of 1,000 superficial feet. Having passed through this filtering medium during thick weather, and around it when no fog exists, the air ascends through gratings in the roof of the vault and enters the warming chamber overhead.

The warming is effected by means of steam conveyed through small pipes on which zinc plates are soldered. These are called batteries, the principle of which is to allow a large quantity of air to be raised in temperature to a moderate degree, so that the heat may be checked promptly whenever a sudden influx of members takes place. Following the onward course of the incoming air after warming it ascends into the equalizing chamber, where heated currents arising direct from the batteries become absorbed by the general body of the air, which assumes an equable temperature throughout before entering the debating chamber overhead, into which it passes.

The floor of the chamber is composed of perforated cast-iron plates, covered with an open-meshed matting of whipcord; there are also numerous openings in the walls and fittings around the chamber. In order to avoid any chilling effect from the upward movement of the incoming air about the members' feet, that portion of the floor immediately in front of the benches is composed of wood covered by rugs. The area of opening in the floor, and panels around the Chamber, is so large that no perceptible draught is felt. Special inlets for air are provided for the galleries all around the chamber.

The vitiated air is extracted through the ceiling, which is composed of a number of ornamental panels slightly raised above their framings so as to permit the outgoing air to pass freely away. Sixty-four of the panels in the center of the ceiling are of glass, through which the light from an equal number of gas-burners overhead illuminates the chamber. The extraction-flues from these burners alone act as powerful ventilators, but in addition to these are two ventilating up-cast shafts, the principal one being in the clock tower, at the base of which a fire is maintained day and night throughout the year.

The ventilation of the House of Peers is effected entirely on the extraction system, by which the air from two adjacent courtyards is drawn through water sprays, canvas screens, and steam-heating batteries, as already described, after which the air ascends through an open perforated floor, covered with a hair cloth carpet, into the debating chamber, passes thence through the ornamental fretwork of the ceiling, and is extracted by furnaces placed at the base of up-cast shafts, the principal one forming one of the angle turrets of the Victoria tower.

The heating medium is steam, which is supplied from four boilers, each 28 feet in length by 7 feet in diameter, and having two furnaces. The cooling of the air is effected both by placing blocks of ice in the intake, or gallery, through which the air is drawn, or by fine sprays of cold water, which, playing upon canvas screens, presents a large surface of cooling medium to the passing air, tending not only to cool, but also to cleanse and moisten it.

Personal Notes.

Mr. H. C. Patterson has resigned the position of superintendent of the Austin, Tex., water and light systems.

Mr. G. P. Coleman, of the engineering staff of the Chicago & Northwestern Ry., has been elected city engineer of Winona, Minn.

Mr. H. Edward Muehlof, Pottsville, Pa., has been appointed structural engineer and master carpenter of the Reading Coal & Iron Co.

Mr. James Nelson has been appointed city engineer of Indianapolis, succeeding Mr. B. J. T. Jeup. The latter will resume private practice.

Mr. Henry L. Doherty has been elected general manager and chief engineer of the American Light & Traction Co., with headquarters at Denver.

Mr. E. C. Crowther has resigned the duties of general superintendent of the Hamilton Iron & Steel Co., Hamilton, Ohio, to become manager of the new Minerva furnaces at Milwaukee, Wis.

Dr. John S. Billings, U. S. A., retired, author of "Ventilation and Heating," and now director of the New York Public Library, received the honorary degree of LL.D. from Yale University on October 23.

Mr. Charles H. Fitch, M. Am. Soc. C. E., topographer of the U. S. Geological Survey, has returned to Washington from Northern Montana, where he has had charge of surveys for the diversion of St. Mary River into the Milk River.

Mr. John A. Cole, M. Am. Soc. C. E., has taken Messrs. Edward S. Cole, M. Am. Soc. C. E., and Charles B. Burdick into partnership, the firm name being John A. Cole & Son. The offices will be at 1580 Old Colony Building, Chicago, and the practice will be in municipal, sanitary and hydraulic engineering.

Mr. Charles W. Leavitt, Jr., of New York, has been retained by the Palisades Interstate Park Commission to study the best methods of preserving and treating the Palisades of the Hudson. He has also been retained by the Saratoga Racing Association to remodel its property at Saratoga, N. Y.

Major Thomas L. Casey, Corps of Engineers, U. S. A., has been transferred to St. Louis, relieving Capt. Edward Burr, who has been assigned to the U. S. Engineer School at Washington, under Major Wm. M. Black. Capt. Charles H. McKinstry and Capt. Wm. V. Judson are also transferred to the School.

A man named Charles Prelini, in an article in "Engineering" of October 11, reproduces without credit facts and illustrations concerning tunneling operations at Chatham Square, New York, published exclusively by The Engineering Record on January 26, from material gathered by its representatives. It is many years since such a graceless appropriation of this journal's property has occurred, and the attention of "Engineering" is called to the character of the work of its contributor.

Notes.

A New Lime Preparation called "limoid" is being made by the Charles Warner Company, Wilmington, Del., from lump lime burnt at Cedar Hollow, Pa. Lime has always been open to objections on account of air slaking and the danger of swelling and pitting unless care and plenty of time are given to slaking. The process by which "limoid" is made is stated to save all loss from air slaking and to furnish a powder which needs only to be mixed with water into a putty to be ready for use. Frequent analyses and tests of the material are made at different stages of its manufacture in order to insure a product of uniform quality.

An Acetylene Mining Lamp which presents a number of advantages for underground work has been placed on the market by the Ingersoll-Sergeant Drill Company, New York. It is constructed in three sizes. The smallest weighs 9 ounces and burns 4 hours, and is intended for the use of an engineer or superintendent. The next size burns ¼ foot per hour and the largest ½ foot; these are not highly finished and are intended for use in place of candles and oil lamps, each of them holding enough calcium carbide for an 8-hour run. The lamps give at a low cost a bright, clear light, free from smoke and odor, and as they are designed for use by unskilled laborers, their field is by no means restricted to mines.

A Long-Range Engineering Prediction by Sir Frederick Bramwell in 1881, that in 50 years steam engines would be found only in museums and all motive power would be derived from internal combustion engines, is recalled by him in a recently published letter regarding the Mond power gas scheme. Dr. Ludwig Mond has designed a producer using the poorest grade of bituminous slack, worth $1.50 a ton, according to "Engineering," which states that about $1.12 per ton of coal is recovered by selling the ammonia saved in the process. A company has been formed to supply this gas over an area of 135 square miles at about 4 cents per 1,000 feet, and Sir Frederick believes that this fact is a long stride toward the fulfillment of his prophesy. There are no signs of panic, however, visible in the British engine-building trade.

A Nice Little Scheme to freeze a private water company out of business has been killed by the Alabama Supreme Court. In 1883 the Bienville Water Supply Company was incorporated to furnish water to the people of Mobile, and works were built for the purpose. They have been in operation down to the present time, but have lately had to meet competition from a municipal water plant. The city has been given power to compel connections with its sewerage system and to charge reasonable rates for meeting the financial obligations due to the sewer works. It has, however, never fixed any rate for the use of the sewers alone, and it will allow none of the company's customers to connect with the sewerage system except at the same price charged for the combined municipal water and sewerage service. This is all wrong, the court says, 30 S. Rep. 445, and a court of equity will enjoin the city from the perpetration of any such wrong to the company.

Air Currents in Churches were discussed before the British Association recently in a paper by Mr. J. W. Thomas, who said that down drafts in lofty buildings are not continuous. Instead, he had come to the conclusion that the cold air falling from the top compresses the layer of air beneath, and owing to the elastic properties of air, remains stationary near the floor of the building for some seconds. Then an air current is formed, the result being that alternating air currents are produced at intervals of about half a minute. The pressure of the outer air when falling down a building at freezing point causes the pressure of the air inside the building to be increased greatly, while during the up-current the pressure is reduced to its lowest limit. Alternating air currents upset the ventilation of high buildings with too much top exit space, he said, and causes the products of respiration to be breathed over again.

The Welding of Iron and Steel is usually accomplished by employing fluxing powders containing a large proportion of borax, the purpose of which is to remove the oxide forming on the surfaces to be welded, and enable the welding temperature to be maintained for a longer time. Mr. J. Lafitte, of Paris, has brought forward a borax mixture in the form of thin sheets in which a fine wire netting is imbedded, which serves to hold the melted flux together. The sheets are divided into squares by grooves, so that a piece of the desired size and shape can easily be separated. Welds made with this preparation are said to withstand the various bending and distortion tests, and to show unusually high tensile strength in trials made at the Cherbourg navy yard and the Toulon arsenal. Time is also said to be saved in making welds by the use of these sheets.

The Preference for Asphalt which is characteristic of New York paving work has been carried to an unusual point in the case of heavily-traveled Broadway, between Fourteenth and Canal Streets. Some notes on this work, written by Mr. Nelson P. Lewis, M. Am. Soc. C. E., read as follows: "The price paid under the present Broadway contract is $5.69 a square yard for the asphalt wearing surface with maintenance for ten years, and 59 cents a square yard for relaying the present pavement. This pavement and that on a number of other streets lately repaved with asphalt is granite block on a concrete foundation. The old blocks are taken up and laid flat on a sand cushion to form a foundation for the asphalt, the surplus blocks being delivered at the city repair yards. Asphalt block is being laid as an original improvement, payable by assessment, on quite a number of streets. A recent and successful practice is to lay such blocks 3 inches in thickness directly in a bed of mortar placed on a concrete foundation. This construction is taking the place of that with 4-inch blocks laid in a cushion of sand, and the cost is about the same.

The Flow of Air through Orifices has been investigated at the engineering laboratories of the Massachusetts Institute of Technology with larger orifices and higher pressures than those on which Fliegner's formulas are based. A battery of 12 tubes, tested to stand 3,500 pounds per square inch hydraulic pressure, was constructed to act as a reservoir, and this is connected by piping to a receiver provided with a safety valve set at about 350 pounds. The reservoir has a capacity of 49.11 cubic feet, including piping to a throttle valve, by means of which any desired pressure up to 350 pounds may be obtained in the receiver, and the receiver and piping from the throttle valve has a capacity of 41.14 cubic feet. Five orifices, from 0.189 to 0.623 inch in diameter, were used, all made with the length of the cylindrical part 1½ times the diameter and with a radius of the rounded approach equal to the diameter. The amount of air passed through the orifice was determined by calculations from the temperature and pressure in both receiver and reservoir at start and at end of test. The observations showed, as did those of Fliegner, that when the receiver pressure was more than twice the atmospheric pressure, the pressure in the orifice was always the same proportionate part of the receiver pressure, but they indicated that there was a different ratio for each orifice. The results also showed the discharge through any orifice to be proportional to the absolute receiver pressure. Values for constants in equations were not given, awaiting additional data. It will be interesting to add that it took two or three hours to fill the tubes to a pressure of 2,500 pounds per square inch and only about three minutes were required to empty them with a ⅝-inch orifice.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Phoenixville, Pa.—Bids are wanted by the American Pipe Manufacturing Co., Philadelphia, until Nov. 4, for the construction of a 10,000,000-gal. sedimentation reservoir near Phoenixville, as advertised in The Engineering Record.

Scammon, Kan.—Bids are wanted Nov. 20 for constructing a system of water-works, as advertised in The Engineering Record.

Cambridge, Minn.—Bids are wanted Nov. 12 for $11,500 water-works bonds. A. H. Southerland, Pres. Village Common Council.

Raymond, Minn.—Bids are wanted Nov. 4 for drilling an 8-in. well. B. T. Barnes, Village Recorder; M. B. Haynes, Designing Engr., Mankato, Minn.

Pittsburg, Pa.—Bids are wanted Oct. 30 for laying 500 ft. of 4-in., 9,340 ft. of 6-in., 8,400 ft. of 8-in. and 1,500 ft. of 12-in. pipe in several streets; also for relaying 700 ft. of 6-in. pipe in 4th Ave. with 8-in., and 900 ft. of 6-in. pipe in Wood St. with 12-in. Edw. M. Bigelow. Dir. Dept. Pub. Wks.

Bradford, O.—Corp. Clk. O. B. Altvater writes that bids will be opened Oct. 30 for $10,000 water-works bonds. John Tinkler, Chmn. Bd. of Water-Works Trustees.

Georgetown, Del.—Mayor Chas. L. Moore writes that a vote will be taken in the near future on the proposition to construct water-works and an electric light plant.

Brookville, O.—Corporation Clk. Ira V. Miller writes that on Oct. 21 it was voted to issue $24,000 bonds for water-works.

Florence, S. C.—Wm. Hoffmeyer, Chmn. Com. of Pub. Wks., writes that this city proposes to construct water-works at a probable cost of $40,000.

Canajoharie, N. Y.—The Water Supply Co., of Canajoharie, has been incorporated with a capital of $40,000. Directors: David Gring, of Newport, Pa.; B. C. Fox and W. S. Bellinger, of Canajoharie.

Marshall, Mo.—Engr. in Charge, Richard H. Phillips, of St. Louis, writes that the first well driven, for the proposed water-works, has proven satisfactory, and that the question of issuing bonds for works will be submitted to the voters in a few weeks.

Riovista, Cal.—Town Clk. F. J. Kalber writes that it is proposed to construct water-works at a probable cost of $20,000, but the matter will have to be submitted to a vote of the people. E. N. Eager, of Fairfield, Cal., Engr.

Washington, D. C.—Plans have been completed for a pumping station to be erected at the Bryan's Point station of the fish commission, for the purpose of pumping water from the Potomac into the fish tanks and hatching tables at the station.

Cripple Creek, Colo.—The Water-Works Co. has been instructed by the City Council to extend water mains in various directions; total length, about 3½ miles, with about 20 hydrants.

Lemoore, Cal.—Press reports state that at a recent election it was voted to issue $22,000 bonds for water-works and an electric light plant.

Tacoma, Wash.—City Engineer Taylor has recommended the laying of a 15-in. stave pipe to South Tacoma at an estimated cost of $12,000.

Sheboygan, Wis.—Press reports state that the city has accepted plans for a new water-works plant, and is considering the building project. The city has made the local company an offer of $200,000 for its plant.

Ashfield, Mass.—In a recent report to the Selectmen (Emory D. Church, Chmn.) concerning the proposed water system for Ashfield Plain, E. C. & E. E. Davis recommend a gravity system with Taylor Brook as its source. Estimated cost, $9,895.

Bloomfield, Ind.—Engineer in Charge C. O. Lucas, of Greenville, O., writes that the Bloomfield Water Co. proposes to construct water-works at a cost of about $26,000. Contracts to be let in the spring.

Charleston, Ill.—The City Council is stated to have authorized the issuing of $5,000 bonds for the purchase of two boilers, one hot water pump and 2,000 ft. of 4-in. pipe for the water system.

Avon, S. D.—Town Clk. Carl Kjelmyr writes that a water-works system will be put in next spring.

Colchester, Ill.—The Council is stated to have under consideration the establishment of a water system.

Whitewright, Tex.—The issue of $6,500 water-works bonds has been approved by the Attorney-General's Department.

Beloit, Wis.—A number of extensions to the water mains are said to have been recommended.

Newark Valley, N. Y.—C. W. Chidister, Pres. of Village, writes that on Oct. 21 a vote was taken in favor of granting a water-works franchise.

Wabasso, Minn.—The matter of water-works, for fire protection, is said to be under consideration.

Moose Lake, Minn.—Water-works bonds to the amount of $2,000 were sold recently. Peter W. Ehr, Recorder.

Victoria, Tex.—A document has been filed with the County Clerk setting forth the intention of Ross L. Clark and others to dam Placedo Creek just above the boundary line of Victoria and Calhoun counties, for the purpose of irrigating rice.

Centerville, S. D.—Press reports state that the water-works committee will arrange for the extension of water mains.

Durango, Mex.—Water-works and sewerage are to be put in. Address The Governor, Durango.

Valley Springs, S. D.—City Clk. W. C. Gilmore writes that on Oct. 15 it was voted to issue $6,000 water-works bonds.

Tempe, Ariz.—Town Clk. F. M. Schureman writes that $30,000 bonds have been voted for water and light purposes.

Cody, Wyo.—The Big Horn County Canal Co. is stated to have been formed, with the object of constructing a canal 40 miles in length to reclaim over 60,000 acres of land.

Houghton, Mich.—The Council has under consideration the question of building a pumping station in connection with the water-works system.

Kokomo, Ind.—Press reports state that the Wayne Engineering & Construction Co., of Ft. Wayne, has withdrawn its offer to construct a system of municipal water-works.

North Chicago, Ill.—Press reports state that about 2 miles of water mains are to be laid, at a cost of about $10,000.

Houma, La.—The taxpayers have voted in favor of the proposition to levy a 5-mill tax for 30 years, for the construction of water-works. Estimated cost of system, $30,000.

Toledo, O.—The water-works department expects to make a 7,000-ft. extension, using 6-in. pipe, at the expense of the Michigan Central R. R., for a water supply to said company's yards.

Lake Charles, La.—Press reports state that the Water-Works Committee has been empowered to engage experts to examine the plant of the Lake Charles Ice, Light & Water-Works Co. with a view to the purchase of same by the city.

Hamilton, Mont.—The Ravalli Land & Irrigation Co. has filed articles of incorporation. Capital, $250,000. Incorporators: A. J. Campbell and John D. Ryan, of Butte, and John G. Morony, of Anaconda.

Encampment, Wyo.—The City Council has approved of a proposition offered by the Frombaugh Water-Works Co., agreeing, upon several conditions, to install a complete water-works system in Encampment.

Denison, Tex.—The Denison City Water Co. has been given a 20-year extension of its franchise and a contract to furnish the city with water at a cost of $7,925 annually, and at once to begin the enlargement of the plant.

Los Angeles, Cal.—Articles of incorporation have been filed by the Sunny Slope Land & Water Co., of Los Angeles. Capital stock, $250,000. Directors: Charles E. Jones and Edwin A. Meserve, of Los Angeles; Albert H. Quatman, of San Francisco, and others.

Harrisburg, Pa.—Water Department bonds to the amount of $75,000 were sold Oct. 19.

Akron, O.—Local press reports state that the Akron Water-Works Co. has purchased 43 acres of land, on which wells are to be sunk for an increased water supply.

Uniontown, Pa.—A water-works franchise has been granted to Isaac W. Semans and associates. Capital of new company, to be known as the Pennsylvania Water Co., $160,000.

Portland, Ore.—The Water Committee has adopted a resolution directing the engineer to report plans and estimates of the cost of extending the water system to the portion of the city known as Albina and adjacent territory.

Clarinda, Ia.—It is stated that bids are wanted Nov. 5 for constructing a 20 x 60-ft. standpipe. C. W. Foster, Mayor.

Newark, N. J.—The following bids were opened Oct. 17 by the Board of Street & Water Commissioners for the construction of an outlet tunnel from Cedar Grove Reservoir, in Verona and Montclair: Morris R. Sherrerd, Engr. & Supt. Dept. Water:

Items and Quantities:	Wright & Lindsley, Orange, N. J.	Dravo Cont. Co., Pittsburg, Pa.	Harrison Const. Co., Newark.	National Cont. Co., New York.	T. A. Gillespie Co., New York.	B. J. Sullivan, Newark.	United Eng. & Cont. Co., New York.	Stewart & Abbot, Ltd., New York.	John F. Shanley, Newark
Earth excav., 60,000 cu. yds.	$.30	$.50	$.75	$.60	$.35	$.60	$.60	$.35	$.45
Refilling, 4,000 cu. yds.	.30	.50	.40	.25	.20	.30	.20	.30	.20
Rock ex. open trench, 2,000 cu. yds.	2.00	2.00	2.00	3.00	1.35	2.50	2.25	1.75	1.50
Tunnel excav., 7,500 cu. yds.	7.00	7.45	6.50	8.00	6.50	7.00	5.72	6.00	7.75
Portland concrete, 4,500 cu. yds.	7.00	6.00	7.00	7.50	7.50	12.00	8.00	12.00	7.50
Expanded metal, 22,000 sq. ft.	.05	.05	.05	.05	.04½	.07	.05	.05	.05
Paving-brick lining, 100 sq. yds.	2.00	4.00	5.00	3.00	1.15	3.00	2.00	4.00	2.50
Granite facing, stone mas., 30 cu. yds.	40.00	40.00	35.00	35.00	35.00	35.00	20.00	35.00	30.00
Rubble stone masonry, 60 cu. yds.	5.00	10.00	5.00	6.00	3.50	4.00	7.00	4.50	7.00
Laying 60-in. C. I. pipe, 375 lin. ft.	3.00	2.00	3.00	2.75	2.30	3.00	2.00	2.50	3.75
Laying 6-in. C. I. pipe, 350 lin. ft.	.50	.30	.25	.25	.20	.50	.15	.60	.25
Furnishing and setting:									
48-in. valves, 2	1,000.00	1,100.00	1,040.00	1,100.00	1,035.00	1,100.00	1,200.00	1,075.00	1,000.00
Iron castings, 8,600 lbs.	.05	.05	.04	.05	.04½	.10	.02½	.05	.04
Structural steel, 1,200 lbs.	.06	.05	.05	.05	.04½	.08	.04½	.05	.05
Seeding, 1 acre	20.00	25.00	50.00	25.00	25.00	40.00	40.00	20.00	25.00
Walks of screenings, 100 sq. yds.	.25	.25	.25	.25	.25	.30	.25	.25	.30
Bronze tablet, 1	50.00	50.00	100.00	125.00	25.00	50.00	79.00	200.00	75.00
Total	$97,697	$98,820	$97,172	$111,144	$93,984	$124,006	$93,736	$112,653	$105,072

Lexington, Mass.—The following bids were opened Oct. 11 for building collecting basin, dug well and laying water pipe: Louis E. Hawes, of Boston, Engr. in charge:

Items and Quantities.	T. Stuart & Son Co., Newton, Mass.	C. N. Taylor, Wellesley, Mass.	A. Michelini, Reading, Mass.	Bruno, Salomone & Petitti, E. Boston.	H.A.Hanscom Co., Boston.
Collecting basin:					
Muck excavated and graded, 872 cu. yds.	$.50	$.50	$.35	$1.00	$.75
Earth excavated and graded, 215 cu. yds.	.50	.70	.40	1.00	.75
Rubble stone masonry, 175 cu. yds.	7.00	8.00	7.60	8.00	5.00
Brick masonry, 4.3 M.	16.50	30.00	20.00	25.00	26.00
Plastering with Port. cement, 243 sq. yds.	.50	.50	.75	.50	.75
Cement concrete, 74 cu. yds.	7.00	8.00	7.50	6.50	8.00
Steel beams, 470 lin. ft.	.25	.50	.21	.25	.50
Wooden roof	600.00	800.00	1,000.00	350.00	1,000.00
Dug well:					
Earth excav. and graded, 96 cu. yds.	1.00	.60	.40	.75	.75
Rock excav., 50 cu. yds.	6.00	2.50	10.00	2.00	5.00
Rubble stone masonry	....	8.00	5.00	8.00	....
Brick, 13 M.	18.00	30.00	20.00	25.00	26.00
Broken stone filling, 9 cu. yds.	2.00	3.50	2.50	2.00	2.50
Sand filling, 61 cu. yds.	1.00	1.50	.90	1.25	1.50
Wood work complete	125.00	200.00	450.00	100.00	125.00
Cast iron pipe laying:					
12-in., 183 lin. ft.	.36	.60	.40	.75	.75
10-in., 1,264 lin. ft.	.36	.50	.30	.70	.75
8-in., 495 lin. ft.	.30	.50	.25	.60	.65
6-in., 41 lin. ft.	.30	.40	.25	.50	.65
4-in., 60 lin. ft.	.26	.40	.20	.40	.65
Cutting out and setting tee in 10-in. pipe	15.00	12.00	3.00	10.00	10.00
Cutting out and setting tee in 8-in. pipe	12.00	10.00	3.00	10.00	10.00
Lumber, 3.3 M. B. M.	30.00	45.00	30.00	40.00	75.00
Total	*$4,854	$5,960	$5,672	$5,871	$6,450

*Contract awarded.

Walhalla, S. C.—J. W. Shelor, Pres. Blue Ridge Water Co., writes that bids will be wanted in January for the construction of water-works, estimated to cost $16,000.

Topeka, Kan.—Bids are wanted Nov. 6 for furnishing material and labor (including foundations), for the erection of a water tower for the Topeka State Hospital. Edwin Snyder, Sec'y, Bd. Trus. of State Charities and Corrections, Topeka.

Albany, Minn.—Press reports state that this village contemplates constructing a water-works and electric lighting system.

Wichita, Kan.—Press reports state that the Wichita Water Co. will expend $50,000 in improvements before next spring. Superintendent Fred. Aley.

Beaver Falls, Pa.—Press reports state that the Union Water Co., which also supplies Rochester and Bridgewater and has recently purchased the water plants of New Brighton and Freedom, is considering contracts which will require the expenditure of over $100,000.

Woodbury, N. J.—The Water Committee has been instructed to prepare specifications for new pumping machinery to be installed at the water-works.

St. Cloud, Minn.—The State Board of Control has decided to expend $10,000 at once in the installation of a new water-works system at the St. Cloud reformatory.

Greenwood, Ind.—The American Light & Water Co., of Indianapolis, is stated to have been granted franchises for a combined water and lighting plant. Press reports state that bids for construction will be received by said company until Nov. 1.

Webster, S. D.—The contract for constructing the water-works and an electric light plant (with the exception of water tower and tank) has been awarded to Allan Black & Co., of St. Paul, for $18,544; the contract for an 85,000-gal. tank with tower 125 ft. high was awarded to the Chicago Bridge & Iron Co. at $5,700.

Meadville, Pa.—The Councils have passed a resolution authorizing a call for bids for a 4,000,000 gal. pump for the water-works.

Springfield, O.—The lowest bid received Oct. 16, for the construction of a supplemental water supply system for this city, is stated to have been from Ulrich & Williams, of Springfield, O., at $53,436. A correspondent writes contracts cannot be legally let until the State Legislature authorizes the issue of bonds for said work.

Forest, Miss.—A special election, held Oct. 21, resulted in a favorable vote on the proposition to construct municipal water-works.

Loudonville, O.—At a special election held Oct. 21 it was voted to issue $2,500 bonds for water-works.

Bay City, Mich.—At a recent election a vote was taken in favor of the issue of $25,000 bonds for the extension of the water-works.

Kirkwood, Mo.—Bids are wanted Nov. 9 for supplying the city with a filtered water supply (a minimum of 100,000 gals. per day), to be taken from the Missouri or Meramec rivers. J. G. Hawken, City Clk.

Paxton, Ill.—Ordinances have been passed providing for the laying of water mains in several streets. D. C. Swanson, City Clk.

Dubuque, Ia.—The City Engineer has been instructed to prepare plans, specifications and estimates for a stand pipe.

Little Falls, N. J.—The taxpayers have under consideration the question of securing a water supply. The East Jersey Water Co. has made an offer, but no decision has yet been reached. Dr. Wm. R. Smith, Chm. of Water Com.

Lind, Wash.—The Adams Co. Board of Commissioners has granted to Neilson Bros. of this town an exclusive franchise covering a period of 25 years, whereby permission is given to lay water mains and operate a system of water-works in Lind.

Kaufman, Tex.—Press reports state that a $20,000 system of water-works is to be built by this town in the spring.

SEWERAGE AND SEWAGE DISPOSAL.

Decatur, Ill.—Bids will be received by the Drainage Commissioners of Drainage District No. 1, of the town of Milan, until Nov. 5, for furnishing and delivering 26,275 ft. of 12, 15, 16, 18, 24 and 26-in. tile necessary for the completion of the drains in said district. Geo. V. Loring, Dist. Engr., Decatur.

St. Paul, Minn.—Bids are wanted Nov. 4 for constructing a sewer in Stryker Ave. C. H. Brenson, Clk. Bd. Pub. Wks.

New Bedford, Mass.—W. H. Richards, Engr. of the Sewer Department, in his annual report recommends that preliminary surveys and plans be made this winter for sewers for the northern portion of the city.

Buffalo, N. Y.—Bids are wanted Oct. 30 for constructing a 15-in. tile and a 12-in. iron pipe sewer in the west side of Jefferson St. R. G. Parsons, Sec'y Bd. Pub. Wks.

Canton, O.—Bids are wanted Nov. 2 for constructing sewers in portions of several streets. C. C. Loyd, City Clk.

Cleveland, O.—Bids are wanted Oct. 31 for the deflection and extension of the outlet of the Erie St. sewer; for the construction of the masonry portion, also the pile and timber foundation and protection for the repair of the outlet of Marquette St. sewer. Chas. P. Salen, Dir. Pub. Wks.

Harrisburg, Pa.—Bids are wanted Oct. 28 for constructing sewers in portions of 7th and Penn Sts. Geo. B. Stucker, Highway Commr.

St. Paul, Minn.—Bids are wanted Nov. 1 for constructing a sewer on Cypress St. B. Zimmerman, Pres. Bd. School Inspectors.

Martinsville, Va.—City Engr. J. R. Gregory writes that sewers are to be constructed at a cost of $5,500, the work to be done by the town under the supervision of the city engineer.

Hutchinson, Minn.—Press reports state that the Council will secure plans for a sewerage system.

Whitinsville, Mass.—Arthur F. Whitin, Sec'y of the Sewer Com., writes that a survey is to be made with a view to securing a means of sewage disposal.

North Adams, Mass.—Press reports state that the city officials contemplate the construction of a sewage disposal plant.

McKeesport, Pa.—The Sewer Committee has under consideration plans for the construction of sewers to carry off the water of Crooked Run in the East End.

Durango, Mex.—See "Water."

Mt. Vernon, N. Y.—City Engr. Geo. W. Drumheller writes that plans and specifications are being prepared for a sewage disposal plant.

Richmond, Cal.—Bonds to the amount of $8,000 are reported to have been voted for a sewer system.

Carthage, Mo.—The contract for constructing a sewer system in Sewer District No. 3 has been awarded to W. W. Cook & Son for about $9,000.

Geneva, O.—The Village Council has under consideration propositions for the furnishing of plans and estimates for a sewer system.

Danielson, Conn.—Press reports state that The Attawaugan Manufacturing Co. is about to construct a system of sewers for its villages of Attawaugan and Ballouville.

Moorestown, N. J.—The contract for constructing a sewerage system is said to have been abandoned by the contractors, to whom it was awarded last July for $39,500, after about $10,000 worth of work was completed. The Township Committee will probably let a contract at once for the completion of this work.

Tarkio, Mo.—Press reports state that the City Council has purchased the sewer system owned by the City Light & Power Co., and will let contracts for additional sewers.

Dell Rapids, S. D.—The City Council is stated to have passed resolutions providing for a system of sewerage.

Newberry, S. C.—Local press reports state that bids are wanted Oct. 29 for $25,000 sewerage bonds. W. S. Langford, City Clk.

Newport, Ky.—The Board of Aldermen has instructed the engineer to receive bids for the construction of the entire system of trunk sewers in District A.

Allegheny, Pa.—The Common Council has passed ordinances authorizing the construction of sewers on several streets.

Ashley, Pa.—An ordinance has been approved by Chief Burgess, R. G. Thomas and Town Council for the extension, construction and maintaining of a sewerage system in Ashley.

Galveston, Tex.—An item of $30,000 for drainage and paving is provided for in the budget, as adopted, for the next six months.

Madison, N. J.—The State Sewerage Commission has approved the plans for a sewage disposal plant for this borough. Estimated cost said to be about $75,000.

Beresford, S. D.—The City Council has awarded the contract for constructing a main sewer—3,700 ft. in length—to the Mankato Heating & Plumbing Co. for $4,600.

Racine, Wis.—Plans and specifications have been submitted by the City Engineer for improvements in Kinzie Ave. Park addition, amounting to $14,000; of this amount $10,000 is for sewers.

Anoka, Minn.—The Board of Control has, according to press reports, decided to install sewage filtration beds at the Anoka Asylum for Insane.

Pekin, Ill.—The City Council has under consideration plans for the construction of a system of sewers.

Bedford, Ind.—It is stated that bids are wanted Oct. 29 for constructing a sewerage system. G. C. Houston, City Engr.

Manitou, Colo.—Local press reports state that plans and specifications are now being made for a sewer system; estimated cost $75,000.

Simsbury, Conn.—A certificate of incorporation of the Simsbury Sewer Association has been filed. The object is to construct sewers in Simsbury. The incorporators are L. S. Ellsworth, A. T. Pattison and George C. Eno.

Gladwin, Mich.—The proposition to issue $3,000 bonds for sewers carried at the recent election.

Denver, Colo.—The Board of Public Works has ordered plans and specifications prepared for Capitol Hill storm sewer sub-district Nos. 1, 4, 10 and 7.

Larchmont, N. Y.—Bids are wanted Nov. 4 for furnishing material and constructing an outlet sewer, into the Sound, through the Park, Circle and Park Aves., and a street sewer in Linden, Grove and Beach Aves. The Engineer's approximate quantities of material required are as follows: 100 ft. of 24-in. cast-iron water pipe, Ward flexible joint, laid on stone foundations; 100 ft. 24-in. cast-iron water pipe, spigot and bell; 2,045 ft. 24-in. vitrified pipe, average cut 9 ft. 9 ins.; 847 ft. 20-in. vitrified pipe, average cut 7 ft. 9 in.; 150 ft. of 15-in. vitrified pipe, average cut 7 ft.; 1,500 cu. yds. rock in trenches to be excavated; 16 manholes, etc. L. S. Knevals, Village Clk.

Houston, Tex.—City Engr. I. Austin Miller has prepared plans and specifications for a sewer on Capitol Ave., from Main to Louisiana Sts.

Chicago, Ill.—Local press reports state that new bids will be asked for the completion of Lawrence Ave. sewer, the contractors who received this contract in 1898 having abandoned the work. Commissioner Blocki estimates that it will cost about $600,000 to finish the work by day labor, and if the new bids are in excess of that sum he will ask that day labor be used.

North Billerica, Mass.—Local press reports state that the Talbot Mills have under consideration plans for the construction of a sewerage system, to be owned by them, but to cover the entire village. Frederick S. Clark, Treas. of the Talbot Mills.

Xenia, O.—Henry J. Farrell, Sec'y of the Bd. of Sewer Commrs., writes that the following bids were opened Oct. 17 for the construction of sewers in Sewer District No. 1: John Williams & Co., Dayton, O., $37,183; W. J. Townsend & Co., Cleveland, O., $35,051; Morris & Chaney, Frankfort, Ind., $39,488; A. F. Shover, Indianapolis, Ind., $30,813 (awarded); Munger Bros., Xenia, O., $32,979. The above work includes 83,790 ft. of 9-in. to 4-in. pipe sewers, 100 manholes, 120 lampholes and 20 flush tanks; the trench to average 10 ft. in depth and be excavated in gravel and loam. Pipe for main line of lateral sewer to be of first quality, deep socket pipe in 3-ft. lengths, specials to be in 2-ft. lengths. Pipe for house connections and sub-drain to be second quality in 2-ft. lengths.

Jackson, Mich.—The contract for constructing Trail St. sewer extension has been awarded to T. C. Brook & Son, of Jackson, at $4.50 per lin. ft., for 1,400 ft. of 60-in. sewer, manholes $30 each, and catch basins $28 each.

Conneaut, O.—City Engr. Geo. B. Pike writes that the following bids were opened Oct. 8 for the construction of sewers in Districts Nos. 3 and 4: Geo. S. Pierson, of Kalamazoo, Mich., Engr. in charge:

Items and quantities.	McMahon & Son, Toledo.	V. D. Eichenlaub, Erie, Pa.
Trenching, including backfilling:		
Less than 6 ft. deep, 1,750 ft.	$.30	$.33
6 to 8 ft., 3,100 ft.	.35	.52
8 to 10 ft., 9,300 ft.	.40	.71
10 to 12 ft., 6,650 ft.	.50	.96
12 to 14 ft., 1,250 ft.	.55	1.27
14 to 16 ft., 500 ft.	.70	1.89
16 to 18 ft., 100 ft.	.85	2.52
18 to 20 ft.	1.00	3.02
20 to 22 ft.	1.25	4.02
Brick sewer, 36 in. inside diam.:		
Section "A"	3.20	3.50
Section "B"	3.20	3.30
Section "C", 1,200 ft.	3.20	3.30
Furn. and laying sewer pipe:		
24-in., 1,950 ft.	.85	.80
20-in., 1,250 ft.	.75	.57
18-in., 1,170 ft.	.75	.45
15-in., 350 ft.	.70	.34
12-in., 1,275 ft.	.40	.25
10-in., 2,580 ft.	.25	.20
8-in., 12,000 ft.	.20	.16
Drain tile: 8-in., 600 ft.	.15	.11
6-in., 3,000 ft.	.15	.07
4-in., 8,000 ft.	.12	.05
3-in., 4,000 ft.	.12	.04
C. I. pipe per net ton, 25 tons	40.00	50.00
Repaving, 300 lin. ft.	.10	1.00
Manholes, 43	20.00	35.00
Lampholes, 10	5.00	4.00
Flush tanks, 12	40.00	40.00
Storm-water inlets, 15	1.50	4.00
Outlet, Dist. No. 4, 1	100.00	50.00
Lumber, per 1,000 ft., B. M., 25,000 ft.	25.00	20.00
Gravel about drains, 400 cu. yds.	.60	3.00
Total	$26,277	$33,815

Havana, Cuba.—According to press reports the following bids were opened Oct. 23 for sewering and paving the city: Pan-American Construction Co., of West Virginia, represented by Michael J. Dady, of Brooklyn, N. Y., and C. A. Palmer, $11,485,896. McArthur Co., of New Jersey, $11,480,964; Havana Construction Co., represented by John D. McLellan, $11,214,506; S. P. McGivney and R. T. Rokeby, of Jersey City, $10,393,016.

BRIDGES.

Sherbrooke, Que.—Bids are wanted Nov. 12 for the superstructure of a riveted steel highway bridge, as advertised in The Engineering Record.

Saginaw, Mich.—Bids are wanted Dec. 17 for building a bridge at Genesee Ave. Address Hiram E. Terry, City Engr.

Jackson, Mo.—Bids are wanted Nov. 4 for building a steel bridge across Hubble Creek, near Jackson; also for building the stone pillars for said bridge. B. A. Daugherty, Road & Bridge Commr.

Delphi, Ind.—Bids are wanted by the County Commissioners until Nov. 4 for constructing 2 bridges and 3 arch culverts in Carroll County. Jas. C. Smock, Co. Aud.

Northeast Harbor, Me.—A steel bridge, 115 ft. span, is contemplated.

New Castle, Pa.—The press is urging the necessity of the erection of an iron viaduct, probably 600 ft. long, to connect two resident sections of the city.

Springfield, O.—The Board of Public Affairs has adopted the report of the City Engineer recommending the construction of a stone arch bridge at Clifton St.

Clarion, Pa.—Press reports state that Edward Wilkins Dewey, who recently purchased the Brady's Bend Iron Co.'s plant, has made an offer to the Commissioner of Armstrong and Clarion counties to build a combined railroad, wagon, and foot passenger bridge across Allegheny River, at a cost of not less than $100,000, provided the counties will contribute $22,000 toward its construction.

Vicksburg, Miss.—Bids are wanted Nov. 4 for repairing Hankinson Ferry bridge. J. D. Laughlin, Clk. Bd. Co. Supervisors.

Livingston, Mont.—Local press reports state that bids will be received by the County Commissioners until Oct. 31 for constructing a 2-span steel bridge across the north branch of Yellowstone River; each span to be 105 ft. long. Plans and specification may be seen at the office of the County Auditor.

Chester, Pa.—See "Railroads."

Seneca Falls, N. Y.—The Rumsey St. bridge bonds, amounting to $11,000, have been sold.

Morgantown, W. Va.—Major Chas. Powell has notified the County Court that the suspension bridge across Monongahela River must be raised 14 ft., so as to admit the passage of steamboats.

West Hoboken, N. J.—The bridge at 14th St. has been reported unsafe and may be replaced with a new structure.

Dartmouth, Mass.—Beattie & Wilcox, of Fall River, are stated to have secured the contract for constructing a bridge across Apponegansett River, at Dartmouth, for $27,900.

Bridgeport, Conn.—Roadmaster R. B. Davis, of the Connecticut Railway & Lighting Co., reports Ash Creek bridge to be in an unsafe condition.

Provemont, Mich.—The Board of County Supervisors has granted permission to the Manistee & Northwestern Ry. Co. to build a bridge across the Narrows of Carp Lake, at Provemont.

Oreland, Pa.—A committee appointed by Montgomery County will recommend the construction of a bridge across the Philadelphia & Reading R. R. tracks, at Oreland.

Buffalo, N. Y.—Bids are wanted, separately, Nov. 4, for the substructure and superstructure of the subway under the Western New York & Pennsylvania R. R. in Fillmore Ave. F. V. E. Bardol, Ch. Engr., Grade Crossing Commrs., Bureau of Engineering.

Boston, Mass.—The following bids were opened, Oct. 24, at the office of the city engineer for building granite piers, on pile foundations, for the section of the new Broadway bridge between Foundry St., S. Boston, and the channel: William J. Lawlor, $27,072; Jones & Meehan, $27,840; Joseph Ross, $23,990; Patrick McGovern, $22,300; Miller & Ellis. $29,424; John Cavanagh, $33,000.

Michigan City, Ind.—F. H. Doran, Co. Aud., writes that the contract for constructing a drawbridge across the harbor, at Michigan City, has been awarded to the American Bridge Co., Lafayette, Ind., for $11,529.

Towson, Md.—The construction of a bridge between Baltimore and Harford Counties is stated to be in contemplation.

Buffalo, N. Y.—Local press reports state that the lowest bid received for reconstructing the counter weights on Michigan St. bridge was submitted by the Kellogg Iron Wks., at $5,900.

Portland, Mich.—The construction of a bridge next spring, between Portland and Danby townships, at an estimated cost of $5,000, is contemplated.

Waterford, N. Y.—State Superintendent of Public Works Partridge has authorized the reconstruction of the State bridge across the canal in Waterford, by the United Traction Co.

Quinnesec, Mich.—A bridge may be constructed this year at Quinnesec, between the counties of Dickinson, Mich., and Marinette, Wis.

Long Island City, N. Y.—The Bridge Department and the Corporation Council have approved plans and specifications for a bridge and viaduct to cross Newtown Creek and the Long Island R. R. tracks, at Vernon Ave., Long Island City, and, according to local press reports, the contract for constructing same will be let in about 3 weeks.

Grand Rapids, Minn.—L. Lindaner is stated to have secured the contract for constructing a bridge across Mississippi River, at $5,975.

Perth Amboy, N. J.—The Raritan River Bridge Committee of the Middlesex County Board of Freeholders has secured plans and estimates for a bridge 4,350 ft. long, which is to cost about $150,000, and to cross Raritan River, between Perth Amboy and South Amboy.

Washington, Pa.—Plans are being prepared for bridges to be built on the electric road between Canonsburg and Washington.

Waterville, O.—It is stated that the Toledo & Lima Electric Ry. Co. has awarded the contract for building a bridge at Waterville to the American Bridge Co., for about $27,000.

Derby, Conn.—The construction of a viaduct across the causeway is contemplated.

Victoria, B. C.—It is stated that bids are wanted Nov. 11 for constructing a steel bridge, 600 ft. long and 24 ft. wide. W. J. Dowler, City Clk:; C. H. Topp, City Engr.

Lake Charles, La.—It is stated that bids are wanted Nov. 16 for building a bridge across Beckworth Creek. J. O. Stewart, Police Juryman.

Ft. Collins, Colo.—Bids are wanted Nov. 4 for constructing a 72-ft. span combination bridge across Fossil Creek. H. E. Tedmon, Co. Aud.

Wilkesbarre, Pa.—Bids are wanted Nov. 7 for repairing South St. bridge. D. W. Jones, Chmn. Joint Street Com.

Elkhart, Ind.—Bids are wanted Oct. 28 for constructing a brick and stone culvert at Beardsley Ave. P. D. Berkey, Co. Aud.

Fowler, Ind.—Bids are wanted Nov. 6 for constructing the substructure and the superstructure of 13 small steel county bridges. James D. Smyth, Co. Aud.

York, Pa.—See "Electric Railways." F

Pasadena, Cal.—The contract for constructing a double-track and highway steel bridge over the tracks of Santa Fe & San Pedro, Los Angeles & Salt Lake R. R.'s on Fair Oaks Ave., is stated to have been awarded to the Union Iron Wks., of Los Angeles, for $13,965.

Albany, N. Y.—Contracts have been awarded as follows by John N. Partridge, Supt. of Pub. Wks.: For bridge over Glens Falls feeder, in Queensbury, Warren Co., to Reardon & Burnham, of Glens Falls, N. Y., at $4,765; for bridge over Champlain Canal, Cohoes, to the American Bridge Co., at $10,405; for bridge over Erie Canal, at Whitesboro, to American Bridge Co., at $1,516; for bridge and approaches thereto over Upper Mohawk Aquedust, near Rexford Flats, to American Bridge Co., at $8,128; for bridge over Cattaraugus Creek, at Versailles, on the Cattaraugus Indian Reservation, to Owego Bridge Co., of Owego, N. Y., at $14,574.

Washington, D. C.—W. J. Douglas, Engr. of Bridges, writes that the following bids, for constructing the foundations for a masonry bridge across Rock Creek on the line of Connecticut Ave. extended, were opened Oct. 12 by the Commissioners, D. C.:

Bidders.	Excavation, 18,000 cu. yds.	Concrete foud., 3,300 cu. yds.	Total.
Lyons Bros., Brookland, D. C....	$.59	$5.87	$29,991
Brennan Const. Co., Washington	.58	5.07	*27,171
Jas. C. McGuire, New York City	.53½	5.61	28,143
Cranford Paving Co., Washington	.80	5.00	30,900

*Contract awarded.

PAVING AND ROADMAKING.

Trenton, N. J.—Bids are wanted Nov. 5 for paving a portion of Center St. with Trinidad pitch lake asphaltum. C. Edward Murray, City Clk.

Wellsville, O.—Bids are wanted Nov. 12 for 4,255 sq. yds. brick paving on 4th St. J. W. McQueen, City Clk.

Buffalo, N. Y.—Bids are wanted Oct. 30 for repaving a portion of East Parade Ave. R. G. Parsons, Sec'y Bd. Pub. Wks.

Washington, Ind.—Bids are wanted Nov. 5 for constructing about 33 miles of roads in Washington Township. W. H. McCarter, Chmn. Bd. Co. Commrs.

Toledo, O.—Bids are wanted Nov. 18 for paving with block pavement on Indiana and Parkwood Aves. and Ontario St. John E. Connell, City Clk.

Columbus, O.—Bids are wanted Oct. 29 for furnishing material and paving with asphalt, hard burned brick or block, macadam or other substantial material on a portion of Buckingham St., including the construction of the necessary sub-drains and catch basins. Clarence M. Addison, Clk. Bd. Pub. Wks.

Toledo, O.—Bids are wanted Nov. 19 for $46,000 street improvement bonds. J. W. Wylie, City Auditor.

New York, N. Y.—The Municipal Council has approved a bond issue of $55,000 for repaving walks in Central Park; also a bond issue of $45,000 for widening 59th St. between 5th and 8th Aves.

Bayonne, N. J.—Mayor Egbert Seymour writes that it is proposed to pave Ave. C. with asphalt. Emmett Smith, of Bayonne, Engr. in Charge.

Midland, Mich.—City Clk. H. O. Holden writes that on Oct. 15 it was voted to issue $14,800 bonds for paving Main St.

Greensburg, Pa.—See "Electric Railways."

Allegheny, Pa.—The Common Council has passed ordinances authorizing the grading, paving and curbing of Terrace Ave., Villa St., Burke and California Alleys.

East St. Louis, Ill.—The City Council has passed an ordinance to pave with brick about one mile of St. Clair County Rock road, at a probable cost of $64,000.

Monongahela, Pa.—R. T. Hallam & Sons are stated to have secured the contract for 1,800 cu. yds. grading, 700 lin. ft. curbing and 5,600 sq. yds. brick paving, at 39 cts. and 55 cts. per cu. yd., and $1.30 per sq. yd. respectively.

Newport News, Va.—It is stated that paving bonds, amounting to $100,000, have been sold.

Waterloo, Ia.—The City Council has decided to grade, gutter and pave with brick, on a 6-in. macadam and a 2-in. sand foundation, a portion of 4th St.

Springfield, Mass.—Subscriptions amounting to $79,000 have been received for the extension of Court Square to the river and the construction of a driveway along the bank of Connecticut River. About $115,000 will be necessary for contemplated improvement.

Cincinnati, O.—Plans for paving Eggleston Ave. with granite have been adopted by the Board of Public Service. Estimated cost, $116,830.

Beekman St. extension bonds, amounting to $35,000, have been sold.

Los Angeles, Cal.—Press reports state that the projectors of the electric road, to be constructed from Los Angeles to Monrovia, will build a boulevard, about 20 miles long, in connection with same. W. H. Holabird is said to be interested.

Delphi, Ind.—The citizens of Burlington and Democratic Townships have voted in favor of constructing 35 miles of gravel roads, at a cost of about $57,000.

Mankato, Minn.—The citizens are in favor of macadamizing the streets of this city.

Galveston, Tex.—See "Sewerage and Sewage Disposal."

Weehawken, N. J.—A portion of Weehawken St. is to be paved with Belgian block, at a cost of $3,000.

Niagara Falls, N. Y.—The Barber Asphalt Paving Co. is stated to have secured the contract for paving a portion of First St., for $9,267.

Latrobe, Pa.—The City Council rejected bids received for paving S. Ligonier Ave. with brick, the lowest being $8,946.

St. Paul, Minn.—It has been decided to macadamize Irving Ave.

Boston, Mass.—Mayor Hart has signed an order for widening Rutherford Ave. and laying it out to a width of 60 ft., from Chapin St. to City Hall Square.

Nashville, Tenn.—Provision has been made as follows for the expenditure of $98,500 worth of bonds recently issued: To pave the Public Square with brick, $23,100; portions of First and Church Sts. with granite, at $24,000 and $8,000 respectively; Broad St., from Vine to the viaduct, with brick, $14,500, and Broad St., from Summer to Vine Sts., with granite, $18,500.

St. Mary's, O.—The City Council has adopted a resolution to accept the bid of Henry Gantz, of Columbus, for the paving of Spring St., using Athens block, the price being $14,799.

Omaha, Neb.—Ordinances have been passed by the City Council for paving portions of Lafayette Ave. and 24th St. with asphalt.

San Juan, Porto Rico.—Local press reports state that probably $400,000 will be expended during the next 12 months on road improvements. The uncompleted sections of the road from Arecibo to Ponce, via Utuado and Adjuntas, will be finished at a cost of $180,000, and it is stated that bids will be asked soon by the Board of Public Works for completing and repairing the road from Caguas to Humacao, estimated to cost $65,000.

Hamden, Conn.—Bids are wanted Oct. 28 for repairing and keeping in repair for a period of 2 years, from Nov. 1, 1901, all the highways in said town, excepting State St., Dixwell and Whitney Aves. W. F. Downes, First Selectman.

Montreal, Que.—Local press reports state that James Cochrane has secured the contract for supplying 41,000 tons of scoria blocks for paving the city wharves. Amount of contract $33,000.

Troy, N. Y.—Bids are wanted Nov. 12 for paving with vitrified brick, with cemented joints, on Second Ave. Approximate quantities, 34,250 sq. yds. on a 6-in. concrete foundation and 24,500 sq. yds. on a 9-in. concrete foundation; 41 bridge stone crosswalks reset; 26,250 lin. ft. curb stone, repairing 41 catch basins and for 41 new catch basins. James M. Riley, Clk. pro tem, Bd. Contract & Supply.

Havana, Cuba.—See "Sewerage and Sewage Disposal."

Louisville, Ky.—Bids are wanted Oct. 29 for brick paving on several streets. Thos. P. Craig, Secy.

Swissvale, Pa.—The contract for paving Denniston Ave., 3,189 sq. yds., also grading 2,537 cu. yds. and curbing 1,918 lin. ft., has been awarded to McCready Bros., of Braddock, for $6,707.

Jersey City, N. J.—Bids were opened Oct. 22 for the improvement of Highland Ave., the engineer's estimate on the principal items being 1,380 cu. yds. of earth excavation, 30 cts. per cu. yd.; 4,000 sq. yds. of asphalt paving, $1.75 per sq. yd.; 2,400 lin. ft. of curbstone reset and redressed, 20 cts. per ft.; 4 receiving basins rebuilt, $25 each; 12 noiseless manhole covers, $6.50 each. The bidders were as follows: Warner-Quinlan Aspt. Co., New York City, 95 per cent. of the engineer's estimate; Barber Asphalt Paving Co., Jersey City, 92 per cent.; Uvalde Asphalt Paving Co., Jersey City, 90 per cent. (awarded).

Chester, Pa.—City Clk. Frank W. Harrison writes that the following bids were opened Oct. 21 for paving a portion of 7th St. with sheet asphaltum: *a*, 5-yr. guaranty; *b*, 10-yr. guaranty: Pennsylvania Asphalt Co., *a* $2.43, *b* $2.60; paving between car track, vitrified brick, *a* $2.27, *b* $2.40; repairing paving, $2.58. Vulcanite Paving Co, city specifications, *a* $2.39, *b* $2.54; paving between car tracks, vitrified brick, *a* $2.25, *b* $2.35; company specifications, *a* $2.09, *b* $2.24; brick as above. W. S. P. Shields, *a* $2.20, *b* $2.45; paving between car tracks, *a* $2.28, *b* $2.45. The contract was awarded to the Vulcanite Paving Co. on its own specifications with the 10-yr. guaranty.

Cleveland, O.—County Surveyor Wm. H. Evers writes that the following bids were opened Oct. 16 by the Commissioners of Cuyahoga County, for grading, draining, curbing, concrete foundation, brick paving and asphalt paving of Detroit St. from Highland Ave. to the Rocky River Bridge in Lakewood Hamlet, with 5-year guarantee. Bidders—A, Engineer's estimate; B, Ayers Asphalt Pav. Co.; C, L. B. Stanley; D, Cleveland Trinidad Pav. Co.; E, Barber Asphalt Pav. Co.:

Bidders.	18,000 cu. yds. grading.	20 catch basins.	1,000 ft. 9-in. basin outlets.	100 yds. sewer, br. mas.	35,000 lin. ft. 5 x 20" curbg.	54,000 sq. yds. con. found.	3,900 sq. yds. 4" br. paving.	50,000 sq. yds. asph. pav.	Addit. guarantee.*	50 cu. yds. concrete.	Total.
A..	$.20	$35	$.25	$5.00	$.29	$.50	$1.00	$1.25	$.05	....	$116,600
B..	.25	35	.55	9.00	.35	.49	1.00	1.10	.05	$5.25	104,523
C..	.15	35	.30	7.00	.30	.45	.90	1.30	.10	6.00	108,010
D..	.25	35	.50	5.00	.33	.40	1.00	1.13	.04	3.50	99,925
E..	.22	33	.35	7.15	.38	.48	1.10	1.29	.05	3.30	113,860

*Wearing surface guaranteed for an additional period of five years.

POWER PLANTS, GAS AND ELECTRICITY.

Holyoke, Mass.—Bids are wanted Nov. 1 for a gas engine, as advertised in The Engineering Record.

Denver, Colo.—The Electric Power & Transmission Co. has been incorporated, with a capital of $50,000, to construct a power plant on the South Platte River and transmit electricity to Denver. Howard T. Crocker, of the First Nat'l Bank, is reported interested.

Louisville, Ga.—The Louisville Mfg. Co. is reported to be investigating the cost of an electric light plant.

Webster, S. D.—See "Water."

Frenchtown, N. J.—The Council is stated to have granted a franchise to the newly organized Frenchtown Gas Co.

Mt. Carmel. Ill.—The Mt. Carmel Improvement & Development Co. is reported interested in the construction of an electric plant at the Grand Rapids dam.

Plattsmouth, Neb.—The Plattsmouth Canal & Power Co. is reported incorporated, with a capital of $250,000, to construct a power canal. Chas. C. Parmele, Pres.; Frank J. Morgan, Sec'y.

Syracuse, N. Y.—The Directors of the Syracuse Lighting Co. are stated to have adopted plans for extending the gas and electric light systems. John J. Cummins, Gen. Mgr.

Tempe, Ariz.—See "Water."

Pittsfield, Me.—Engr. in Charge P. H. Cooms, of Bangor, Me., writes that Robt. Dobson & Co. and Allen Hackett, of Pittsfield, are interested in the proposition to develop the water power at Pittsfield. Topographical surveys are now being made.

Farmington, N. M.—The Town Trustees are stated to have granted Arthur McLaran a franchise for an electric light plant.

Houston, Tex.—It is reported that the Citizens' Electric Light Co. will expend about $150,000 in improvements. W. W. Chapman, Mgr.

Monterey, Cal.—See "Electric Railways."

Denver, Colo.—The bill granting a 20-year franchise to the Denver Steam Heating Co. was passed by the City Council Oct. 14.

Little Falls, Minn.—See "Electric Railways."

Milan, Minn.—Johnson & Bystrom are reported to be considering the establishment of an electric light plant.

Niagara Falls, N. Y.—The contract for constructing the power house of the Niagara Falls Power Co., at Niagara Falls, is stated to have been awarded to Mosier & Sons, of Buffalo, for $250.000.

Lemoore, Cal.—See "Water."

Orange, N. J.—Chief Justice Depue is reported to have signed an order setting aside the resolution recently passed by Council awarding the contract for lighting the city to the United Electric Co.

Georgetown, Del.—See "Water."

Oakland, Cal.—The Suburban Electric Light Co. has applied for a franchise, and bids for same will be received by the County Supervisors until Nov. 18. F. H. Mason, Deputy Clk.

Greenwood, Ind.—See "Water."

Newcomerstown, O.—C. L. Gates is reported interested in the construction of an electric light plant.

Encampment, Wyo.—It is stated that the Emerson Electric Co. is about to commence the construction of an electric light system.

Lafayette, Ind.—Chas. Meeker and L. Sparks, of Lafayette, are reported interested in the construction of a power plant on the Tippecanoe River at Horse Shoe Bend, to supply power for Delphi, Lafayette and other places.

New Haven, Conn.—See "Schools."

Georgetown, S. C.—A charter is stated to have been granted to the Georgetown Electric Co., with a capital of $50,000.

ELECTRIC RAILWAYS.

Loveland, Colo.—The Great Western R. R. Co. is stated to have been formed, to construct an electric railway, about 25 miles in length, from Loveland to Berthaud. Chas. Boettcher and John F. Campion are reported interested.

Monterey, Cal.—Fred'k W. Swanton, of Santa Cruz, is stated to have petitioned the Council for a franchise to construct an electric railway between Monterey and Pacific Grove, also to furnish these places with electric lights.

Little Falls, Minn.—The City Council is stated to have granted B. H. Warren, of Pittsburg, Pa.; John A. Wood, of New York, and John L. McCague, of Omaha, Neb., permission to construct an electric railway and to erect poles and string wires for electric power transmission.

Greensburg, Pa.—The Council is stated to have granted a franchise to the Greensburg & Southern Electric St. Ry. Co., from its terminus, along W. Otterman St., to the Ludwick Borough line, and also from the railroad station on Harrison Ave. to W. Otterman St.; the company must help pave thoroughfares traversed.

Sioux City, Ia.—Prof. H. A. Miller, Pres. Sioux City Business College, is reported interested in the construction of an electric railway between Sioux City, Le Mars and Spirit Lake; total length to be about 90 miles.

Marysville, O.—A. P. Sandles, of Ottawa, O., is reported to be securing right of way through northeastern Union County for an electric railway to connect Ottawa, Kenton, Richwood, Magnetic Springs and Delaware with Columbus.

Pittsburg, Pa.—Charters have been granted to the Ruth St. Ry. Co., Pittsburg, to build 2 miles of road; capital $12,000; and to the Duquesne Heights St. Ry. Co., Pittsburg, to build 3 miles of road; capital $18,000. Geo. W. Wilson, of Pittsburg, is President of both companies.

Albion, Mich.—The Council is stated to have granted a franchise to W. A. Boland.

Gardiner, Me.—The State R. R. Commissioners are stated to have approved articles of association of the Gardiner Electric Ry. Co., which proposes to construct and operate 3 miles of track in Gardiner; capital, $28,000.

Missoula, Mont.—The Council is stated to have granted O. C. Finklenberg, of Missoula, a franchise for an electric railway.

New Cumberland, W. Va.—Watson C. Johnson and A. P. Howard, of Congo, W. Va., are reported to have petitioned the Commissioners of Hancock County for a franchise to build an electric railway between Congo and Chester.

Rochester, N. Y.—The State Board of R. R. Commissioners is stated to have granted the Rochester & Eastern Rapid Ry. Co. permission to construct and operate an electric railway line 40 miles long, from Rochester to Geneva, with a branch from Pittsford to Fairport.

Woodbury, N. J.—The Paulsboro Traction Co. is reported to have petitioned the Gloucester County Supervisors for permission to lay its tracks over the Crown Point stone road, in the townships of Greenwich and West Deptford.

Richmond, Ind.—The Wayne County Commissioners are stated to have granted a franchise to the Hamilton, Eaton & Richmond Traction Co.

Columbus, O.—The Columbus Ry. Co. is reported to be making arrangements to reconstruct certain portions of its electrical system, at a cost of about $75,000. M. S. Hopkins, Gen. Supt., Columbus.

Kansas City, Kan.—W. E. Winner is stated to have petitioned the Wyandotte County Commissioners for a franchise for an electric railway which he proposes to construct along the Kaw Valley from Kansas City to Topeka.

Syracuse, N. Y.—The Directors of the Syracuse & Suburban Ry. Co. are reported to have decided to construct about 50 miles of extensions. C. E. Hubbell, Gen. Mgr., Syracuse.

Sioux Falls, S. D.—Col. W. H. Chase, of Atlanta, Ga., is reported interested in the construction of an electric railway between Sioux Falls and Madison.

York, Pa.—A press report states that the York & York Furnace Traction Co. is about to be formed, with a capital of $420,000, to construct a line from York, via Yoe Borough, from Red Lion through Windsorville, Bittersville, Martinsville, Craleyville, Long Level, Wrightsville, Hellam and York, and back to Red Lion. At York Furnace, on the Susquehanna River, a joint bridge is to be built with the Conestoga Traction Co., and the road is to connect with lines to Philadelphia.

Pleasant Ridge, O.—The Council is stated to have granted the Rapid Ry. Co. a franchise for 25 years to operate through the village. The company has now a complete right of way from the Hamilton County and Warren County lines down to Norwood.

Berwick, Pa.—A charter is stated to have been granted to the Berwick & Nanticoke Electric R. R. Co., to construct an electric railway to connect Berwick, Beach Haven, Hicks Ferry, Shickshinny and Nanticoke. C. C. Peacock, of Bloomsburg, is the secretary.

Brockville, Ont.—Surveyors are reported to be in this locality, accompanied by Mr. Carson, of Kingston, Ont., laying out the route for a new electric railway to be constructed between Toronto and Brockville.

Dover, N. H.—It is stated that an application has been filed at Concord for a charter for a railway, to start in Dover as an extension of the Dover, Somersworth & Rochester road, and to extend across Great Bay to Greenland, to connect with the Portsmouth & Exeter line, to be built next spring. Wallace D. Lovell is one of the incorporators.

Hancock, Mass.—The Selectmen are stated to have granted a franchise to the Berkshire St. Ry. Co. Chas. K. Sterns, Engr., 93 Federal St., Boston.

Lead, S. D.—The Burlington officials are reported to be circulating a petition for a franchise for an electric road from the Deadwood-Central depot to the upper portion of Main St. E. J. Blake, Consulting Engr., Chicago, Ill.

Milwaukee, Wis.—The War Department is reported to have approved plans for a tunnel to be constructed by the Milwaukee Electric Ry. & Light Co. under the river from E. Water to Clinton Sts. The tunnel will be 5 ft. in diameter and 37 ft. below datum. It is designed to carry electric cables. John I. Beggs, Gen. Mgr., Milwaukee.

Amsterdam, N. Y.—Local papers state that contracts for equipping the electrical generating power station to be built by the Amsterdam St. R. R. Co. at Tribes Hill have been awarded as follows: 3 engines of 1,500 H.-P. each, together with pumps, etc., to the Allis-Chalmers Co., of Milwaukee, Wis.; 10 boilers, having a total of about 5,000 H.-P., together with the contracts for the water tower and hot wells, to the Springfield Boiler Co., of Springfield, Ill.; economizers to the Cromwell-Schmidt Co., of York, Pa., and all electrical equipment to the General Electric Co., of Schenectady. The contract for the building of the power station has not yet been awarded, the plans not being fully completed. C. H. Ledlie, of St. Louis, Mo., is the Consulting Electrical Engr.

Milwaukee, Wis. — The Milwaukee-Western Consolidated Electric Ry. Co. has petitioned the Council for a franchise. It proposes constructing a line from Milwaukee to Lake Geneva. C. B. McCanna, Burlington, Wis.; E. T. Peterson, Rochester, Wis., and Wm. Shenkenberg, Wis., are among the incorporators.

Albany, Minn.—See "Water."

Upton, Mass.—It is stated that the Upton St. Ry. will be built at once and will be 3 miles long, constituting a loop through Upton and West Upton, connecting with the Grafton & Upton R. R. The steam railroad will be equipped with electricity, and operated in conjunction with this loop. E. D. Bancroft, Hopedale, and Wendell Williams are among the directors.

Walla Walla, Wash.—The Council is stated to have granted E. S. Isaacs a franchise over 4 miles of streets in this city.

Washington, D. C.—Local papers state that the Washington Traction Co. is about to begin the construction of an extension of the Connecticut Ave. line to Mt. Pleasant, a distance of about 1 mile; probable cost of work, $115,000.

Burlington, Ia.—The Council has granted the Muscatine N. & S. Ry. a right of way through certain streets and alleys of the city on condition that the road be completed on or before Dec. 31, 1902. Address F. S. Churchill, of Burlington.

Tipton, Ind.—The Council is stated to have granted the Union Traction Co. an additional franchise through Tipton, and it will build the north and south line from Kokomo to Indianapolis. G. F. McCulloch, Gen. Mgr., Anderson.

RAILROADS

Paducah, Ky.—The Paducah & Cairo R. R. Co. is reported organized, with a capital of $700,000, to construct a railroad from Paducah to Wyckliffe and from there over the Illinois Central tracks to Cairo. E. W. Smith, Pres.

Omaha, Neb.—A press report states that the Wabash R. R. Co., Jos. Ramsey, Pres., St. Louis, Mo., has purchased the Omaha & St. Louis R. R., which extends from Pattonburg, Mo., to Omaha, and will expend about $1,000,000 in improvements.

Jackson, Miss.—A charter has been granted to the New Orleans, Ansley & Birmingham R. R. Co. to construct a railroad from New Orleans to Birmingham, entering Mississippi at Logtown, and traversing Harrison, Hancock and Jackson counties to the State Line. Incorporators: L. J. Anderson and M. E. Ansley, of Bay St. Louis, Miss.; H. Dudley Coleman, of New Orleans, La., and others.

Chicago, Ill.—The Committee on Track Elevation is stated to have ordered the raising of 4 tracks on the Chicago, Milwaukee & St. Paul R. R., (H. R. Williams, Gen. Mgr., Chicago), between 40th Ave., and 51st Ave., and on the Belt Ry., (B. Thomas, Gen. Mgr., Chicago), from Chicago and 46th Aves. to Milwaukee Ave. and Irving Park Boulevard; total distance, about 4 miles; estimated cost, $1,000,000.

Maxwell City, N. M.—The Cimmarron River & Taos Valley R. R. Co. has been incorporated with a capital of $1,000,000 to construct a railroad from Maxwell City on the Santa Fe system to Elizabethtown, a distance of about 54 miles. Headquarters to be at Cleveland, O. Sam'l A. Williams, of Cleveland, O., is the principal stockholder.

Decatur, Ala.—It is stated that surveys have been completed for the proposed new line for the Central of Alabama R. R. Co., to be constructed from Decatur to Jasper, Ala., a distance of about 76 miles.

Chester, Pa.—Mayor D. W. Jefferis is reported to have signed the ordinance authorizing the Pennsylvania R. R. Co. to abolish its grade crossings by elevating its tracks over the streets by bridges; the improvement will cost about $1,000,000. W. H. Brown, Ch. Engr., Philadelphia.

Puntarassa, Fla.—A press report states that a charter has been granted to the Southern Florida & Gulf Coast Ry. Co., witn principal offices at Ureppa Island, Lee County, Fla.; capital, $2,000,000. The object is to build, maintain and operate a railroad through the counties of Brevard, Osceola, De Soto and Lee, from Ft. Pierce to Punta Passa, Lee County, a distance of about 150 miles. Incorporators: John M. Roach, Wm. W. Gurley and Millard B. Hereley, all of Chicago, Ill.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Baltimore, Md.—Bids will be received by the Board of Awards until Oct. 28 for installing a hot water heating apparatus in truck house No. 11; also for a 40-H.-P. multipolar motor, to be placed in City Hall to operate elevator. Thos. G. Hayes, Pres.

Dayton, O.—Bids will be received by Jas. C. Michie, Post Fund, Central Branch, N. H. D. V. S., Dayton, until Oct. 29, for furnishing material and performing all labor required for new plumbing, bath tubs, wash stands, etc., also putting in new lead and soil pipe and resetting old fixtures, for the improvement of the Home Hotel near Dayton.

Winchester, Va.—Bids are wanted Nov. 1 for furnishing material and erecting the Winchester Memorial Hospital at Winchester. Address, Dr. Hunter H. McGuire, Pres.

Monessen, Pa.—The St. Leonard R. C. Congregation is reported to have decided to erect a $25,000 church, from plans of J. M. Beall, of Monessen.

Denver, Colo.—F. J. Sterner, of Denver, has prepared plans for a 2-story brick hospital to be erected on Colfax Ave., by the Jewish Home for Consumptives. Cost, $30,000.

Logansport, Ind.—It is stated that the Trustees of the Market St. M. E. Church have decided to erect a $15,000 edifice.

Newark, N. J.—Final plans for the new isolation hospital are reported to have been accepted by the Board of Health, and the architects, John H. & Wilson C. Ely, 756 Broad St., are about to receive estimates on the construction of the buildings.

Farmington, Mo.—H. H. Hohenschild, Rolla, Mo., is stated to have been selected to prepare plans for a $29,000 building at the Insane Asylum here.

Houston, Tex.—F. S. Glover is stated to be preparing plans for a city hall with a market house adjoining, to be erected on Congress and Preston Sts., to cost about $200,000.

Bainbridge, Ga.—W. H. Carr, of Bainbridge, is stated to have secured the contract to erect the Decatur County court house, for $32,500.

Turtle Creek, Pa.—S. Colfax Richards, of Braddock, is stated to have been engaged to prepare plans for a $10,000 municipal building.

Watertown, S. D.—It is reported that a $15,000 addition will be erected to the court house.

Hart, Mich.—The Supervisors of Oceana County are stated to have voted to erect a $15,000 jail.

Escanaba, Mich.—The contract for erecting the city hall is stated to have been awarded to John W. Lawson, for $28,590.

Des Moines, Ia.—The stockholders of the Methodist Hospital are reported to be considering the erection of a new building, to cost about $50,000.

Boston, Mass.—Mayor Hart has signed orders appropriating $90,000 for a bath in the N. End and $50,000 for one on Cabot St.

The Common Council on Oct. 17 passed loan orders of $25,000 for a site and erection of a fire engine house at Orient Heights, and $40,000 for enlargement of the greenhouse, etc., at Mt. Hope cemetery.

Libraries.—Andrew Carnegie is stated to have made offers to the following cities for public libraries: Nashville, Tenn., $100,000; Revere, Mass., $20,000; Austin, Minn., $12,000, and Meenah, Wis., $10,000.

Brooklyn, N. Y.—The Board of Aldermen, on Oct. 22, concurred in the action of the Council to provide $20,000 for improvements to the Brooklyn Hall of Records.

Greensburg, Pa.—The Nelson-Buchanan Bridge Co., of Chambersburg, is stated to have secured the contract for the structural steel in the subbasement of the Westmoreland County Court House, for $10,470.

Washington, Ind.—Patton & Miller, 115 Monroe St., Chicago, Ill., are stated to have prepared plans for a Carnegie Library, to cost about $20,000.

New York, N. Y.—The Board of Aldermen, Oct. 22, concurred in the resolution recently passed by the council appropriating $44,000 for more toilet facilities in Manhattan Parks.

St. Louis, Mo.—The various buildings of the Louisiana Purchase Exposition, their sizes and the names of architects who have designed them, are given in an article on the general design of the exposition on page 406 in this issue.

Louisville, Ky.—The Directors of the German Protestant Orphan Asylum are stated to have accepted the plans of F. Erhart, 666 W. Jefferson St., for an orphanage to be located at Baxter and Longest Aves., to cost $40,000.

Fresno, Cal.—It is stated that plans for the Carnegie Library will be received until Dec. 1, Address, Chas. E. Jenney, Box 602, Fresno.

Cincinnati, O.—Bids are wanted Nov. 2 for erecting a market house on Wade St. Geo. F. Holmes. Clk. Bd. Pub. Service.

Bloomfield, Conn.—Bids are wanted by the Building Committee until Nov. 2 for erecting a brick library and town hall in Bloomfield. Curtis & Johnson, Archts., Hartford.

Digby, N. S.—Bids are wanted Nov. 8 for a heating apparatus in the post office at Digby. Fred. Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont.

Des Moines, Ia.—It is stated that bids will be received by the Board of Public Works until Nov. 6 for erecting a contagion hospital north of North Des Moines.

National Soldiers' Home, Va.—Bids are wanted Nov. 14 for erecting, heating, plumbing and electric wiring one 2-story brick extension to the hospital at Southern Branch, National Home for D. V. S. Wm. Thompson, Treas.

BUSINESS BUILDINGS.

Niagara Falls, Ont.—Bids are wanted for erecting a steel frame machine shop, as advertised in The Engineering Record.

Appleton, Wis.—Sidney Lovell, 355 Dearborn St., Chicago, Ill., is stated to have completed plans for the proposed $30,000 theater.

Allentown, Pa.—The Directors of the Y. M. C. A. are stated to have adopted plans for a $50,000 building.

Seattle, Wash.—E. W. Houghton, Collins Bldg., is stated to have prepared plans for a theater to be erected on 2d and University Sts. for Edw. Sweeney, of the Seattle Brewing & Malting Co., to cost about $125,000.

Sioux City, Ia.—Thos. Ross, of Brookings, S. D., is reported interested in the construction of a $35,000 hotel on Nebraska and 3d Sts.

East St. Louis, Ill.—J. N. Bartlow, cor. Main and Division Sts., is reported to be preparing plans for a 4-story business and office building to be erected on B'way and Collinsville Ave.; probable cost, $80,000.

Steubenville, O.—The "Labelle" Mill people are about to construct a storage house 500 ft. long, adjacent to their present new building in the 6th Ward.

Portland, Ore.—Deere & Co., Moline, Ill., are reported to be preparing plans for the erection of a 3-story warehouse in Portland, to measure 100 x 200 ft.

Houghton, Mich.—It is reported that about $75,000 will be expended in rebuilding the Douglas House, recently burned. J. C. Mann, Mgr.

Parkersburg, W. Va.—Caldwell & Drake are stated to have received the contract to erect an opera house for the Opera House Investment Co.; probable cost, $150,000.

Denver, Colo.—H. T. Barrensen, 512 Mack Blk., has prepared plans for a $40,000, 3-story brick office building, to be erected at 1469 California St. Owner, A. L. Engelbach.

Spokane, Wash.—Cutter & Malgrem, Exchange Bldg., have prepared plans for a brick block on First Ave. Owner, Henry White. Cost, $50,000.

Ottumwa, Ia.—The Ottumwa Telephone Co. has just sold $50,000 worth of bonds, and will erect this year a 3-story and basement brick building, size 40 x 90, for telephone exchange, offices and store-rooms; Jas. Wilson, of Ottumwa, will construct a brick building 20 x 90, adjoining above building.

Houston, Tex.—The Hutchins House is reported to have been destroyed by fire on Oct. 19.

Chicago, Ill.—The contract for erecting an addition to the Illinois Central passenger station at 12th St. and Michigan Ave. is stated to have been awarded to Geo. B. Swift & Co., 188 Madison Ave., for $125,000.

Augusta, Ga.—It is stated that plans have been completed for a $20,000 clubhouse, to be erected by the Elks' Whitney County Club.

Calumet, Mich.—H. T. Liebert, of Calumet, is stated to have prepared plans for a 3-story brick business block for this place, to cost $50,000.

Detroit, Mich.—Kastler & Hunter, 927 Chamber of Commerce, are stated to be preparing plans for an entertainment hall, to be erected in the northeastern part of the city, to cost about $23,000.

Nashua, N. H.—Proctor Bros. & Co. will rebuild its plant, recently burned. The main mill will be 3 stories high, 120 x 50 ft. Engines and boilers not damaged.

Denver, Colo.—J. E. Fisher has prepared plans for a $30,000 brick and stone building to be erecton Champa and 14th Sts. for the Fraternal Union of America.

New York, N. Y.—It is stated that Stewart H. Chisholm, a director of the U. S. Steel Corporation, will build a hotel, to cost $2,000,000, at the S. E. cor. 52d St. and 5th Ave. It will be 18 stories high with a 10-story extension. Architect, Wm. C. Hazlett, 1133 B'way.

Paterson, N. J.—The Paterson, Passaic & Suburban Telephone Co. will erect a 3-story building, 50 x 88 ft., on Smith and Hotel Sts.

Menasha, Wis.—The National Hotel, a 4-story brick building, is reported to have been destroyed by fire on Oct. 23.

Hammond, Ind.—The packing plant of the G. H. Hammond Co. is reported to have been seriously damaged by fire on Oct. 23.

Wheeling, W. Va.—The German Fire Insurance Co. is reported to have decided to erect a 6 or 7-story steel, stone and brick office building on Market St., to cost about $50,000.

Harrisburg, Pa.—A. F. Smith, of Reading, is stated to have completed plans for a 2-story gray stone depot, to be erected here by the Philadelphia & Reading Ry.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

Clinton & University Pl, br and stone lofts and stores; c, $30,000; o, Lorence Cavinato; a, C Cavinato.
373 & 375 B'way, br stores and lofts; c, $150,000; o, Henry Corn; a, Robt Maynicke.
325 3d Ave, br factory; c, $20,000; o, L. Teitebaum; a, M Bernstein.
49th St & 7th Ave, br hotel; c, $350,000; o, Hallahan & Ahearn; a, Neville & Bagge.
73 & 75 E 89th St, br stable; c, $20,000; o, Edmund J Curry; a, Chas Stegmayer.
218 & 220 W 84th St, br loft building; c, $24,000; o, E P S Wright; a, Alfred H Taylor.

DWELLINGS.

Kansas City, Mo.—Jefferson Brumback is about to erect an $11,000 brick dwelling at Highland Ave. and 8th St.

Philadelphia, Pa.—It is stated that a local syndicate represented by S. Davis Page will erect an apartment house on 39th and Chestnut Sts., at a cost of about $600,000. Architects, Milligan & Webber, 520 Walnut St. Builders, Machin & Brown, 147 N. 7th St.

Chicago, Ill.—L. M. Mitchell, 145 La Salle St., is stated to have prepared plans for a 3-story brick apartment house, 187 x 50 ft., to be erected on Yale Ave. and 67th St. for B. F. George, to cost about $70,000.

Burlington, Ia.—Rev. Bernard Mackin is having plans prepared for a $12,000 parsonage, fireproof throughout.

SCHOOLS.

Cleveland, O.—Bids will be received by the Board of Education until Nov. 11 for furnishing material and installing an electric elevator in the Franklin high school. Thos. H. Bell, School Dir.

Philadelphia, Pa.—Bids will be received by the Committee on Property, at the office of the Board of Public Education, until Oct. 29, for erecting a school on Clearfield St., a building at Torresdale, ventilating and heating the annex to boys' high school, at 15th and Green Sts., etc. A. F. Hammond, Sec'y.

Passaic, N. J.—Bids are wanted Oct. 30 for erecting the Dundee school. John N. Ryan, Com. on Dundee School, Bd. Educ.

Kenosha, Wis.—Bids are wanted Oct. 29 for erecting an 8-room school; also bids for plumbing. Norman L. Baker, Supt. of Schools.

Union, N. Y.—The citizens are stated to have voted to erect a $15,000 school.

Chelsea, Mass.—It is reported that at a meeting of the Board of Aldermen, Oct. 16, an order was introduced appropriating $130,000 for erecting a high school, and $48,000 for a grammar school.

Rowena, S. D.—Bids are wanted Nov. 5 for erecting a school.

Houston, Tex.—Cook & Co. are stated to have been selected to prepare plans for an 8-room brick school to be erected in the 3d Ward, to cost about $18,000.

Lincoln, Ill.—The contract for erecting Lincoln College is reported to have been awarded to Hall & Walker, of Danville, for $20,344.

Milwaukee, Wis.—The Finance Committee is stated to have recommended for passage bond ordinances for $400,000 to erect schools and $60,000 for building 2 police stations.

New Haven, Conn.—Bids are wanted Nov. 1 for a ventilating and heating apparatus and electrical work in the high school on York Sq. C. T. Hewlett, Clk. Bd. Educ.

South Bethlehem, Pa.—It is reported that $35,000 bonds will be issued for the erection of a high school.

Guilderland, N. Y.—Bids will be received by the Board of Education of the Union Free School Dist. No. 7, until Nov. 6, for $15,000 school bonds. Address, Winfield S. Keenholts, Clk. Bd. Educ., Altamont, N. Y.

New York, N. Y.—The following bids were opened Oct. 21 by the Committee on Bldgs., Bd. of Educ., for sanitary work at school 186, Boro. of Manhattan: Wm. Brodie, $16,380; Edw. J. Renehan, 163 E. 35th St., $12,082 (awarded); Jere. J. Deady, $13,189; Jas. Fay, $12,959; John J. McGrath, $13,199.

Bids opened at the same time for sanitary work and gas fitting at school 129, Boro. of Brooklyn, were as follows: Wm. Brodie, $11,524; Michael F. Gleason, $10,647; Jas. Fay, 205 E. 51st St., N. Y. City, $8,187 (awarded); J. Manneschmidt, Jr., $9,250; Jere J. Deady, $8,349; Jas. Harley & Co., $8,211; John J. McGrath, $8,997.

STREET CLEANING AND GARBAGE DISPOSAL.

New York, N. Y.—Bids are wanted Nov. 1 for the final disposition of the ashes and street sweepings in the Boroughs of Manhattan and Bronx; also separate bids for similar work in the Borough of Brooklyn. P. E. Nagle, Commr. of Street Cleaning.

Spokane, Wash.—The Council has directed the purchase for a crematory site, cost not to exceed $3,000.

New Brunswick, N. J.—A committee from the Board of Aldermen, Board of Health and citizens is considering the matter of building a garbage crematory.

Canton, O.—Bids are wanted Nov. 16 for erecting a building for garbage disposal works; bids will also be received for furnishing and installing a garbage furnace or crematory in said building; capacity, 50 tons per 24 hours, with smokestack having odor-consuming furnace at base. The garbage furnace to be constructed in 2 separate parts, so that one can be operated independently of the other. C. C. Loyd, City Clk.

Springfield, O.—Local press reports state that a garbage crematory will probably be built next spring.

Philadelphia, Pa.—The estimate of the Street Cleaning Bureau for next year is $1,071,320. The principal items are $550,000 for removal of ashes and house waste; $46,000 for cleaning alleys and undedicated paved streets; $442,000 for removal of garbage and dead animals. Specifications for cleaning the streets and removing garbage next year are now in the hands of Director of Public Works Haddock, and local press reports state that bids will soon be asked.

Wilmerding, Pa.—The Council has passed an ordinance granting the exclusive right for removing all garbage to James L. Waddell, for a period of ten years. The ordinance provides that Mr. Waddell shall erect a garbage furnace at some point without the borough limits.

Lowell, Mass.—The contract for a $25,000 crematory (Smith improved, daily capacity 50 tons) has been awarded to the Bridgeport Boiler Works.

GOVERNMENT WORK.

Ft. Banks, Mass.—Bids are wanted Oct. 29 for erecting an addition to the barracks at Ft. Banks. Address, A. B. Putnam, A. Q. M.

Sabine Pass, Tex.—Bids are wanted Nov. 1 for constructing a wharf on which to erect a life-saving station at Sabine Pass. Address S. I. Kimball, Gen. Supt., Treas. Dept., U. S. Life-Saving Station Service, Washington, D. C.

Cincinnati, O.—Bids are wanted Oct. 30 for the extension of the firing pits, construction of a coal vault and a railway for the transport of coal, etc., in the U. S. Custom House and Post Office Building, Cincinnati. Lewis Voight, Sr., Custodian.

Portsmouth, N. H.—Bids are wanted Nov. 9 for the removal of Henderson's Point, Navy Yard, Portsmouth, involving about 220,000 cu. yds. of rock and 10,000 cu. yds. of earth. Appropriation, $7,200. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

San Francisco, Cal.—Bids are wanted Nov. 23 for furnishing and installing 3 200-H.-P. boilers at the Navy Yard, Mare Island, Cal. Mordecai T. Endicott, Ch. Bureau of Yards and Docks, Navy Dept., Washington, D. C.

Mobile, Ala.—Bids are wanted Nov. 21 for furnishing material and constructing 10 beacons in Mobile Bay, Ala. Lieut.-Col. A. N. Damrell, Corps Engrs., U. S. A.

Sullivan's Island, S. C.—Bids are wanted Nov. 22 for erecting one barrack and one administration building. Address, David Price, Q. M.

Annapolis, Md.—Bids are wanted Nov. 27 for erecting a cadets' quarters building at the U. S. Naval Academy, Annapolis. A. S. Crowninshield, Ch. Bureau of Navigation, Navy Dept., Washington, D. C.

Ft. MacKenzie, Wyo.—Bids are wanted Nov, 20 for erecting, plumbing, heating and electric wiring a brick barrack building at Ft. MacKenzie. Address, Capt. R. L. Brown, Q. M., Sheridan.

Savannah, Ga.—Geo. A. Gilchrist, of Belfast, Me., is stated to have received the contract for constructing a dredge for use in the improvement of Cumberland Sound, for $150,000. Capt. Cassius E. Gillette, U. S. A., Savannah, Engr. in Charge.

Savannah, Ga.—Bids are wanted Nov. 21 for ballast, gangways, etc., at the U. S. Quarantine Station, Savannah. James Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C.

MISCELLANEOUS.

New Orleans, La.—Bids are wanted Nov. 19 for furnishing and erecting a steel shed, as advertised in The Engineering Record.

Portland, Ore.—The Port of Portland Commission has decided to build a 30-in. dredge, to cost approximately $165,000.

Cleveland, O.—The National Dock & Fuel Co. has been formed, with a capital of $300,000, to provide docking facilities in Cleveland for the Midland Coal Co. Geo. E. Tener, Pres.; S. M. Taylor, Vice-Pres.; M. K. Salsbury, Treas., and John A. Donaldson, Sec'y, all of Pittsburg, Pa.

Milwaukee, Wis.—See "Electric Railways."

Cleveland, O.—Bids are wanted Oct. 31 for constructing a retaining wall at the north end of Hamlet St. Chas. P. Salen, Dir. Pub. Wks.

Buffalo, N. Y.—Bids are wanted Oct. 31 for dredging Buffalo River and the City Ship Canal, including the removing of rock. R. G. Parsons, Sec'y Bd. Pub. Wks.

Two Harbors, Minn.—Local press reports state that the Duluth & Iron Range R. R. Co. has under consideration plans for the improvement of ore dock No. 4 at Two Harbors. Total cost of contemplated improvements, $160,000. R. Angst, Ch. Engr., Duluth, Minn.

Montrose, Colo.—C. M. Hammond, Pres. of the State Bd. of Control, writes that surveys for State Canal No. 3 are about completed (work to be done by convict labor), and the erection of barracks for convicts and machinery will be placed by Dec. 1. Probable cost, $400,000. J. A. Curtis, of Delta, Colo., Engr. in Charge.

Newport News, Va.—Thomas G. McKell, Pres. of the McKell Coal & Coke Co.; C. J. Wittenberg, Pres. of the Chesapeake & Ohio Coal & Coke Co., and others, are said to have purchased land on which it is proposed to construct what its projectors claim will be the largest and most completely equipped coal pier in this country.

Detroit, Mich.—Bids are wanted Nov. 1 for $81,000 park and boulevard bonds. F. A. Blades, City Comptroller.

Detroit, Mich.—Bids are wanted Oct. 28 for repairing 24th St. dock. D. W. H. Moreland, Commr. of Pub. Wks.

Kansas City, Mo.—Engr. Daniel Bontecou writes that no bids were received Oct. 15 by the Consolidated Electric Light & Power Co. for the construction of a 48-in. concrete tunnel 400 ft. in length, for supplying water from Kaw River to the power station.

Governor's Island, N. Y.—Bids are wanted Nov. 9 for rebuilding and extending wharf at Bedlow's Island, as advertised in The Engineering Record.

Philadelphia, Pa.—The lowest bid received Oct. 18 by Col. John V. Furey, Asst. Q. M., U. S. A., for the erection of a brick fireproof storehouse at Schuylkill Arsenal, is stated to have been from Cramp & Co., at $85,378.

NEW INDUSTRIAL PLANTS.

The H. Y. Haws Fire Brick Co., Curwensville, Pa., is being organized to erect a new plant, and will probably install two 100-H.-P. boilers and a 150-H.-P. engine.

The Alhambra Tile Co., Newport, Ky., is building a 3-story factory 110 ft. square, and will install a 40-H.-P. engine and a 50-H.-P. boiler.

The Clarksville, Ga., Tobacco & Mfg. Co. is thinking of equipping a warehouse with machinery to manufacture furniture.

M. Wakeman's Sons, Brockroad, Va., will build a 20 or 30-bbl. flour mill near that place and are in the market for a good second-hand engine.

The Dover, N. J., Boiler Works will erect an 80 x 150-ft. building, to be equipped with a 15-ton and a 5-ton traveling crane. The company will install its own power plant, which will be 80 H.-P.

The Rutland-Florence Marble Co., Rutland, Vt., has placed contracts for its mill, except those for machinery to be run by electricity, such as cranes, generator, engine, etc.

The Jernigan Lumber Co., Whitfield, Fla., will rebuild its plant, recently burned, to a capacity of 20,000 ft.

The Racine, Wis., Malleable & Wrought Iron Co., is building a 40 x 74-ft. foundry and needs electric motors, cupolas, tracks, turntables, etc.

William E. Louttit, Auburn, R. I., will erect a 3-story, 40 x 100-ft. brick laundry building in Providence, and install a 65-H.-P. engine, a 100-H.-P. horizontal boiler and a 300-light dynamo.

The Theo. Hamm Brewing Co., St. Paul, Minn., will build the following additions: A 3-story and basement, 48 x 212-ft. fireproof wash-house; engine house to contain a 320-ton refrigerating machine and electric plant and a boiler house to contain two 500-H.-P. water-tube boilers; a 4-story, 88 x 96-ft. fireproof addition to refrigerator house, and a 1-story and basement, 135 x 270-ft. bottling house. Oscar Beyer, 56 Fifth Ave., Chicago, architect.

Block & Co., Macon, Ga., are preparing to erect a 30-ton ice plant in Athens, Ga.

The American Laundry, 407 East Locust St., Des Moines, Ia., is about to erect a 40 x 132-ft. building, and may be in the market for a 14-ft. horizontal boiler of 42 ins. diameter.

The Central Station Heating Co., 110 E. 3d St., Cincinnati, O., will erect a new plant including boiler and steel works, forge and blacksmith shops, machine shop, foundry, engine and boiler rooms, pattern shop and storage rooms. The location is not fully decided.

The Colburn Machine Tool Co., Franklin, Pa., will erect a plant to include a 100 x 200-ft. machine shop, a 30 x 45-ft. engine room, a 25 x 45-ft. boiler room and a 30 x 50-ft. blacksmith shop. Electric transmission will be used.

T. J. Dudley & Sons and the T. U. Butts Lumber Co., Columbus, Ga., capital $100,000, will consolidate and build a new factory, to be equipped with shaving exhaust, elevators and electric light plant. The present steam power plant, with some additions, will be used.

Florsheim & Co., Milwaukee Ave. and Carpenter St., Chicago, Ill., contemplate erecting a new shoe factory. Plans have not been completed.

Armour & Co., Chicago, will erect a 416 x 924-ft. packing house of six and seven stories, at East St. Louis, Ill. A 2,400 H.-P. water-tube boiler plant with an equipment of mechanical stokers and coal-handling machinery, a 1,000-kw. electric plant, and a 250-ton refrigerating plant will be installed. A 9.5-ft. brick chimney will be built, 200 ft. high.

BUSINESS NOTES.

The Midland Portland Cement Co. has been incorporated with a capital of $1,000,000 by Orlando M. Packard, John L. Benedict, and Danton A. Foulk, all of Jersey City, N. J.

The Ball Engine Co., Erie, Pa., reports selling engines to the following: Pacific Coast Co., Seattle, Wash.; Cleveland, O., Macaroni Co.; Driskill Hotel, Austin, Tex., and the College of Physicians & Surgeons, Chicago.

The York Mfg. Co., York, Pa., reports the receipt of the following orders: A 30-ton ice making and refrigerating plant for the Palestine, Tex., Packing Co.; a 50-ton can ice plant for the Knoxville, Tenn., Ice Co.; a 60-ton ice plant for the Vicksburg, Miss., Ice Co.; a 60-ton refrigerating machine for the Houston, Tex., Packing Co.; a 25-ton can ice-making plant for the Consumers' Ice & Coal Co., Hopkinsville, Ky.; a 15-ton can ice-making plant for G. W. Sitton, Johnson City, Tenn.; a 125-ton refrigerating machine for the Moesrer Ice & Cold Storage Co., Topeka, Kan.; a 15-ton ice-making plant for the Nevada, Mo., Crystal Ice & Cold Storage Co., and a 40-ton can ice-making plant for the Crystal Ice Co., Weatherford, Tex.

J. Holt Gates, western agent for the Warren Electric and Triumph Electric Companies, reports the sale of two 60-K. W. 220-volt, 60-cycle, two-phase Warren alternators to the Sanitary District for the Drainage Canal at Lockport, Ill., to heat the various buildings by electricity with twenty-seven 5-K. W. American Electrical Co.'s heaters, and to light the offices and buildings by arc and incandescent lamps. Twenty arc lamps will be used for the illumination of the falls and grounds. Power will also be stepped up to 10,000 volts for the various bridges along the Drainage Canal.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Oct. 26.	Pumps, Washington, D. C. Adv., Eng Record, Oct. 5.	Oct. 5
Oct. 28.	Pipe, Atlantic City, N. J. Adv., Eng. Record, Oct. 12, 19.	Oct. 12
Oct. 28.	Fayette, Miss Adv., Eng Record, Oct. 12	Oct. 12
Oct. 30.	Pumping plant, Savannah, Ga Adv. Eng. Record, Oct. 12, 19.	Oct. 12
Oct. 30.	Pittsburg, Pa	Oct. 26
Nov. 1.	Greenwood, Ind	Oct. 26
Nov. 1	Hazlehurst, Miss	Oct. 5
Nov. 1.	Greenwood, Miss Adv., Eng. Record, Sept. 21 to Oct. 5.	Sept. 21
Nov. 1.	Randolph, Neb	Oct. 19
Nov. 2.	Plymouth, O Adv., Eng Record, Oct. 19.	Oct. 19
Nov. 4.	River Forest, Ill	Oct. 19
Nov. 4.	Raymond Minn	Oct. 26
Nov. 4.	Phoenixville, Pa Adv., Eng. Record, Oct. 26.	Oct. 26
Nov. 5.	Clarinda, Ia	Oct 26
Nov. 6.	Topeka, Kan	Oct. 26
Nov. 7.	New York, N. Y	Oct. 19
Nov. 9.	Kirkwood, Mo	Oct. 26
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
Nov. 12.	Grand Rapids, Mich Adv., Eng. Record, Oct. 12, 26.	Oct. 12
Nov. 15	Cincinnati, O	Oct. 19
Nov. 20.	Scammon, Kan Adv., Eng. Record, Oct. 26.	Oct. 26
Nov. —.	West Lebanon Ind	Oct. 19
Nov. —.	Farmersville, Tex	Oct. 12
Dec. 4.	Sale of pumping works Chicago, Ill Adv., Eng. Record, Oct. 12.	Oct. 12
Dec 17.	New York, N. Y	Oct. 19
Jan. —.	Walhalla, S. C	Oct. 26

SEWERAGE AND SEWAGE DISPOSAL.

Oct. 28	Harrisburg, Pa	Oct. 26
Oct 29.	Bedford, Ind	Oct. 26
Oct 29.	Hammond, Ind	Oct. 19
Oct. 30.	Beaumont, Tex	Oct. 19
Oct. 30.	Buffalo, N. Y	Oct. 26
Oct. 31.	Cleveland, O	Oct. 26
Oct. 31.	New Philadelphia, O	Oct. 12
Nov. 1.	Greenwood, Miss Adv., Eng. Record, Sept. 21 to Oct 5.	Sept. 21
Nov. 1.	St. Paul, Minn	Oct. 26
Nov. 2.	Canton, O	Oct. 26
Nov. 2.	Washington D C Adv., Eng. Record, Oct. 19.	Oct. 19
Nov. 4	Toledo, O	Oct 19
Nov. 4	St. Paul, Minn	Oct. 19
Nov. 4.	Emeryville, Cal	Oct. 19
Nov. 4.	Glenville, O	Oct. 19
Nov. 4.	Burlington, Ia	Oct. 5
Nov. 4.	Larchmont, N. Y	Oct 26
Nov. 5.	Decatur, Ill	Oct. 26
Nov. 8.	Hudson, N. Y	Oct. 12
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
Nov. 16.	Roswell, N. Mex	Oct. 19

BRIDGES.

Oct. 28.	Elkhart, Ind	Oct. 26
Oct. 31.	Livingston, Mont	Oct. 26
Nov. 1	Milwaukee, Wis	Sept 5
Nov. 4.	Buffalo, N. Y	Oct. 26
Nov. 4.	Vicksburg, Miss	Oct. 26
Nov. 4.	Ft. Collins, Colo	Oct. 26
Nov. 4.	Delphi, Ind	Oct. 26
Nov. 4.	Jackson, Mo	Oct. 26
Nov. 4	Kentland, Ind	Oct. 5
Nov. 5.	Princeton Ind	Oct. 5
Nov. 6.	Fowler, Ind	Oct. 26
Nov. 7.	Wilkesbarre, Pa	Oct. 26
Nov. 11.	Victoria, B. C	Oct. 26
Nov. 12.	Fargo, N. D	Oct. 19
Nov. 12.	Sherbrooke, Que Adv., Eng Record, Oct. 26.	Oct. 26
Nov. 16.	Lake Charles, La	Oct. 26
Dec 17.	Saginaw, Mich	Oct. 26
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

Oct. 28.	Hamden, Conn	Oct. 26
Oct. 29.	Columbus, O	Oct. 26
Oct. 29.	Louisville, Ky	Oct. 26
Oct. 30.	Buffalo, N. Y	Oct. 26
Nov. 1.	Greensburg, Ind	Oct. 19
Nov. 4.	Toledo, O	Oct. 12
Nov. 4.	Roseburg, Ore	Sept. 21
Nov. 4	Bloomfield, Ind	Oct. 5
Nov. 4.	St. Paul, Minn	Oct. 19
Nov. 4.	Gravel roads, Fowler, Ind Adv., Eng. Record, Oct. 19.	Oct. 19
Nov. 5.	Wellsville, O	Oct. 12
Nov. 5.	Washington, Ind	Oct. 26
Nov. 5.	Trenton, N. J	Oct. 26
Nov. 8.	Freemont, O	Oct. 19
Nov. 11.	Camden, N. J	Oct. 19
Nov. 12.	Troy, N. Y	Oct. 26
Nov. 12.	Wellsville, O	Oct. 26
Nov. 13.	Toledo, O	Oct. 19
Nov. 18.	Toledo, O	Oct. 26

POWER, GAS AND ELECTRICITY.

Oct. 26.	Power house on hospital grounds, Washington, D. C Adv., Eng. Record, Oct. 5.	Oct. 5
Oct. 29.	Brazil, Ind Adv., Eng. Record, Oct. 12, 19.	Oct. 12
Oct. 30.	Wiring State House, Columbia, S. C.	Oct. 19
Oct. 30.	Media, Pa Adv., Eng. Record, Oct. 19.	Oct. 19
Nov. 1.	Middletown, N. Y. Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Nov. 1.	Hazelhurst, Miss	Sept. 28
Nov. 1.	Burlington, Ia Adv., Eng. Record, Sept. 28 to Oct. 12.	Sept. 28
Nov. 1.	Muscatine, Ia	Oct. 19
Nov. 1.	Greenwood, Ind	Oct. 26
Nov. 1.	New Haven, Conn	Oct. 26
Nov. 1.	Gas engine, Holyoke, Mass Adv., Eng. Record, Oct 26.	Oct. 26
Nov. 11.	El. light plant franchise, Yazoo, Miss	Sept. 14
Nov. 18.	Franchise, Oakland, Cal	Oct. 26

GOVERNMENT WORK.

Oct. 28.	West Point, N. Y Adv., Eng. Record, Sept. 28 to Oct. 19.	Sept. 28
Oct. 28.	Wiring, etc., Altoona, Pa Adv., Eng. Record, Oct. 12, 19.	Oct. 12
Oct. 29.	Ft. Banks, Mass	Oct. 26
Oct. 30.	Cincinnati, O	Oct. 26
Oct. 31.	Fort Terry, N. Y Adv., Eng. Record, Oct. 5 to 26.	Oct. 5
Nov. 1.	Sabine Pass, Tex	Oct. 26
Nov. 2.	Ft. Banks, Mass	Oct. 12
Nov. 2.	Tompkinsville, N. Y	Oct. 19
Nov. 2.	Governors Island, N. Y Adv., Eng. Record, Oct. 5 to 26.	Oct. 5
Nov. 2.	Buildings, Boston, Mass	Oct. 5
Nov. 2.	Washington, D. C	Oct. 12
Nov. 4.	Ft. Monroe, Va	Oct. 12
Nov. 4.	Wharf, Norfolk, Va Adv., Eng. Record, Oct. 12, 26.	Oct. 5
Nov. 6.	Fitchburg, Mass Adv., Eng. Record, Oct. 5, 12.	Oct. 5
Nov. 7.	New York, N. Y Adv., Eng Record, Sept. 28, Oct. 5.	Sept. 28
Nov. 8.	Htg P. O. bldg., Altoona, Pa Adv., Eng. Record, Oct. 19, 26.	Oct. 12
Nov. 9.	Portsmouth, N. H	Oct. 26
Nov. 9.	Governor's Island, N. Y Adv., Eng. Record, Oct. 26.	Oct. 26
Nov. 14.	Portland, Ore	Oct. 19
Nov. 19.	Ft. Terry, N. Y Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Nov. 20.	Ft. MacKenzie, Wyo	Oct. 26
Nov. 21.	Savannah, Ga	Oct. 26
Nov. 21.	Mobile, Ala	Oct. 26
Nov. 22.	Sullivans Island, S. C	Oct. 26
Nov. 23.	San Francisco, Cal	Oct. 26
Nov. 30.	San Francisco, Cal	Oct. 12
Nov. 27.	Annapolis, Md	Oct. 26
Dec. 2.	Htg. apparatus, Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 3.	Wiring, etc., Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15

BUILDINGS.

Oct. 28.	Htg. truck house, Baltimore, Md	Oct. 26
Oct. 29.	Plumbing in pub. bldg., Dayton, O	Oct. 26
Oct. 29.	School, Kenosha, Wis	Oct. 26
Oct. 29.	School, Philadelphia, Pa	Oct. 26
Oct. 30.	School, Passaic, N J	Oct 26
Oct. 31.	School, Messina, Fla	Sept. 28
Oct. 31.	Library, Ft. Wayne, Ind	Oct. 12
Oct. 31.	Pub. bldgs., Nat. Military Home, Ind	Oct. 19
Nov. 1.	Library, Charlotte, N. C	Oct. 12
Nov. 1.	Htg., etc., school, New Haven, Conn	Oct. 26
Nov. 1.	Hospital, Winchester, Va	Oct. 26
Nov. 2.	Pub. bldgs., Cincinnati O	Oct. 26
Nov. 2.	Town Hall, Bloomfield, Conn	Oct. 26
Nov. 4.	Jail, Meridian, Miss	Aug. 31
Nov. 4.	School, Leavenworth, Kan	Oct. 5
Nov. 4.	Hospital, Birmingham, Ala	Oct. 19
Nov. 4.	Repairing Jail, Terre Haute, Ind	Oct 19
Nov. 4.	Fire station plans, South Bend, Ind	Oct. 19
Nov. 5.	School, Rowena S. D	Oct. 26
Nov. 6.	Hospital, Des Moines, Ia	Oct. 26
Nov. 7.	Jail, Akron, Pa	Oct. 12
Nov. 8.	Htg. post office, Digby, N. S	Oct. 26
Nov. 9.	School addition, Washington, D. C.	Oct. 19
Nov. 11.	Hospital, Johnson City, Tenn Adv., Eng. Record, Oct. 12 to 26.	Oct. 12
Nov. 11.	Court house, Reidsville, Ga	Oct. 5
Nov. 11.	Court house plans, Crowley, La	Sept. 21
Nov. 11.	Htg court house, Mauston, Wis	Oct. 19
Nov. 11.	Elevator in school, Cleveland, O.	Oct. 26
Nov. 14.	Pub. bldg., National Soldiers Home, Va	Oct. 26
Nov. 14.	Add'ns, etc., to Capitol, Tallahassee, Fla	Oct. 5
Nov. 18.	Court house, Jackson, Miss	Oct. 19
Nov. 22.	Court house, Greenville, Ga	Oct 12
Nov. 30.	Capitol plans, Harrisburg, Pa	Aug. 31
Dec. 1.	Library plans, Fresno, Cal	Oct. 26
Dec. 2.	Court House, Hazelhurst, Miss	Oct. 19
——	Machine shop, Niagara Falls, Ont Adv., Eng. Record, Oct. 26.	Oct. 26

MISCELLANEOUS.

Oct. 28.	Repairing dock, Detroit, Mich	Oct. 26
Oct. 31.	Cleveland, O	Oct. 26
Oct. 31.	Dredging, Buffalo, N. Y	Oct. 26
Nov. 1.	Garbage crematory, So. Bend Ind.	Oct. 5
Nov. 1.	Street cleaning, New York N. Y	Oct. 26
Nov. 5.	El. Ry. franchise, Los Angeles, Cal.	Oct. 12
Nov. 6.	Canal, New Orleans, La	Oct. 19
Nov. 11.	Dock Michigan City, Ind	Oct. 19
Nov. 11.	El. Ry franchise, Whittier, Cal	Oct. 12
Nov. 11.	El Ry. franchise, Yazoo, Miss	Sept. 14
Nov. 16.	Garb. crematory, Canton, O	Oct. 26
Nov. 19.	Shed, New Orleans, La Adv., Eng. Record, Oct. 26.	Oct. 26
Dec. 31.	Incinerators, Calcutta, India	Aug. 3

THE ENGINEERING RECORD.

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Reliability of Electrical Engineering in Power Development Undertakings.

So much has been written and said concerning the large Niagara Falls power plant that anything more on the subject at the present time must suffer from lack of novelty, whatever its merit. Yet no reader of The Engineering Record interested in water-power and electric stations should fail to read a paper by Mr. L. B. Stillwell on "The Electric Transmission of Power from Niagara Falls," presented at the last annual meeting of the American Institute of Electrical Engineers. This recites in a masterly manner from full knowledge the history of this great power plant, although some of the difficulties encountered by the promoters and their technical staff are not given all the prominence they might receive from another author. At the time this development of power was first talked over, electrical transmission was a branch of engineering still in its infancy, and a conception of the new and complicated problems which had to be met by the engineers in designing the original plant can be formed only by considering the manifold uses to which the energy of Niagara Falls is now successfully applied, and the wide territory covered by the electrical power-distribution system.

There was no precedent to assist in the selection of the type and design of generators best suited to the work, of the voltages to be used, or of the best method of distribution. In fact all the details were necessarily new, and their design and subsequent utility in practical service depended upon the inventive ability of the engineers. As Mr. Stillwell states, "the plant is a demonstration of the ability of applied electrical engineering science to attain in commercial practice results predicated, in large degree, upon theory." Confidence in the engineering profession is necessarily inspired when an engineer of Mr. Stillwell's standing asserts that if the Niagara Falls Power Company were facing to-day the same problem it solved in 1893, and should bring to bear upon it the same comprehensive and thorough-going methods which characterized the work at that time, the designs, based upon eight years' experience, would be so nearly identical with those previously adopted that the cost of power delivered to users would not be affected to the amount of one dollar per kilowatt-year.

It is seldom that so forcible an illustration of the wisdom of engaging competent expert advice is furnished, and, while it is gratifying to engineers in allied divisions of the profession to note that electrical engineering, as exemplified by the Niagara plant, may be considered as established upon a basis as certain and permanent as other branches, the attention of the reader is particularly called to the policy of the directors of the Niagara Falls Power Company in the matter of the design of their plant. The leading specialists of this country and Europe were engaged, with Dr. Coleman Sellers as chief engineering adviser to the board of directors. The question of the expense of engineering advice was not considered, and after eight years of operation we have this unequivocal and practical testimonial to the wisdom and far-sightedness of the officers of the company in pursuing this policy. It is unfortunate that, in this country particularly, so many industrial enterprises involving engineering problems are hurried through to completion without proper technical consideration. It is still more unfortunate that, in many instances, the capital invested is handled by men who are blind to the importance of scientific advice, and that capital itself, in its eagerness to obtain immediate returns, considers first cost, to the exclusion of permanency and low cost in operation.

A Manufacturer's Right to His Name.

The United States Circuit Court for the Northern District of California rendered a decision on September 25 which will doubtless please every manufacturer who aims to produce goods or apparatus of the highest quality and of individual peculiarity of design. It has occasionally happened that a firm introduces a type of machine or apparatus of special design, which design becomes popularly known by the maker's name. When the patents controlling the main design expire, it can be made, of course, by others. These imitators have sometimes also taken with the design the original maker's name, which has been long associated not only with the type, but also with good material and workmanship. Such a taking of a firm name, with or without other words, is now declared to be contrary to our laws.

The subject came up in a suit brought against a California firm by the Babcock & Wilcox Company. This corporation, with its predecessor, the firm of Babcock & Wilcox, has built up a high reputation for its steam apparatus by employing the best quality of workmanship and materials. The name "Babcock & Wilcox" was used from the outset by the men interested in the business as their trade name, and the Circuit Court now rules that the name identifies exclusively the steam apparatus manufactured by the company and its quality, durability, efficiency and safety, due to the care, experience, workmanship, materials, methods and tools employed by the company, and distinguishes it from all apparatus of whatsoever form or character made by other manufacturers.

The defendant, in the case tried, offered for sale, under the name "Standard Babcock & Wilcox," boilers not manufactured by the Babcock & Wilcox Company. The court declared this an infringement of the company's right to its trade name and issued a perpetual injunction enjoining the defendant "from using the name 'Babcock & Wilcox,' either alone or combined with other word or words upon or in connection with the sale or offering for sale of any boiler or other steam apparatus not manufactured by the complainant, and from stating or representing that any boiler or other steam apparatus sold, or dealt in by the respondent and not manufactured by complainant, is a Babcock & Wilcox boiler, and from selling or offering for sale, or passing off any such boiler or other steam apparatus as and for boilers or steam apparatus manufactured and sold by complainant."

This is a decision which every manufacturer ought to applaud on the ground of his business interests, if for no other reason. The general use of the name of a going concern to designate a type of apparatus introduced by them but now made by competitors, is the very best advertisement the original makers can desire, from one point of view, for when these competitors call the apparatus by the name of its original builder they give notice to the world that they are merely copying some other people's ideas. On the other hand, the original maker suffers from the poor grade of some of the apparatus bearing his name, but not up to the quality of his own product. Hence no one is really the gainer by such a course, and fortunately the check given it by the court adds the power of law to the urging of reason toward abandoning the practice.

Steam Engineering in the Navy.

A few years ago engineers of all branches of the profession united in an endeavor to obtain a change in the regulations regarding the steam engineering personnel of Navy Department, and the unusual interest in the movement will not be forgotten soon. Owing largely to the favorable report of President Roosevelt, then assistant secretary of the department, those changes most strongly urged by the Bureau of Steam Engineering were made by Congress. It has been evident from the first trials of the new system that the desired results were not likely to be obtained, and in Rear Admiral Melville's latest report, just published, he states without qualification that there has been a retrogression rather than an advance along steam engineering lines during the last two years. The practical working of the new regulations has been, in great part, to take the junior half of the old engineer corps and transfer them to line duties. While individual officers have striven to perfect themselves in engineering duties, no systematic measures have been taken to train officers for the engineering needs of the future, although it was understood when the bill was passed that such measures would be adopted by the Secretary of the Navy. The line offers greater attractions than the engineering service to young officers under the present interpretation of the personnel bill, and they naturally accept the most attractive duties.

It is not open to argument that a skilled engineering force may have the greatest influence on the result of a naval fight. Spanish officers have borne witness to the discouragement caused by the celerity with which the 16-knot battleship Oregon overhauled the 20-knot armored cruiser Colon. The result of that chase was due to the engine-room force on the two ships. That is one picture. For another, look at the present broken-down condition of our torpedo boats. The decrease in the efficiency of their machinery since the demoralization of the steam engineering corps was begun has been very great; the deterioration on the larger vessels has not become marked yet, but that it is taking place cannot be truthfully denied. It is imperative for the good of the service, for the protection of the people who maintain the navy, that such a condition should cease. Admiral Melville says it will come to an end if the Secretary will interpret the personnel bill as Congress expected. The policy of detailing junior officers of the line exclusively to engineering duties should be greatly extended. A post-graduate course in marine engineering should be established at the Naval Academy for the junior line officers who desire to familiarize themselves with the subject. At least two war vessels should be used in part for the training of firemen, as is done in foreign navies. Several torpedo boats should be kept in commission for training the machinists and water tenders on such craft. Instruction in naval duties should be provided for the young and inexperienced machinists enlisted in inland cities, and the warrant machinists should be placed on the same footing in every respect as other warrant officers. Special pay should be given to the warrant machinists of torpedo boats, as is already the case with certain warrant deck officers.

Whether these recommendations will have the desired result is a question which demands more space for its discussion than can be afforded at this time. The details of naval regulations have been discussed so fully, indeed, that the fundamental fact at the basis of the whole matter has often been dropped out of sight. It is human nature to take up those opportunities which afford the most honor and pay. That is the fact which is entirely overlooked by those people having such a strong bent of mind toward engineering that the drawbacks of their work are largely offset by the pleasure it affords them. Even among men engaged in engineering work, the enthusiasts are very few in number, for most people are engaged in it largely as a matter of chance. While it is reasonable to expect that a rather larger percentage of the young men at the Naval Academy are more interested in mechanical subjects than the same number at a civilian university, it is out of all reason to expect that enough of them will, under existing conditions, voluntarily enter the engineering corps, where the service is far harder, promotion slower and honors far less. The line officers may regard the proposal as rank injustice, but it seems to the unprejudiced civilian critic that the United States Navy Department ought to follow the example of private corporations and raise the pay of its engineer corps to a level much above that of the line officers of the same rank. The delicate punctilios of naval precedence will thus suffer no shock, and the greater difficulties and additional discomforts which fall to the lot of the engineer officer will have some reward. Under the present conditions the steam engineering department seems to offer about as much attraction to a Naval Academy graduate as a steady job in some cross-roads blacksmith shop.

The Good Roads Special Train which the Southern Railway is sending over its system as a missionary enterprise has twelve cars, a full equipment of road-building machinery, and a staff of eighteen men, including Mr. Martin Dodge of the office of Public Road Inquiries and President W. H. Moore, of the National Good Roads Association. The train will stop at about a dozen leading southern cities, and a practical demonstration will be made at each of the method of constructing roads suitable to the locality. Such trains have already been run over the Illinois Central and the New York Central, with good results in the way of increased interest in good highways.

Asphalt Pavements in the Borough of Manhattan, New York.

By Edward P. North, M. Am. Soc. C. E.

The third annual report of the Department of Highways of the city of New York has recently appeared as a handsomely published book of 253 pages. The street work of the American metropolis is naturally a subject of much interest, and it may not be amiss, therefore, to compare some of the statements in the report just issued with similar statistics in two other reports issued by the city. These are "Asphalt and Asphalt Block Pavements Laid in the Borough of Manhattan, New York City, up to January 1, 1901," and "Memorandum of Asphalt Pavements laid in New York up to January 1, 1898." To save space these documents will be referred to in the following notes as the first, second and third reports, respectively.

In the first of these reports, as in preceding ones, the commissioner has treated each of the five boroughs as an isolated city; hence there is neither summary of results accomplished nor comparison of methods employed. In fact there is not even a summary of improvements made in any one borough; and the Society for Improving Municipal Accounts might, with advantage to the taxpayers of this city, refer to the marked dissociation between quantities and costs in the commissioner's report and in the financial statement.

The wrong-headedness of the New York charter makers of four years ago in refusing to require that the heads of our great technical departments should be men of technical education, who had had wide and satisfactory experience in designing and executing works of like character to those they were to oversee, instead of leaving the positions open to the grasp of any local political magnate desirous of greater income, is no more clearly shown in the report under consideration than in other reports of the city departments that have come to the writer's notice during the past three years. The last charter revision committee unfortunately learned nothing from the testimony of various commissioners before the Mazet committee or their declarations in connection with the proposed Ramapo charter, and we apparently may expect for an indefinite time a succession of irresponsible and unsuitable commissioners presiding over great interests and more or less successfully kept in the right path by engineers of greater or less ability.

The report, however, is not entirely devoid of interest and information. Both the engineer of the Bronx and of Brooklyn give information in well-arranged tables; and the last mentioned refers to the absurd studies in cements of the Commissioners of Accounts, who seem to share with Deputy Chief Devery the distinction of being the only city officials who have incurred the mayor's public endorsement. The Brooklyn engineer of highways says: "Natural cement has been used on all assessment work, as it is somewhat cheaper and gives very satisfactory results. We have been criticized for using it by some who seem to judge the value of a cement for such purposes solely from apparent hardness of the concrete within a short time after it has been placed in position, and who have evidently had little experience in the use of natural cements. The fact that of the 17,628,833 barrels of cement used in the United States in 1899 62 per cent. was natural rock cement, shows that it is still highly esteemed by those using cements understandingly."

Possibly for political purposes, some writing has been done relating to prices for asphalt pavements in the Borough of Manhattan. The prices paid up to and during the Strong administration, i. e., up to the close of 1897, and those that are paid now are not directly comparable for political or other purposes, as they do not cover the same items. The prices paid for asphalt pavement up to the close of 1897 covered not only furnishing and laying the asphalt, but also relaying the old stone pavement as a foundation, with dressing and resetting old curbstones. These are now separate items, and at least an inspection of each final estimate would be necessary to arrive at a conclusion that might not be misleading. At the close of the Strong administration the last above-mentioned "Memorandum" was compiled and printed, covering the locality, foundation and area of asphalt pavements, the price per square yard, date of acceptance and years of maintenance, with the price of maintenance per year in cases where maintenance contracts had been made. It was strongly hoped this would form a part of the report of the last Commissioner of Public Works of the old City of New York, but it was suppressed more ruthlessly than the main text of that report. It showed the cost of any or all asphalt pavements in the city. This year a limited circulation has been given to the second report, the list of pavements laid in the city up to January 1, 1901, but this document does not contain any areas, and in some instances the price given for asphalt laid before 1897 seems to have been arbitrarily advanced from that mentioned in the contract. These inaccuracies have, as far as possible, been corrected, and the required areas supplied, in compiling the figures summarized in the last small table below.

Reminding the reader that, under the law, a pavement paid for by assessing the property directly benefited cannot have its maintenance and repair for over five years provided for in the contract, and that up to the close of 1897 substantially all contracts for asphalt pavements paid for by appropriation from general funds, taxation or bonds, specified a maintenance of fifteen years, the following table, showing the prices paid to the nearest mill, is presented. It is divided into two periods, viz., for the administrations of Mayor Gilroy as both commissioner of public works and as mayor, ending with the close of 1894, and for that of Mayor Strong, ending with 1897, during which Mr. William Brookfield and Gen. C. H. T. Collis were Commissioners of Public Works.

Gilroy Administration to End of 1894.

	Area, sq. yds.	Aggregate cost	Cost per sq. yd.
5-year	166,626.2	$537,099.91	$3.223
15-year	951,202.4	3,644,292.35	3.831

Strong Administration to End of 1897.

	Area, sq. yds.	Aggregate cost	Cost per sq. yd.
5-year	123,663.0	$319,002.06	$2.580
15-year	1,386,071.9	4,383,394.74	3.162

It will be immediately noticed that during the Gilroy administration the difference in the average costs of five and fifteen-year pavements was $0.608, and this difference fell during the Strong administration to $0.582. This, it is believed, is the first time any large body of data has been consulted on the question of long or short terms of maintenance. The statistics are untainted and the areas are very large, so that the influences of local circumstances are greatly eliminated. The only noticeable difference in the specifications of the two periods is that those of the Strong administration were much the more rigorous of the two. The onerous provision that a pavement should be repaired whenever a depression in its surface of ½ inch could be found under a 4-foot straight-edge was, it is believed, the first time written during the Strong administration. Though this applied equally to both five and fifteen-year pavements, it is undoubtedly harder on the fifteen-year than on the five-year contractor. It is interesting and valuable to note that though contractors have always protested, and still do, against long-time maintenance contracts, the consensus of their opinions, as indicated above, is clearly that increasing experience shows them to be less onerous than at first thought.

The comparative account between the two terms of maintenance may be stated as follows, first premising that in the case of five-year maintenance contracts payment is made in full on acceptance, reliance being had on the sureties for the five years of maintenance; while in the case of fifteen-year maintenance contracts, 70 per cent. is paid on acceptance and the remaining 30 per cent. is paid in ten annual payments, commencing with the sixth year, sureties being also required. Also, during the Strong administration, contracts for ten years maintenance were made, as shown in the "Memorandum," covering 34 different prices of asphalt, at an average cost per annum of 7 cents per square yard. With these data, taking the prices and quantities of the Strong administration as a basis, and neglecting interest, we have for 1,386,071.9 square yards:

For Fifteen-year Contract.	
1st payment; 70% of $3.162	$3,068,376.32
10 annual payments, commencing with 6th year	1,315,018.42
Total for 15 years	$4,383,394.72
For Five-year Contract.	
1st payment, $2.58	$3,576,065.50
10 annual payments of 7 cents, commencing with 6th year	970,250.33
Total for 15 years	$4.546.315.83
Loss to the city	162,921.11

This last sum, it seems, with interest on about half a million dollars, would have been an absolute loss to the city if five-year maintenance contracts had been made, as in many cities, and the figures seriously question the judgment of engineers who advocate short terms of maintenance. The clause providing for fifteen-year maintenance was insisted on by Mayor Gilroy, and was not questioned during the Strong administration.

The table giving the prices of asphalt during the administrations of Mayors Gilroy and Strong shows a very marked reduction in costs in the three years ending with 1897, as compared with the prices paid up to and including 1894. When Mr. Brookfield assumed the duties of Commissioner of Public Works there were rumors of a combination between the asphalt contractors bidding for work in this city. He opened the way for additional competition, which policy was continued by his successor, with the result that the average prices per square yard stood as below:

Guaranty period.	5-year.	15-year.
Gilroy, including 1894	$3.223	$3.831
Strong, including 1897	2.580	3.162
Differences	$0.643	$0.669

If the prices of the Gilroy administration had been paid for the area laid under the Strong administration, the cost to the city would have been, in round numbers, one million dollars in excess of the actual cost.

The list published by the present administration, report two, shows that in conformity with the specifications, contracts are made for 5, 10 and 15 years' maintenance. The quantities and prices of the work contracted for since the close of 1896 are tabulated below:

	Area, sq. yds.	Aggregate cost.	Cost per sq. yd.
5-year	13,263.7	$39,236.06	$2.958
10-year	152,299.6	436,629.72	2.867
15-year	115,456.0	486,681.26	4.215*

* Fifty thousand yards of this 15-year work is on heavily traveled portions of Broadway, which accounts in part for a portion of this high figure.

These figures do not strengthen the theory advanced when discussing the relation between prices paid during the Gilroy and Strong administrations under their maintenance contracts. They are probably, from some cause, misleading.

Reference has been made to the fact that under the present specifications a separate price is bid for relaying the old stone pavements to serve as a foundation for the asphalt pavement, and that a separate price is bid for redressing and resetting old curbstones; both of these items were, before 1898, included in the cost of the asphalt pavement. An average, too rough to be more than an approximation, would put the present contract price for redressing and resetting old curb at 50 cents, and the price of new curb at $1. As there are 3 1/3 square yards of pavement per running foot in most streets, if we assume the curb to be half old and half new, it would now cost $1.50 per running foot, as against 50 to 60 cents under the old form of specifications. But this curb at present is undoubtedly better dressed than previously, and 75 cents per foot, or 22.5 cents per square yard, would probably be a liberal estimate for the increased cost. This may show that the old bluestone ring has its foot on its native heath, the New York taxpayer's neck, again, or this additional sum may be used to decrease the price of the asphalt. This may be possible, as the retained percentage is now calculated merely on the price of the asphalt, and its application in the case of the ten-year asphalt would bring its cost up 13.4 cents above the five-year. But the price of the fifteen-year pavements, already high enough, would also be augmented.

By the same rough approximation the price paid for repaving with old blocks as a foundation for asphalt may be put at about 40 cents per square yard; 12 cents would be a good price for this work. But quid nuncs insinuate that no part of this goes to the asphalt contractors, and that it saves a great deal of trouble to subcontract the paving before the bidding.

In view of these complications, the writer is of the opinion that the second report mentioned at the outset, contains no valuable information bearing on maintenance contracts. But in view of the value of a trustworthy comparison of 5, 10 and 15-year terms of maintenance, the hope is expressed that some of the engineers in the Department of Highways may be allowed to clear up the anomalies, so that the costs to municipalities of different terms of maintenance may be more clearly established than at present.

The New Boiler Plant of the United Railways & Electric Company, Baltimore.

The United Railways & Electric Company was formed by the consolidation of the Consolidated Railway Company, Baltimore City Passenger Railway Company and the several electric lighting companies established in Baltimore. At the present time it has twelve or thirteen power stations, but it is intended ultimately to consolidate these various stations under one roof. The beginning of this movement was inaugurated by the construction of the boiler plant which is the subject of this article. The 94 x 131½-foot building, which is of the steel-cage construction, with brick walls and slate roof, is built on piles on 2½-foot centers and 16 feet long, and is located directly on the water front and adjacent to one of the present power stations of the company.

The concrete for the foundation is laid on top of and around the piles, the pile heads extending into the mixture 6 inches, as shown in the accompanying cross-section of the building. The thickness of the concrete under the supporting columns is 7½ feet, and under the stacks in the center of the building 13½ feet. The foundation for the stacks is carried throughout the length of the structure, space being left at each end for a passage between the basements on each side. The basement floor is 3 feet thick. Although the surface of the ground at the site of the power station is not more than 3 feet above high tide and the basement floor is below tide water, no trouble has been so far experienced from seepage.

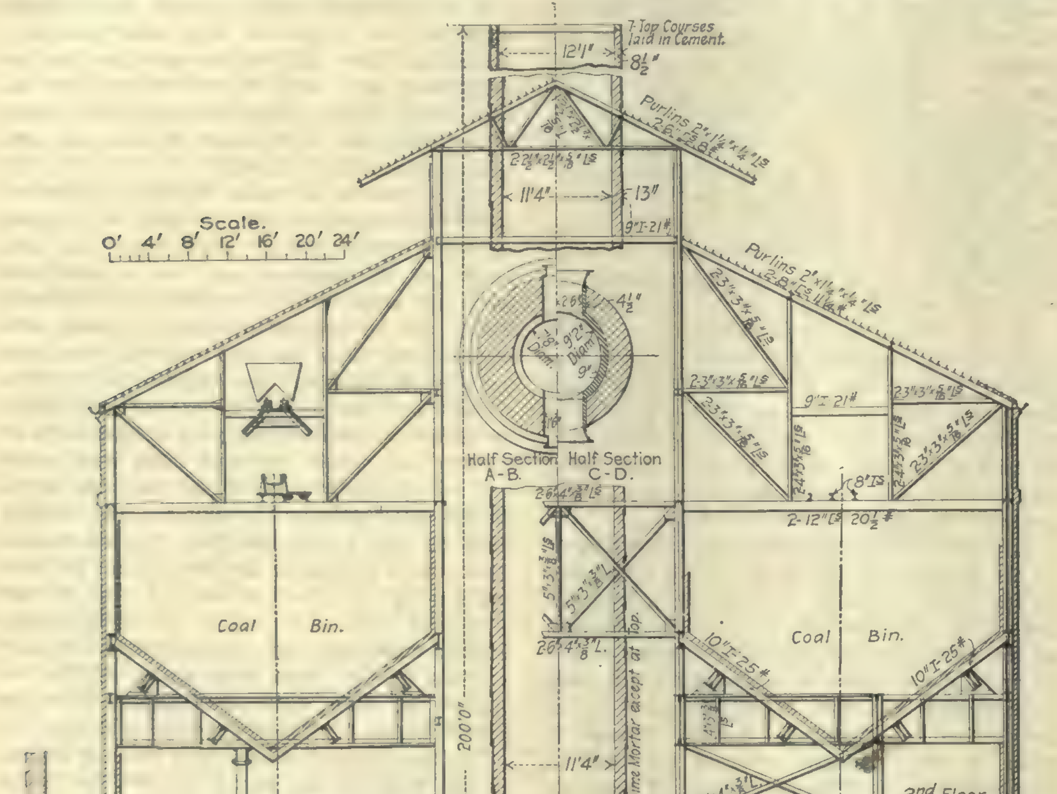
There will be installed eventually 16,000 horse-power, of which 4,000 horse-power is now in place, the present installation of boilers being used to supplement the boiler plant of the old station adjacent and to furnish steam for several large new units which have been recently installed there. The remaining portion of the new boiler house will contain boilers intended to furnish steam for a new power station, to be erected next to the boiler plant and on the opposite side from the old station. The boilers are of the Babcock & Wilcox make and are of 500 horse-power each, placed in batteries of two. There will be four batteries on each side, making eight on each floor. Each stack will be connected with four batteries, two on the lower and two on the upper boiler-room floor, or a total of 4,000 horse-power to each stack. Each boiler has 216 4-inch tubes, 18 feet long, laid 12 high and 18 wide, and two 42-inch drums, 22 feet long.

Roney stokers are used, driven by 6-horse-power Westinghouse engines with 4½ x 6-inch cylinders. The driving shaft runs the full length of the building and two engines are used, one connected to each end of the shaft. There will be two such engines on each side of the lower floor and the same on the upper boiler room floor, or eight engines in all. The stokers are equipped with special drip pans, as shown in the accompanying cross-section of the fire box, which are kept filled with water and are designed to catch the fine coal which always sifts through the stokers and usually finds its way to the ash pans and is wasted. This coal is reclaimed and used again, the saving amounting to about one per cent. of the coal used. The feed pumps are of the Blake vertical compound type, with cylinders 10 and 18 x 10 x 18-inch. One such pump will be installed for each 4,000 horse-power, or eight pumps in all. The pumps are in duplicate.

The feed water is taken from the city mains, as the water in the harbor is unfit for boiler purposes. It passes around the engine bearings of the large direct-connected units in the engine room, adjoining the new boiler house, and from there passes through National heaters to which the exhaust from the main engines is carried. From these heaters it is conveyed to Warren-Webster open heaters, as shown on the accompanying section, to which the exhaust from the auxiliary engines and pumps is carried. The temperature of the feed water delivered to the boilers is 208 degrees Fahrenheit. Double blow-off valves are used, and the boilers are also equipped with Pierson's automatic check valves, attached directly to the steam nozzles on top of the boilers.

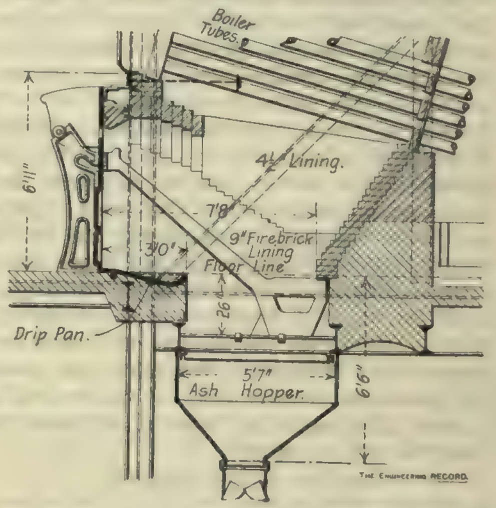
The stacks are constructed of steel, with brick lining. They are 200 feet high and 13½ feet inside diameter. The breeching connecting the boilers with the stack is of sheet steel covered with asbestos plaster. Cleaning doors are provided in each stack, situated on the level of the lower boiler-room floor. There are four openings for the smoke flues, two for two of the lower batteries on opposite sides of the house, and two on the upper floor level for two batteries on opposite sides of the upper boiler room floor. The ash pans are shown in the accompanying section of the fire box. The coal is conveyed to the boilers from the storage bins by gravity through movable hoppers which deliver the fuel to the stoker hoppers. All the steam mains are extra-heavy welded flange pipe. The piping was erected by the Thomas C. Basshor Company, of Baltimore. All piping except the blow-off pipe is carried overhead on specially constructed galleries. As the windows extend above the floor of the galleries ample light and easy facilities for repairs are obtained. The main steam header for each set of four batteries is 16 and 20 inches in diameter. There will be four such headers, equipped with W. A. Pearson's expansion joint. The Holly gravity return system is used, and all condensation from the steam mains is returned to the boilers.

Coal is delivered to the power station either by rail or by water. A hoisting tower, shown in the accompanying drawing, is located at the eastern end of the building for handling the coal from either cars or vessels. The towers are 183 feet high, and it is planned to use the duplicate tower when the boiler plant is increased. The engine platform is 120 feet above the street surface and the loading or car platform 102 feet. The present plant is capable of handling 50 tons of coal per hour, which will give a total capacity of 100 tons per hour when the plant is complete. The construction of the lower portions of the tower is interesting, and was adopted on account of the necessity of allowing the passage of cars, locomotives and traffic on the street below, and also to provide space for the passage of the buckets when unloading from cars. A horizontal boom 52 feet long extends over the water, and the buckets are lowered by means of a cable passing over a pulley carried on the boom truck, which runs back and forth on tracks or guides carried on the boom and is adjusted to different positions along the latter, from which it may be desired to do hoisting, by means of a special cable attached to a separate drum on the engine platform, which is operated by the engineer. The drums operating the bucket hoists and boom truck are operated electrically by motors geared to the drums. The electric installation is particularly interesting in view of the service required.



Cross-Section of Boiler House, United Railways and Electric Co.

The requirements are, one round trip of a bucket weighing 2,900 pounds, with its load of coal weighing 2,200 pounds, more or less, in 72 seconds, the guaranteed performance being 50 tons per hour. As time is consumed in loading and unloading the bucket, the available time for accelerating, lifting and lowering is reduced, and consequently the speed of accelerating, lifting and lowering must be increased. As the turning effort is transmitted through gears to the hoisting drums, it is essential that the gears be not subjected to shock by too sudden application of power. In order that the acceleration may be smooth and at a rate depending upon the will of the operator, the armature of the hoist motor derives its current from a generator which is motor-driven. The fields of the hoist motor are excited directly from the feeder which supplies the power for the motor driving the generator. A foot-operated rheostat having a considerable range of resistance is introduced in the field circuit of the generator and the exciting current obtained from the same source as the main motor. As the generator is driven at a constant speed, its E. M. F. is proportional to its field, which is controlled by the operator. The current flowing through the armature of the hoist motor is proportional to the E. M. F. of the generator, and as the armature of the hoist motor revolves in a constant field, its torque is, therefore, proportional to the field strength of the generator, which is, as before stated, controlled by the operator. Lowering the bucket is accomplished by braking, which is to be abandoned in favor of an arrangement whereby the hoist motor will be used as a generator, converting the force of gravity into electrical power, the reverse of the operation of the hoisting. It can be readily seen that where so many operations must be performed during such short intervals it is a difficult problem to secure a motor which works satisfactorily, and at the same time the cost per unit of electric power generated in the central station adjacent is much less than the cost of steam power.

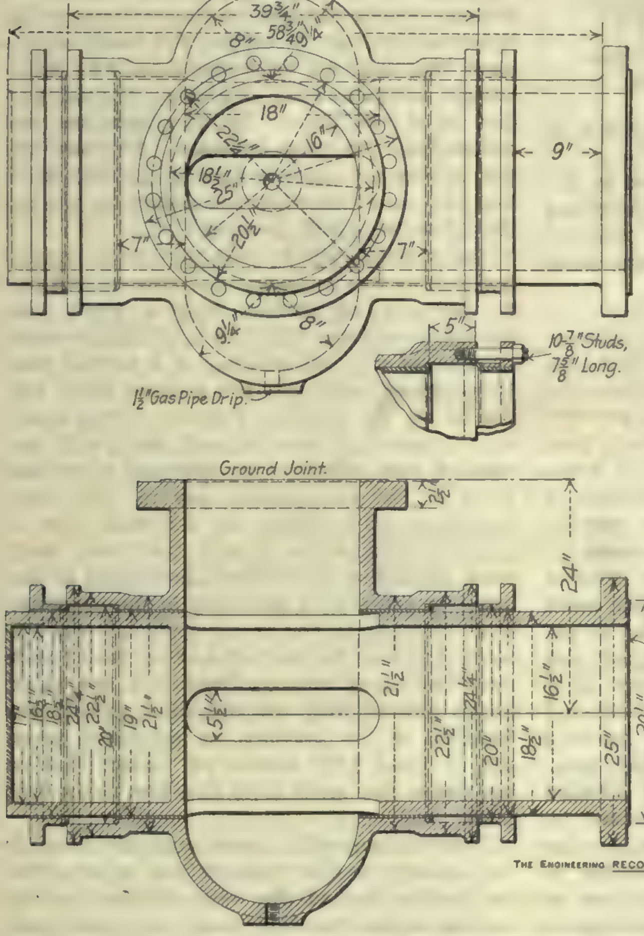


Section of Fire-Box and Ash Hopper.

The coal hopper is situated on the front of the tower on the engine platform, and the coal after being dumped in the hopper is weighed and passes to a crusher suspended from the engine platform floor. After passing the crusher the fuel is dumped into a car, which is placed under the hopper on the car platform. The railway is automatic, and two men only are required to handle the coal after it is loaded into the buckets, one to operate the motors and one to unload the buckets. The operation of the railway is as follows: The car after loading runs down the track over the coal bins by gravity. When the loaded car reaches the end of its journey it has raised a counter-balance weight to a certain height by means of a steel wire cable which the car picks up while descending. After the load has been automatically dumped, the impulse received by the car from the fall of the counter-balance weight is sufficient to return the empty car back up the grade to its starting point. The car may be made to dump at any point along the track. The coal handling machinery, as well as the ash conveyor, were erected by the C. W. Hunt Company, of New York.

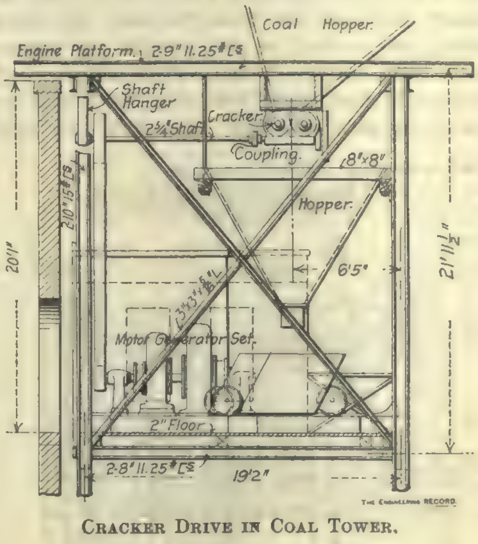
The ash conveyors are shown in one of the accompanying cuts. The ashes are removed from the hoppers under the fire boxes by gravity and conveyed to an ash chute at top of the building, where they are dumped by gravity to the ash tank located on the hoisting tower. From this tank the ashes may be drawn and hauled by cart, in cars or in vessels.

The framework of the building is supported on seventy-four columns arranged in six longitudinal and nine transverse rows, five of the latter being double rows. The distance between the transverse rows is 15¼ feet except in the end panels, where it is 19 feet 1½ inches. The distance between the longitudinal rows is 13½ feet in the side panels, 24 feet 8 inches in the center panel, and 20 feet 3½ inches in the intermediate panels. The double rows of columns are required to accommodate the boiler settings and the columns in them are 4 feet apart transversely. The framework is symmetrical about both the longitudinal and transverse center lines. The wall columns are built solid into buttresses in the brickwork, and have I-shaped cross-sections made up of a web plate and four angles, except in one end wall, where, like the interior columns, they have H-shaped cross-sections, made up of a web plate and four Z-bars.



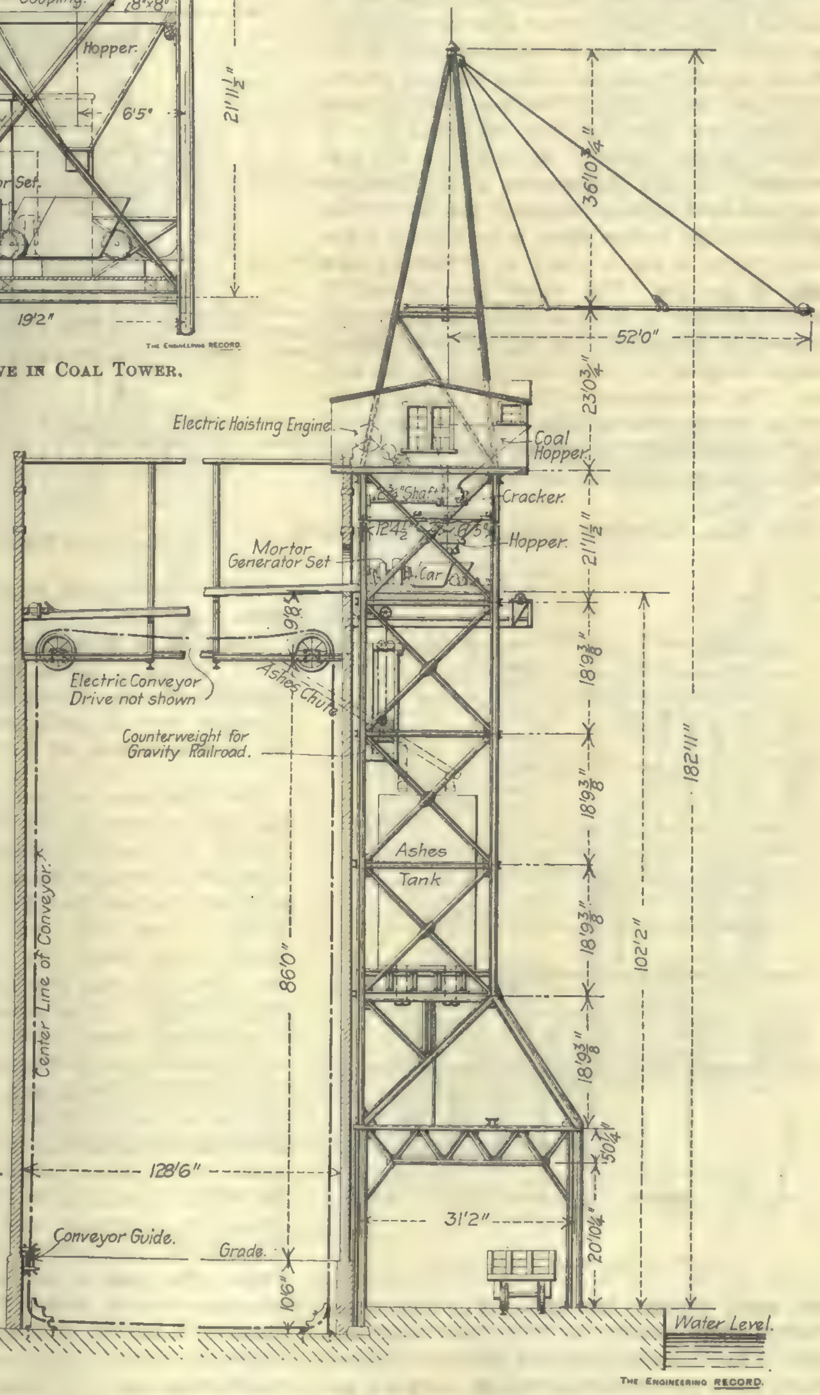
HIGH-PRESSURE PEARSON EXPANSION JOINT.

There are two main floors, each supporting a tier of boilers, and each divided into eight duplicate panels with two boilers in each panel. In the first floor the four panels on one side of the building are entirely separate from those on the other side, and there is no connecting floor platform between them. On the second floor, however, the two sides of the building are connected by transverse 10-inch I-beams, which support 5-inch transverse and longitudinal beams and channels on which iron gratings are laid, making an open floor through which there is free ventilation, and the hot air continually rises to the roof louvres. Between each row of boilers and the side wall there is in the first and second stories a mezzanine floor about 13 feet wide, above the firemen's working floor, on which the pipe lines are supported and are all readily accessible. This floor is carried on 8-inch transverse I-beams 15 feet apart, which are supported at the outer ends on the wall beams and at the inner ends by longitudinal trusses which connect the columns and support the second-floor beams.



CRACKER DRIVE IN COAL TOWER.

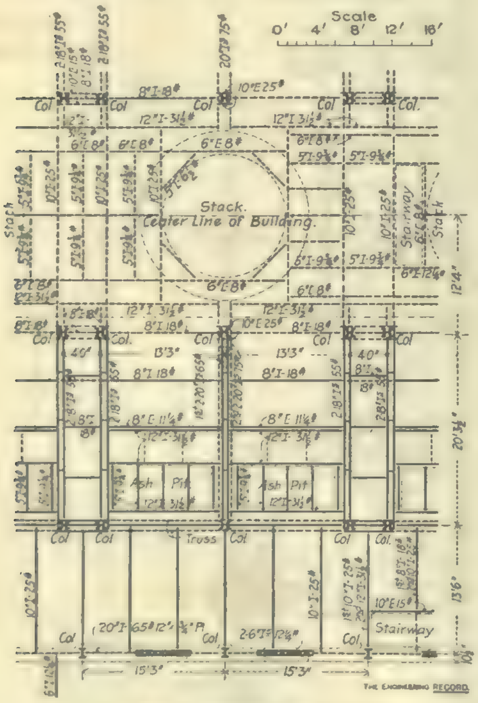
The accompanying beam plan is typical of the whole of both first and second floors, and shows the beams and girders of the first floor by full lines. The arrangement and dimensions are essentially the same in the second floor, except that the longitudinal beams connecting the interior columns are there replaced by riveted trusses, which, together with the platform beams between and around the smokestacks at the second floor level, are indicated by dotted lines. The main longitudinal beams in the first floor have intermediate supports on short basement columns interpolated between the main columns in the rows next the wall columns. The corresponding beams in the second and in both mezzanine floors are supported by longitudinal trusses, so that both boiler-room floors are unobstructed between main columns. This arrangement is seen in the general cross-section of the building, where the outer intermediate column is shown on the right and the elevation of the web members of the longitudinal trusses is shown on the left. The 20-inch main transverse girders of the second floor project about 2½ feet clear of the center columns to reduce the span of, and form cantilever supports for, the floor rack around the stacks.



COAL AND ASH HANDLING PLANT.

The side wall columns are about 104 feet and the center columns 124 feet high, all of them extending to the roof and supporting in each bent its three simple short-span riveted trusses, as shown in the general cross-section of the building. The intermediate columns are only about 75 feet high and terminate about 8 feet above the second-story pipe floor, where the ends of the main transverse girders for the coal bins are seated on them. In each main bent of the building the center and intermediate columns are braced together by 6 x 4 x ⅜-inch angle X-braces in every panel between the floorbeams, thus making two vertical sway-brace trusses reaching from the ground to the bottom of the coal bin girders. Just above this point the two center columns are united by two panels of X-brace and transverse struts of heavy angles, and these members, together with the coal bin and roof construction, give the building lateral stiffness. There is no longitudinal diagonal bracing, and the stiffness of the building in this direction is derived from the floors and roof, the solid coal bin construction, the longitudinal track systems, the longitudinal floor trusses already described, and the outer walls.

The two coal bins each extend from end to end of the building without interior partitions, and have extreme inside dimensions of 32 feet width, 24 feet depth and about 128 feet length. The upper part of the sides have vertical walls 12 feet high, from the feet of which the V-shaped bottom slopes to an angle on the center line. The end construction of the bins corresponds with that of the sides, but the sloping portion of the bottom there is only about 6 feet wide, while it has a width of 20 feet on each side of the bin. The center part of the V-shaped bottom is filled in so as to make eight hoppers 15 feet square on top, with a pyramidal bottom sloping to a 2 x 2-foot chute in the center. The construction of the bins is very simple, as shown in the general cross-section, without interior struts or braces, and without exterior bracing except in the transverse bents of the building.

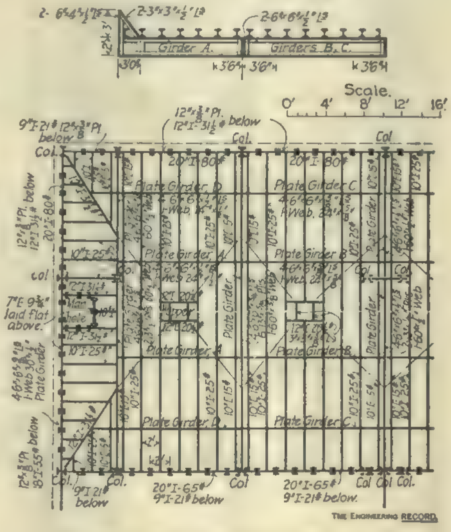


Part of General Beam Plan.

The main transverse 5-foot plate girders 15 feet apart support four lines of 24-inch longitudinal plate girders, all with their webs normal to the inclination of the bottom. The two lower lines are web-connected to the main girders and the two upper lines are web-connected to pedestals set on their top flanges. The longitudinal girders support, across their top flanges, inclined 10-inch transverse beams 2 feet apart, which are connected together with a mitered joint at the lower ends and are connected at their upper ends to 20-inch longitudinal I-beams in the planes of the wall and center columns. There are vertical 7-inch I-beams, 2 feet apart, in the sides of the bins, staggered with the 10-inch beams, and both sets are covered with Rapp system fire-proof flooring.

The upper ends of the vertical beams in the sides of the bins are riveted to the horizontal webs of 12-inch channels in the walls, and at this level there is in each main bent of the building a transverse beam about 33 feet long, trussed with the roof bracing so as to carry in the center the coal-conveying apparatus.

The roof of the building is of slate laid on book tile, which is supported by 2½ x 1¼-inch purlins on 10½-inch centers, and the first and second floors are made of red brick arches and cinder concrete filling on the Rapp system. The roof is proportioned for a load of 60 pounds per square foot and the floors, outside the boiler setting, for a load of 150 pounds per square foot. Each battery of two boilers weighs, with setting complete, about 264 tons. Each coal bin has a capacity of 3,000 tons and the total weight of structural steel in the building is about 1,200 tons.



Partial Beam Plan of Coal Bins.

The plant in its entirety was designed by Mr. P. O. Keilholtz, Assoc. A. I. E. E., consulting engineer of the United Railways & Electric Company, and the architects were Messrs. Baldwin & Pennington, of Baltimore.

The Importance of Careful Work in excavating and reinforcing old foundations and preventing all chance of undermining them when disturbed, is demonstrated by a recent accident to a building on East Thirty-fifth Street, New York. A new cellar was being carried down about 10 feet below the rubble foundations of the brick side wall of a four-story brownstone front residence. The excavation was made up to a vertical plane in the face of the existing wall through very soft rotten stone which could be crumbled in the fingers. No sheeting or underpinning was attempted, and no support was given to the building except by some horizontal cross braces between its side wall and the adjacent building on the next lot, reaching across the excavation, and some of them bearing against the middle of the wall between floors. The side of the excavation caved in, leaving a sloping bank with a steep angle running back several feet into the basement of the house and carrying out about 20 feet of the footing and a section of the wall above about 10 feet high in the middle. Fortunately the wall was of such good construction that the bricks arched and carried the upper part over the opening without causing the collapse of the whole building. Pairs of long steel I-beams were immediately set as needlebeams to carry the wall above the break, and were supported on vertical wedged shores from the bottom of the excavation and on jackscrews set on longitudinal sills on the basement floor 10 feet or more back from the wall, so as to be beyond the crumbling edge of the bank. The wall was thus held until underpinned.

Reconstructing the Morse Building, New York.

The Morse Building, now called the Nassau-Beekman Building, has a frontage of about 85 feet on Nassau Street and 70 feet on Beekman Street, New York. Originally it had a basement with its floor a little below the street level and nine upper stories from 14½ to 15 feet high, which rose to a total height of about 140 feet above the curb. It was built in 1879 and had its floors supported wholly on the massive brick walls without any columns. Radical alterations and extensions were recently planned to enlarge the structure and make it conform to the present arrangement and equipment of tall office buildings, which are far different from the best practice at the time this building was erected.

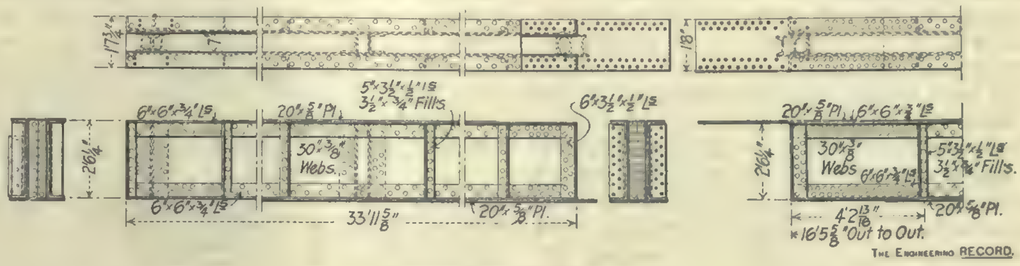
As the building was of massive fireproof iron and brick construction in good condition and filled with tenants, it was determined to make the necessary reinforcements and interior alterations, and to build a six-story steel-cage office building of like area on top of it without materially disturbing the interior, interrupting the business there, obstructing the streets or interfering with the tenants to any appreciable degree. The design of the new work and methods of execution present some unusual and interesting features.

The construction of the upper stories and the change in conditions which had arisen since the building was erected made it necessary to remodel the design of the old street fronts. The architects decided to lighten the color and change the style. The lower stories have been modified by facing them with light-colored artificial stone, replacing the old portico by a new one of Indiana limestone and redesigning the main entrance. The new upper stories are faced with light-colored brick and have an enriched cornice separating the upper from the middle section.

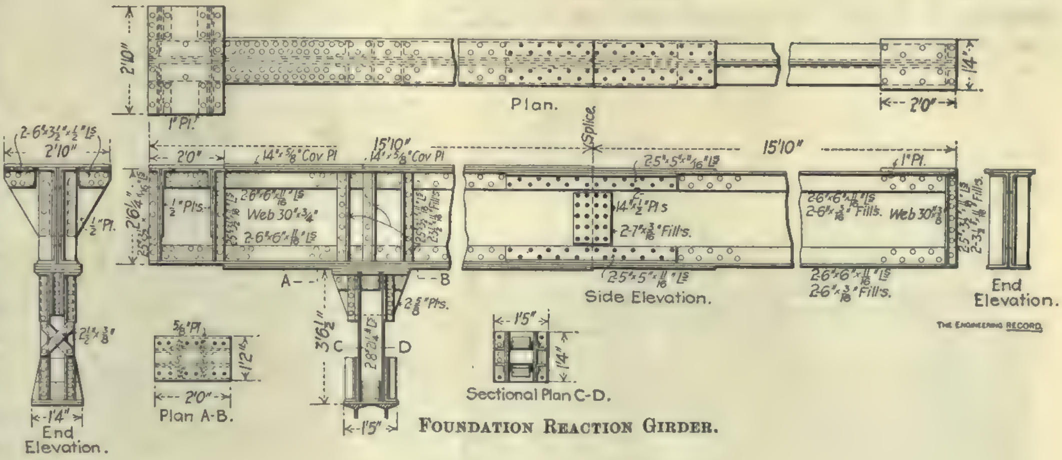
The building was divided into three unequal portions by two transverse partition walls about 17 feet apart on centers, between which were the main corridors with two hydraulic elevators at one end and the stairway in a central position. These walls and the exterior walls supported all the 15-inch I-beams, 7 feet apart, which carried the concrete arch floors with corrugated iron soffits set on cast-iron skewbacks fitted to the corrugations and to the lower flanges of the I-beams. All the walls were of uniform dimensions (except that front walls were reinforced by buttress piers about 30 feet apart on centers), 4 feet thick in the basement, with inverted arches at all openings, and offset to 6 feet at the base, where they rested on 8-foot continuous concrete footings 2 feet thick, which impose, with the additional stories now included in the building, an estimated pressure of about 8,000 pounds per square foot on the dense, fine moist sand 25½ feet below curb level.

Computations and a careful examination made by cutting into the brickwork at many different points, showed the walls and foundations to be adequate for the proposed increased loading except on the north side, where the wall footings were eccentric and only 6 feet wide. When the twenty-story American Tract Society Building, almost 300 feet high, was built on the adjacent lot in 1894, its footings were carried down to ground-water level 35 feet below the curb, as described in The Engineering Record of December 15, 1894. The old wall was underpinned with brick and concrete, and carried down to the pile tops, 10 feet below the original foundation-level, and the new footings were made flush with the face of the old wall on the lot line, and offset beyond the interior face of the wall, as shown in the accompanying foundation section. The original symmetrical footings had been cut off where they projected beyond the lot line, and the reduced area of the new footings would have been loaded to about 12,000 pounds per square foot by the addition of the new load, an amount so much larger than is elsewhere imposed that it would give rise to danger of unequal settlement. Additional footings were therefore designed to receive the excess load on this wall, and were constructed in a novel manner so as to receive their proportionate loading, practically remove the eccentricity, and put the loads and reactions in equilibrium.

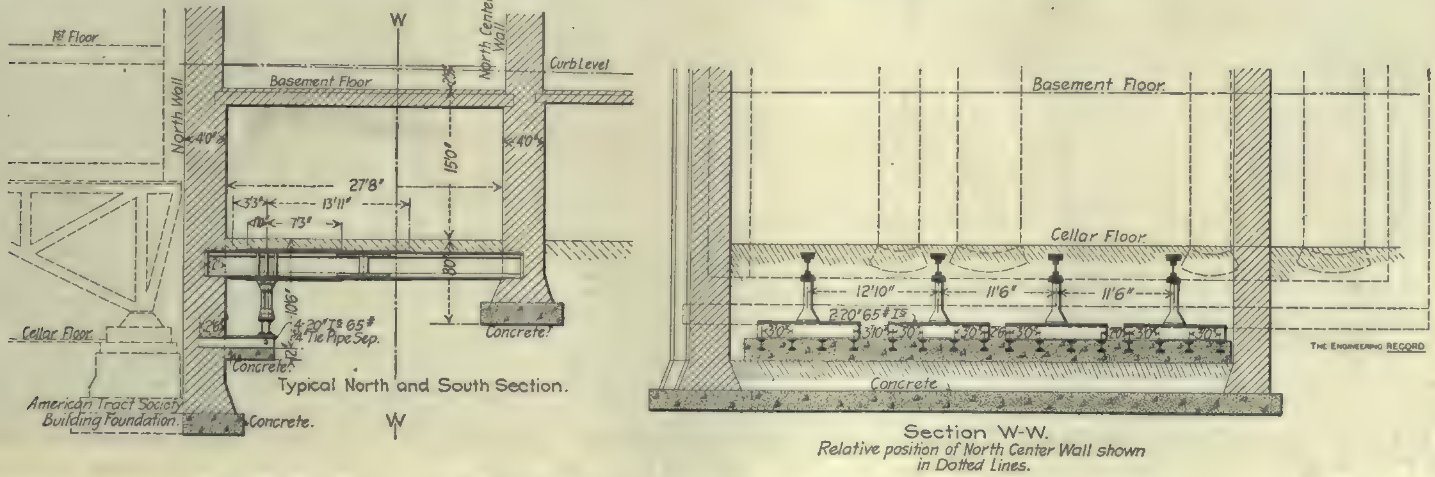
A trench 11½ feet deep, heavily sheet-piled and braced, was dug in the cellar floor, and in it a concrete footing, 5 feet wide and 32 inches deep, was laid alongside the north wall, and about 2 feet below the sub-cellar level of the American Tract Society Building. Horizontal transverse 20-inch I-beams, about 3 feet apart, were embedded in the upper part of the concrete and projected 2½ feet into recesses cut in the face of the north wall. Four pairs of longitudinal distributing beams about 10 feet long were set on the outer ends of these footing beams, and served as grillages from which short center posts were carried up vertically to bearing against horizontal transverse reaction girders just below the cellar floor, which took bearing at the widened and reinforced ends of their upper flanges against the brickwork in recesses cut in the north and north-partition walls. By this arrangement the transverse girders act as cantilevers supporting a proportionate amount of the initial weight of the wall and nearly doubling the effective area of the footings to resist settlement. The reactions are distributed through the main walls of the building, and the result is equivalent to supporting a portion of the load on cantilever girders and grillage footings.



DOUBLE-WEB WALL GIRDER.



FOUNDATION REACTION GIRDER.



Typical North and South Section.

Section W-W. Relative position of North Center Wall shown in Dotted Lines.

EXTENDED FOOTINGS AND REACTION GIRDERS.

The underpinning of the north wall was laid up with Dyckerhoff Portland cement, which had become so hard that three steam rock drills were two months in drilling in it the 2-inch holes, 3 inches apart, for the recesses for the transverse beams and reaction girders. Granite wedging posts, enclosed in the brickwork, were encountered by the drills in every recess, and some of them were so hard that the tools would not cut them, and they had to be removed piecemeal by heating them with a plumber's torch and then playing a cold water jet on them, which cracked off an inch or two at a time. The beam and girder bearings in the walls were made by pairs of steel wedges driven up solid, and the work of setting the new beams and girders in the cellar pits was accomplished without jeopardizing the stability of the walls, and obviated any direct underpinning. The cellar was occupied for storage by a tenant who could only release one longitudinal half at a time, so that the reaction girders were received and set in two pieces each, after which their middle splices were riveted together in place. The girders were then wedged to a firm bearing so as to produce a direct strain on the grillage. These conditions made the work tedious and expensive, so that the reinforcement of about 50 lineal feet of foundations cost about $6,000.

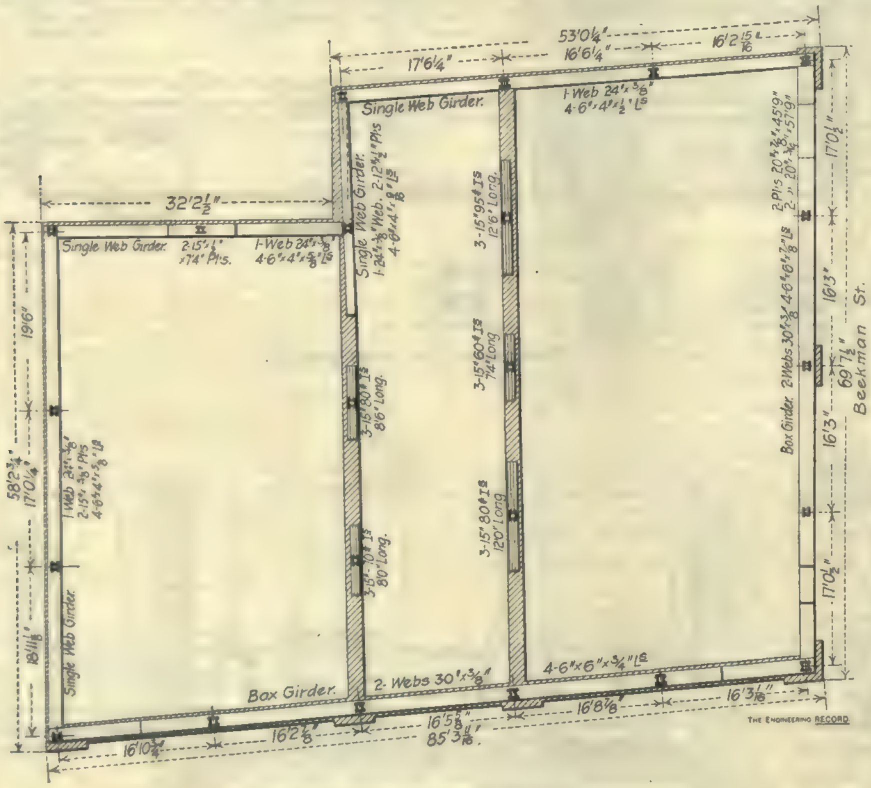
A temporary wooden roof and walls were built to enclose the eighth story, and the old walls were taken down to the eighth-floor level, about 117 feet above the curb, where they were 20 inches thick. The top of the brickwork was carefully leveled and relaid, and on it was set a system of single and double-web plate girders 24 and 30 inches deep. They were set a little inside of the center lines of the walls, covered the full length of the exterior walls, and were web-connected together at the corners of the building with riveted joints calculated to transfer the full load of one girder to the other in case of local settlement or failure of any part of the brickwork. These girders were of the full length of the wall sections and served as distributing footings for the columns of the steel-cage superstructure which was built above them.

The box girders were delivered from the shops with detached flange cover plates, which were shipped separately to make them lighter for handling. The maximum girder weight lifted in one piece was about 13,000 pounds, which was raised about 120 feet high from the trucks in the street at the full radius of a 53-foot boom. Each set of cover plates, weighing about 3,300 pounds, was hand-riveted to the flanges on the working platform built over the eighth-story temporary roof, each girder being riveted up by two gangs in about one and one-half days. The girders were set on the tops of the walls with grouted bearings over the piers between the windows only, at first. Special care was taken to avoid bearing between the girders and the brickwork over the window openings until after the full dead load had been imposed on the girders and no further flexure could occur to make possible cracks in the lintels and brickwork panels, when the bearings were grouted over their entire surface.

The eighteen steel wall columns for the six new stories were set directly on the wall girders, and five interior columns were set on nests of short triple 15-inch grillage beams laid on top of the transverse partition walls where the use of plate girders required so much space that it would have been necessary to interpolate a mezzanine story. The wall girders were enclosed in a thin shell of face bricks and terra-cotta, making a projecting belt course at the eighth-floor level, and the new construction above was ordinary steel framework, with a 12-inch curtain wall of cream bricks over the piers, and between them an imitation bronze, cast-iron front. At the tenth floor there is a deep galvanized-iron cornice and brackets painted in imitation of white terra-cotta and backed up with a 12-inch wall of hollow terra-cotta tiles.

The new eighth story is wholly unobstructed except by the five interior columns on the transverse partition walls, which carry the ends of five lines of longitudinal girders in the ninth floor. These girders support five more lines of interior columns, ten in all, which are carried up to the roof, and receive the tiers of 9, 10 and 12-inch floorbeams from 16 to 19½ feet long and about 5 feet apart, which frame into 15-inch and 18-inch I-beam girders. The columns have closed rectangular cross-sections made up of pairs of channels and cover plates, with bracket shelves and riveted web connections for the wall and floor girders. The floors and roof are made with Roebling construction concrete arches. The floors, finished with 3 inches of granolithic surface and flat ceilings, weigh 55 pounds per square foot, and are proportioned for a live load of 75 pounds per square foot. The roof is finished to about the same dead weight, with five layers of felt set in asphaltic cement, and provided with a granolithic wearing surface. The distribution of total loads from the old and new parts of the building combined is so uniform that there is not a variation of more than 5 per cent. from the unit pressure of about 8,000 pounds per square foot on the footings.

Sets of four vertical web-stiffener angles are riveted to the webs of the box and plate girders on the exterior walls at the eighth-floor level, so that their outstanding flanges are in line of the sides of the columns seated above them, and serve as pedestals to take the shear from the column loads. The girders resting on walls are bedded in Portland cement grout to cushion around the rivet heads in the flange cover plates.



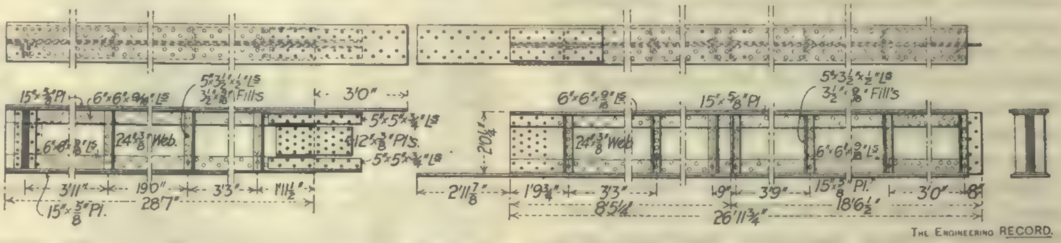
EIGHTH STORY GIRDER PLAN.

The steelwork of the upper stories was erected with two stiff-leg boom derricks set on the floorbeams and raised every second tier. One of them had a 53-foot boom, and was used for hoisting from the street, and both were operated by a Lidgerwood engine and boiler temporarily set on the eighth floor. At the commencement of work the engine, boiler and smaller derrick were hoisted from the street by a hand windlass and shears. As the work progressed the two derricks lifted each other two stories and were reset in six hours.

The old smokestack was of brick up to the top of the roof, and thence was continued 153 feet higher by a 27-inch steel tube which weighed about 12,600 pounds. It was suspended from a gin-pole on the roof of the adjacent building while the brick lower part was removed and rebuilt, and finally was reseated in permanent position without having been lowered to the ground.

Originally the floor of the 12-foot basement was about 2 feet below the street-level, and there was an interior entrance flight of stairs up to the 18-foot first story. Now these stairs have been removed, the basement floor raised to a few inches above curb-level, forming the main entrance hall, and that portion of the first floor over the main hall raised 5 feet so as to form a mezzanine floor. The corridor from the old elevators, which were situated at the extreme rear, to within about 22 feet from the front of the building, was removed in every story. The entire beam framing was taken out floor by floor at night and a temporary wooden flooring, supported from the floor next below, was in each case ready for use of tenants in the morning. Simultaneously with the removal of each floor the old stairway was taken out and a temporary stair placed there until the reframing of the floor for the three new elevator shafts and new stair well was accomplished, and the new stairs erected in place. The temporary wooden flooring was then removed and the entire floor filled in complete with the Roebling system of concrete arches in a single night. This work was carried out one floor at a time in such manner as to give the tenants free access to their offices at all times during business hours. As soon as work was commenced one of the elevator cars was removed and a builder's hoist, operated by a hoisting engine set on the working bridge, 15 feet above the street, was put in its place to raise such materials as could be taken up inside.

The old boilers, which were of the brick-set, horizontal, tubular type, were situated at the extreme rear of the building, had been in use since the building was erected, and were in very bad condition. Two new boilers of about 2½ times the steaming capacity of the old, of the Fitzgibbon's internally-fired marine type, were brought to the building Saturday night and lowered to the cellar through the floor of the main entrance hall, which was removed for that purpose, and by continuous work were set on their foundations near the coal bin, at the southeast corner of the building, by 2 o'clock on Monday morning, and the whole floor restored ready for use. One of the old boilers was then removed to make room for the smoke connections for the new, the elevator and other pumps being run by one old boiler until the change was effected, when they were connected up with the new boiler and the second old boiler was removed.



EIGHTH STORY WALL GIRDER.

During this time the new machinery for three modern high-speed hydraulic elevators was being installed by the Portland Company, of Portland, Me., and these have now been placed in use. As soon as the first of the new elevators was running to the eighth floor the old elevator which had been in use was removed and the entire change of boilers, and from old to new elevators, was accomplished without any interruption in the service. After the complete installation of the second and third new elevators running to the roof, the sheaves of the first one were raised from the eighth floor to their permanent position to lift the car the full height of the shaft.

When the building was erected oil lamps were used, and when gas pipes were provided later they were run outside the walls and partitions. Now these have been replaced by a complete electric lighting system, and new steam-power and heating plants have been installed for an entirely new service for the enlarged building.

The direct radiators in the upper four stories are supplied on a two-pipe system from a distribution main suspended from the attic ceiling. The radiators in the lower eight stories and basement are supplied from an independent main run around the basement ceiling. The plumbing fixtures in the old part of the building have been replaced throughout, one story at a time, without interrupting the service to tenants.

The street fronts will be veneered to a height of 40 feet with 4-inch blocks of artificial stone in pieces up to 2½ x 5 feet, which are cast in sand molds and have copper staples projecting from the back to dowel them to the old wall. Above the veneering, to the seventh story, the exterior will be unchanged.

The reconstruction is nearly completed, and has been carried out according to the design of, and under the personal direction of, the owner and engineer, Mr. Charles Ward Hall. Messrs. Bannister & Schell are the associated architects. The general contractors were the Hall & Grant Construction Company, incorporated, who have carried out the work without accident or damage of any kind, with great expedition considering the difficulties encountered, work having been begun about April 1 and being now practically completed.

Speed Regulation of Prime Movers and Parallel Operation of Alternators.

A paper read before the American Institute of Electrical Engineers by Charles P. Steinmetz.

Regarding the effect of speed regulation of prime movers on the parallel operation of alternators therefrom, three features have to be considered:

1. The permanent variation of speed, due to a change of load.

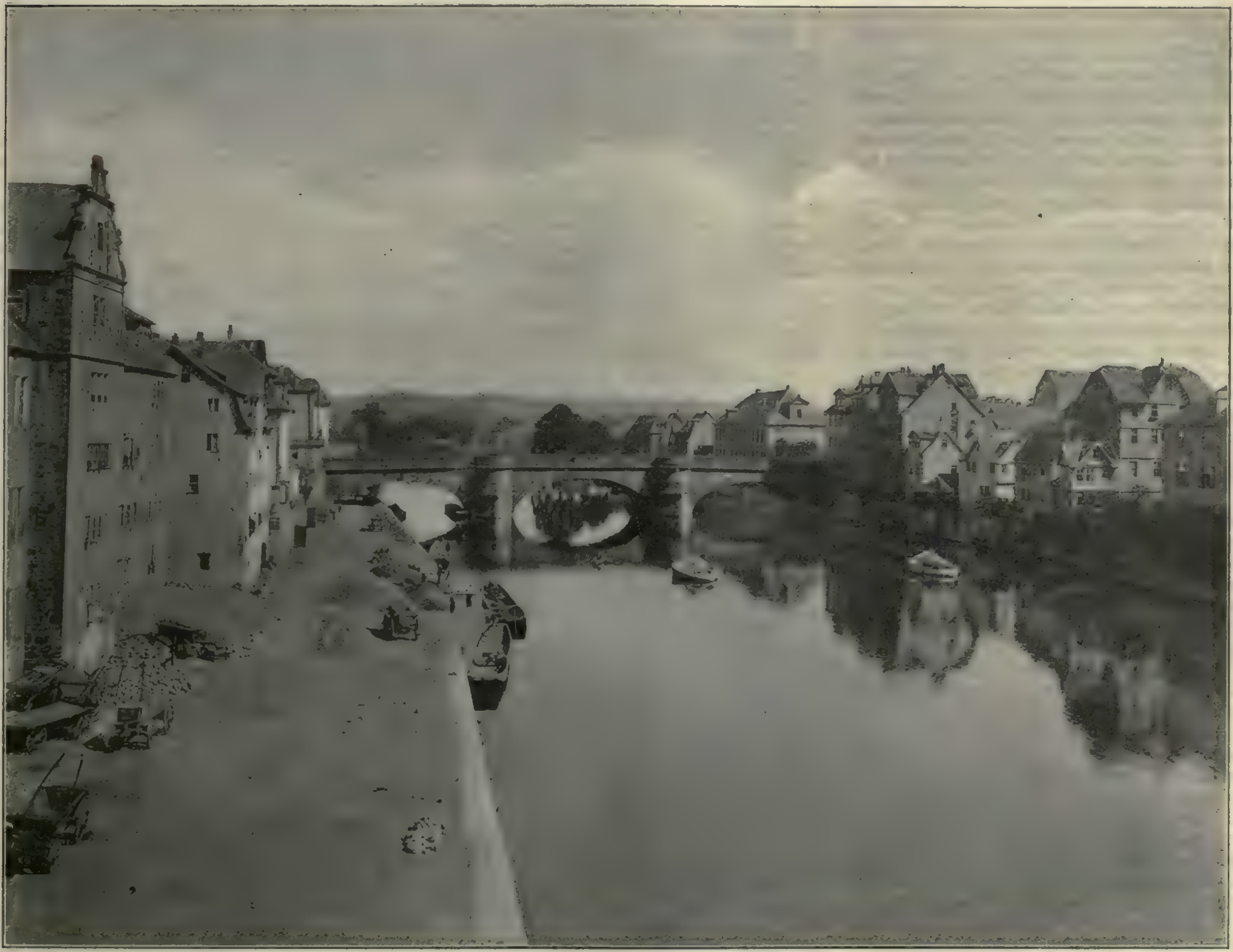
2. The temporary change of speed, due to a sudden change of load.

3. The periodic change of speed during each revolution.

1. With a change of load on the alternator, the power supplied to the prime mover must be changed correspondingly. This is done by a regulating mechanism which is based either on the speed (speed governor) or the acceleration (inertia governor). The speed of the prime mover is a function of the load, usually decreasing more or less with the increase of load. Since, however, alternators in parallel operation, and thus the prime movers driving them, must run in synchronism with each other, it follows that the division of load between alternators driven by independent prime movers depends on the division of power between the prime movers at (electrical) inequality of speed, but not upon the characteristics of the alternator; thus it cannot be changed by a change of excitation of the alternator, etc., but only by reacting upon the governor (or by a change of belt tension with alternators belted to the same shaft). Therefore for parallel operation of alternators a certain drop in speed with increase of load is necessary, and with a governing mechanism maintaining absolutely constant speed at all loads, the division of load becomes indefinite and parallel operation ceases to be feasible. If the drop of speed with increase of load is not uniform, but the speed almost constant for moderate load, alternators may operate satisfactorily in parallel at load, but seesaw at light load.

2. With a sudden change of load, since time is required for the governor to act and for the flow of power to the prime mover to change to the condition corresponding to the changed load, a temporary change of speed occurs, larger than corresponds to the change of load, and to reduce this variation of speed, storage of energy by the momentum of the fly wheel is necessary. With the steam engine the momentum of the steam as expansive fluid is usually negligible in its effect, and the temporary effect of speed depends mainly upon the rapidity of the action of the governor. With water power, frequently the momentum of the moving mass of water predominates as a cause of the speed fluctuation with sudden change of load, and the speed fluctuation thus depends upon the momentum of the total moving mass of water. Stand pipes, relief valves and deflecting nozzles represent means to reduce or eliminate the effect of the momentum of the moving water column upon the regulation of speed at sudden change of load.

3. Most rotary prime movers, as water-wheel, steam turbine, etc., give a uniform supply of power, and thus uniform speed during the revolution. Others, however, as reciprocating prime movers, steam and gas engines, supply the energy by a number of impulses, and the torque, and therefore speed, of the prime mover thus periodically varies during the revolution. The



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XL, CASSEL, FULDA BRIDGE.

An excellent example of a three-arched bridge, with admirable relation of massive piers to the span and form of the arches.

resultant torque of these prime movers consists of the pulsating torque of the energy supply (indicator diagram), the alternating torque of acceleration and retardation of the reciprocating masses, the alternating torque due to the finite length of the connecting rod, with vertical engines, the alternating torque of gravity in the ascent and descent of the reciprocating masses, and in gas engines also the pulsating negative torque of the compressor. The speed variation resulting herefrom can be reduced by such a design of the prime mover that the different components of torque superimpose upon each other to a more nearly uniform torque, or by the use of a heavy fly-wheel. The most objectionable result of this periodic variation of speed is, however, the hunting of alternators and synchronous apparatus (as motors and converters), and this tendency to hunting seems to be aggravated by the use of heavy fly-wheels on the prime mover.

Electrical motors as a rule are not considered as prime movers, although no reason appears for making a distinction between the supply of power through a hydraulic pipe line or through an electric transmission line. With electric motors the rate of rotation is uniform and the periodic variation of speed thus absent, and due to the practical absence of a time lag the temporary variation of speed at a sudden change of load absent also, constancy of the supply voltage assumed. With continuous current shunt motors a cumulative series field may be necessary for parallel operation of alternators to secure the necessary drop of speed with increase of load. With induction motors, while the drop of speed under load may be considerably less than required for good parallel operation of engine-driven alternators, the speed variation with the load is so uniform that no difficulties are met.

In parallel operation of alternators driven by synchronous motors, due to the absolute constancy of speed under load, an entirely different set of phenomena occurs, similar in some respects to the parallel operation of rigidly connected alternators, but differing therefrom, due to the flexibility of the synchronous motors in their relative phases, but rigidity in frequency.

Difficulties with parallel operation of alternators driven from separate prime movers may be due to:

1. Lack of synchronizing power, due to excessive armature reaction. This is practically unknown with modern alternators, in which the synchronizing power is always far in excess of the requirements of keeping them in step.

2. Surging or hunting between the alternators. Regarding hereto, forced surging and cumulative or resonating surging may be distinguished. With prime movers giving a periodic variation of speed during the revolution, periodically varying cross-currents flow between the alternators and between alternators and synchronous motors, in extreme cases even between alternator and induction motor, of an amplitude depending upon the amplitude of the speed variation. Under certain conditions this surging becomes cumulative, gradually increasing in amplitude so that the machines may break out of synchronism. The cause of this cumulative effect may be found in the electrical circuit in certain relations between the momentum of the moving mass and the electric constants of the circuit, or it can be found in the mechanical construction of the prime movers, foremost their governors. When due to the former cause it can occur also with turbine-driven prime movers and synchronous motors, while the mechanical hunting of the governing device, which is the more frequent and serious phenomenon, is most frequently found in direct-connected engine-driven plants.

The cumulative hunting is overcome by eliminating its cause, that is breaking the resonance condition of the electric circuit by interference, or by changing its constants and damping the governor so as to stop its ability to hunt, or by reducing the amplitude of the hunting by a damping device in the electric circuit, usually in the field of alternators of other synchronous apparatus.

The Architectural Treatment of Bridges.

The widespread condemnation by architects of the Tower Bridge, the bascule-suspension structure across the River Thames at London, has hardly been forgotten by readers of The Engineering Record, but a more recent outburst of vigorous protests against another Thames bridge has not been mentioned to any degree in American journals. These later criticisms have been directed against the plans of the engineer of the London County Council for the three-hinge concrete-arch Vauxhall Bridge, illustrated in The Engineering Record of February 25, 1899, and the most vigorously worded protests in print have come from Mr. H. Heathcote Statham, F. R. I. B. A., editor of "The Builder." He has not been content merely with criticisms, however, for in a recent issue of his journal he has presented a scheme for the architectural treatment of the bridge on the same structural lines as those of the approved plans. His opinions are so interesting to both engineers and architects that the following abstract of them is herewith presented:

The question where engineering ends and architecture begins, in the case of a bridge,—and the correlated question, where is the line of demarcation between the province of the engineer and the architect,—is not such a very easy one to settle; it seems indeed to call for a kind of æsthetic application, if one may so say, of differential calculus. There may be architectural effect without any embellishment; effect arising solely out of line and mass, and in which decoration has little or no place. In the case of a built bridge of stone or granite, this effect may be arrived at without going beyond the best structural requirement; in other words, without going out of the engineer's province. The best lines of structure, in such a case, will often produce also the best effect.

As soon as the element of embellishment or decoration comes in, however, we are purely in the architect's province. An engineer's education does nothing for him in training the eye and taste in architectural decoration; his faculty of design, in the artistic sense, has never been cultivated, and the probability is that he appropriates stock features out of architectural books, treats them clumsily and misapplies them so as to be absurd and unmeaning. On the other hand, if we go back to the early stages of the structure, the preparation of the foundations in deep water, it is equally certain that here we are on the ground which is peculiarly the engineer's, and for which the usual education and experience of the architect have not prepared him.

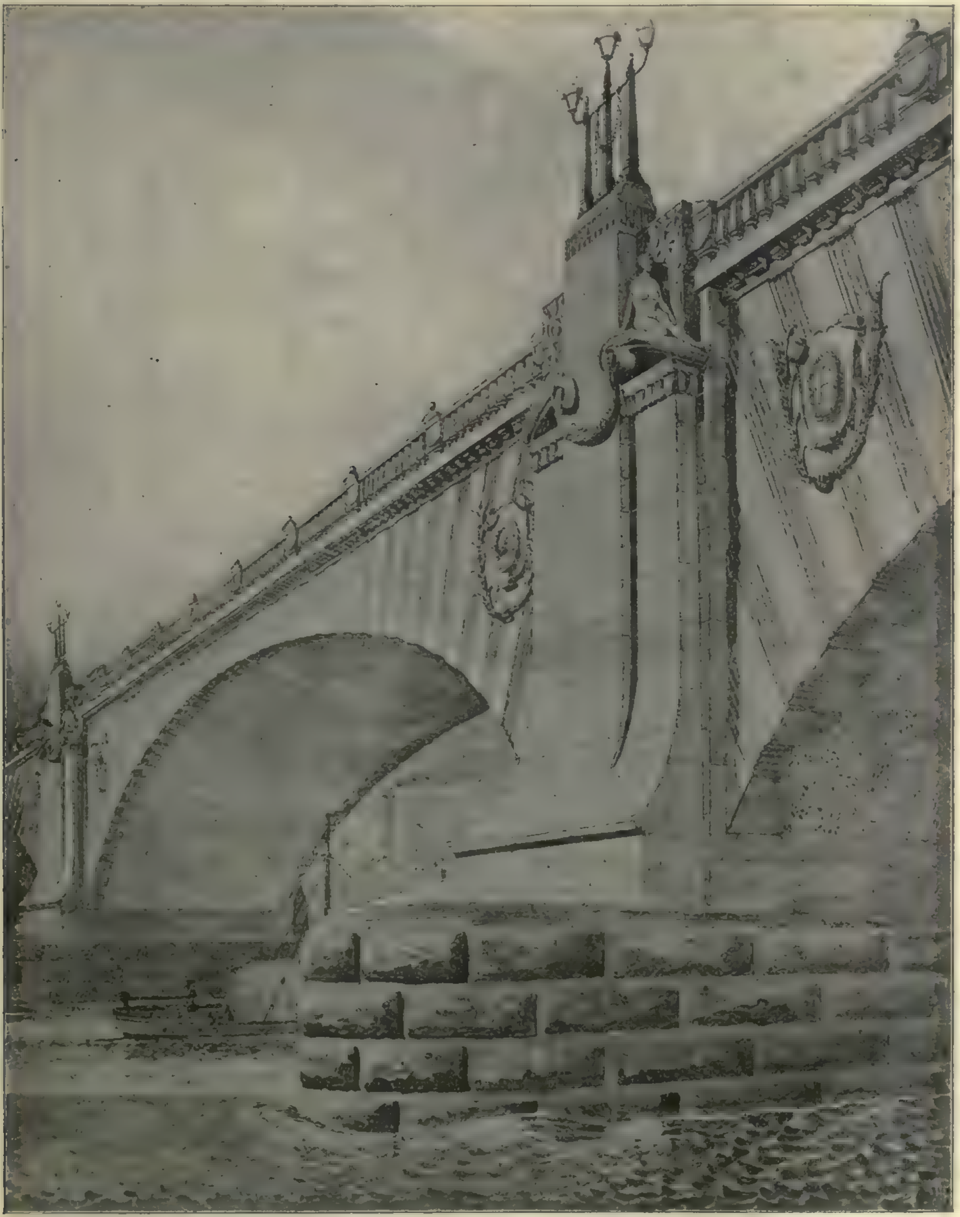
We may say, then, that there are three stages in bridge building on a large scale and in a sumptuous manner: the preparation of the foundations and the inner structure of the piers, which is purely engineering work; the decorative embellishment, which is purely architectural work; and an intermediate stage which, according to circumstances, might be handled either by engineer or architect, but which will be in general the better for the collaboration of the two.

The case of the Vauxhall Bridge affords an apt illustration of this latter point. In this case the wide flat segmental arch, starting abruptly from the piers and as if jammed between them, has anything but a good effect. But we are told that these lines are almost absolutely settled by practical conditions. The piers were, by the requirements of the Thames Conservancy, to have so much waterway between them; the crown of the arch was to give so much headway above the water level: on the other hand, by the requirements of the shore authority (the County Council) the gradient of the roadway was limited to a certain minimum of rise. Obviously under such conditions there is very little margin left to the constructor, and it is not surprising that a steel bridge was at first proposed as the only solution. There was a considerable public feeling, however, in favor of a granite bridge; but no engineer, or architect either, would have recommended the erection of an arched masonry bridge of so great a span on such flat lines. Then came the via media of a concrete arch, so-called, which is really rather a couple of huge cantilevers than an arch; which can be safely constructed on the lines required by the authorities, and which could be faced with granite so as to give the effect of a monumental bridge of that material. This was apparently quite satisfactory to the County Council's engineer; but from an architect's point of view the result is this, that an apparently granite arched bridge is designed on lines which would not be employed if it were really of that construction, and of which consequently the effect is unsatisfactory to the eye. And here comes in the point at which the presence and influence of an architect in this intermediate stage would have been of value.

In the first place, an architectural coadjutor would never have passed or permitted such clumsy and vulgar details as were shown in the engineer's design; in the second place, he would certainly have put the question whether these lines and proportions of construction proposed were really so necessary and inevitable as was pretended. Engineers wanting to build ugly things are so fond of professing that whether you like it or not, they cannot help it; that the proportions are fixed by circumstances or authority; and so on. An architectural adviser could and probably would have put the question —is it really necessary to have so wide a span between the piers, spoiling the proportions of the bridge by so flat an arch? Is not this extreme width a somewhat imaginary necessity, and is it not worth while to give up something of space for the sake of a finer structure? An argument of that kind, strongly pressed, might perhaps have been met by a relation of the conditions which are supposed to have been so imperative, and by an admission that something must be conceded on both sides; but there was no one to do it. Did such a case occur in France, the architect commissioned along with the engineer would almost certainly have put that argument; and what is more, he would have been listened to. In France such considerations have weight. In England it is a fixed idea, in regard to engineering structures, that the practical considerations are everything, and that no argument in regard to architectural appearance is of any consequence at all.

Thus it comes about that we are having a bridge erected which, while on the face of it it is to appear as a masonry structure, is not structurally such, and is designed on lines which, on so large a scale, are unsuitable and insecure-looking for such an apparent structure. Regarded as such, it is too flat in its lines and too weak in its crown. No treatment could really make it satisfactory. What is important to note, however, is that if the system of concrete hinged arches, or cantilevers, with a granite facing, is to be accepted as a favored form of bridge-building in the future, it is necessary that a treatment of facing granite should be adopted suitable and expressive of the circumstances, and totally distinct from that which is suitable when the bridge is really a monumental and homogenous structure of stone or granite. In the latter case, the more powerful and massive the face design is the better. In the former case, a lighter and perfectly different treatment is required, to express the true function of a facing which is a revetement and not an essential element of the construction.

It would be worth while, perhaps, to take into consideration the possibility of a satisfactory surface treatment of the concrete itself without any masonry facing; and let a concrete bridge, if that construction be decided upon, appear frankly as such, with a cement treatment on the face of it. Such a bridge could never have the imposing appearance of a masonry bridge, and it is not likely it would ever be adopted except where circumstances of site or a rigid necessity for economy demanded it; but there would be a certain merit in frankly accepting the concrete bridge and making the best of it.



Architectural Treatment of Vauxhall Bridge, following the Engineer's Design.

Coming back to solid granite or masonry bridges, however, which after all are likely to keep the field more or less (for they certainly make the finest and most monumental class of bridge structures), the points which seem most to require attention are the face of the main piers, and the spandrels of the arches. There has been a greater prevalence of the use of columnar orders on the face of the piers, in the shape of engaged columns or pilasters. This is really a misuse of such a feature. There has been a feeling that something must be done at that point in the way of architectural or decorative treatment, and the column has been seized upon, as it has in many more purely architectural structures, because something is wanted, and that is a historic feature which comes readiest to hand. The pier has to have the effect of lateral strength; there is nothing of any consequence to support above it; and a feature which expresses resistance to vertical weight is out of place. What we want is something of the suggestion of a buttressing mass; not applied to the face of the pier, but resulting from the shape and design of the pier itself.

Then, in a bridge on a large scale, the spandrels of the arch offer a considerable space which may or may not be specially treated. Panelling has been resorted to, but it is a weak expedient, and suggestive of a structure other than masonic. In a bridge of a severe type, perhaps nothing is better than to leave the lines of the masonry, more or less emphasized by rustication. If it is desired to fill in or diversify this blank space, it would seem that here we may rightly apply something of the nature of a surface decoration; either a bas-relief where the bridge is a comparatively small one, or a heraldic device, or a bust in a medallion. It depends to some extent on the amount of decorative treatment admitted in other portions of the bridge, whether we should leave the spandrels as plain masonry, or relieve the space with a decorative feature. In the case of the design published in this issue, where the voussoir lines are carried up to the corbel-table under the balustrade, the longer lines in the haunches of the arch are too insistent and require something to break them; hence the heraldic escutcheons and wreaths, æsthetically of the nature of an applied ornament, but of course in reality carved out of projections left in the solid stone. In this case the spandrel, in the usual sense, has disappeared; the facing is, so to speak, all voussoir, and the decoration does not follow but breaks their lines. So it would be also in the case of a bridge with spandrels of masonry in horizontal or nearly horizontal courses, above a strongly marked system of voussoirs.

Then there is the question of a cornice. Here again we should recognize a distinction between the solid and veritable masonry bridge, and the bridge which is a concrete structure with a mere facing of masonry. In this latter case a heavy cornice of great projection is out of place; it is emphasizing too much and placing too much weight on what is only a decorative facing. But in a solid masonry bridge a powerful cornice is a fine source of effect; only, in introducing it, we must remember that we are not dealing, as in an ordinary building, with a true horizontal line; unless in case the approach is artificially built up in order to leave the bridge its unbroken horizontal line. Where the bank level is not very high, and a certain minimum of headway is required above the water level, a bridge will always have to assume a certain degree of slope and curvature of line on either side of the crown. In that case the cornice becomes a raking cornice, and it is essential that it should be stopped by the piers, not made to break round them, because such a break cannot be properly constructed; either the cornice must rake round the vertical feature (whatever it is) of the pier, which has the worst possible effect, or it must stop on the further side and begin again at a slightly lower level; an arrangement which cannot be worked at all. That was one of the worst faults of detail in the engineer's original design for Vauxhall Bridge, published in our plates a year or two ago; the large cornice was supposed to be carried in a continuous line round a great circular column on the pier, and resumed on the other side. Such an arrangement could only be worked by "fudging" the mouldings.

A Tunnel for Steam Heating Mains, return pipes and electric wires is to be built at the Iowa State College, at Ames, Ia., to connect the new Engineering Hall with the central power station. It will be 460 feet long, 5 feet wide and 6 feet high in the center. The top will be a circular arch on a 2.5-foot radius, and both top and sides will be of brickwork, 8 inches thick, laid in natural cement mortar, with a plastering on the outside of Portland cement mortar. The bottom of the tunnel will consist of 3½ inches of Portland cement concrete and ½ inch of cement, sloped toward the center line at the rate of 1 inch per foot. An interesting feature is that besides longitudinal stringers of timber imbedded in the brickwork on the inside of the tunnel, both at the spring line of the arch and about 1 foot above the floor, for fastening various supports, columns of 2-inch steam pipe will be spaced on 10-foot centers along the center of the tunnel. At the top, these will pierce the brickwork and in that manner be held fast, and at the bottom they will take a bearing on plates on the concrete floor which, at these points, will be made about 9 inches thick. A 4-inch drain tile pipe will be provided beneath the concrete floor. The contract for the tunnel, including the columns, was let for $3,300, which is a little more than $7 per foot. The work is to be done under the direction of Prof. G. W. Bissell, head of the Department of Mechanical Engineering at the College.

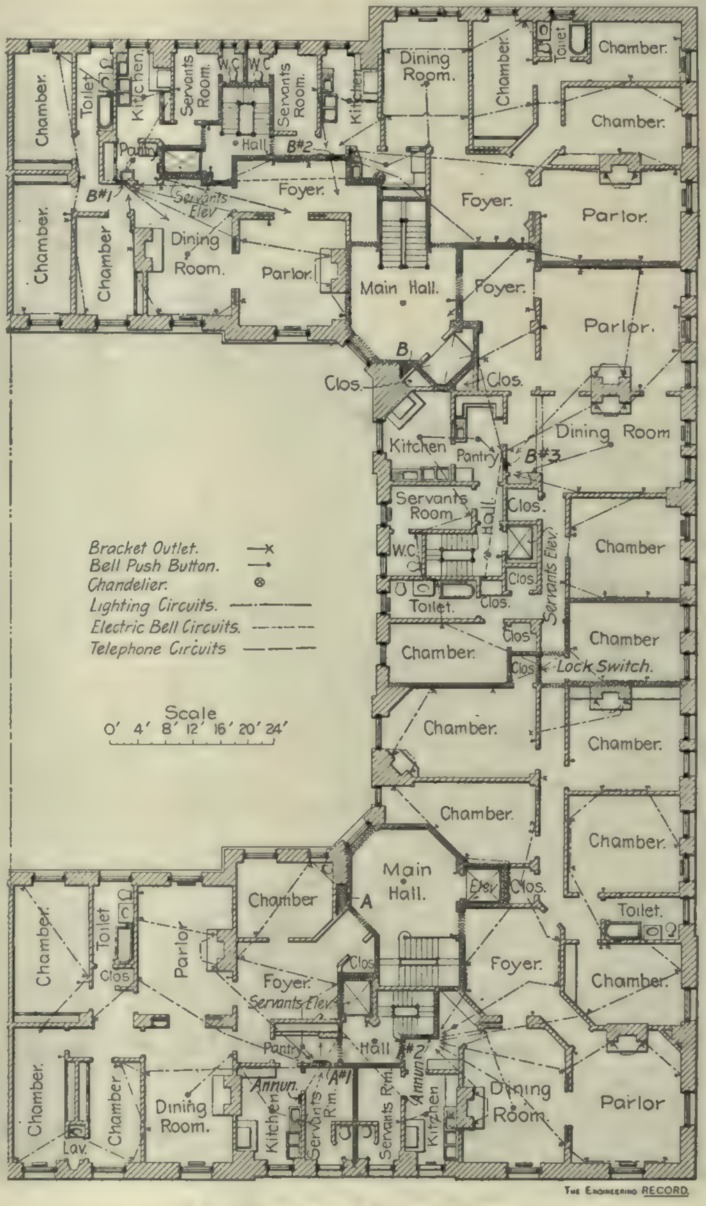
Lighting and Heating in the Graham Court, New York.

A heating, lighting and general power plant presenting quite a number of unusual features has been installed in the Graham Court, one of the latest of New York's large apartment houses. In common with many of the buildings of this class, it has its mechanical plant, employing water-tube boilers and direct-connected electric units, warming the building with exhaust steam, supplemented, as usual, with live steam, when necessary. The plant provides for both lights and power, the latter largely for an extensive electric elevator equipment, which draws current directly from the switchboard in connection with a storage battery and a constant-current booster; this arrangement, of course, to meet the momentarily high current demands of the elevator machinery, so as to maintain practically a constant demand on the generators with consequent constancy of voltage and minimum fluctuation in brilliancy of the electric lamps. Other features of the plant are an electric bell and annunciator service for each apartment, all wired from a separate storage battery for that purpose, and a system of wiring by which the different apartments are lighted by electricity from a street service on a distribution from the basement, so that it can readily be inspected and controlled at that floor.

The building is an eight-story structure, extending on Seventh Avenue from One Hundred and Sixteenth Street to One Hundred and Seventeenth Street. It is about 170 x 200 feet in plan, in the form of a hollow square. The entrance from the street is through an arched carriage and footway in the center of the Seventh Avenue front, by which one reaches a court 75 x 105 feet in size. In the center of this is a fountain banked in flowers, encircled by a driveway continued from the entrance, and the whole set off and illuminated by clusters of lights on decorative posts. The entrance is provided with tall wrought-iron gates, guarded by a man in uniform. Within the court, from its four corners are the entrances into the building proper. Each of these opens upon a main hall, from which rises a passenger elevator and a stairway serving all floors in each case. In general there are ten apartments per floor. In compliance with the building law, those of one half of the building are separated from those of the other half by an unpierced fire wall, and one-half of the building is symmetrical with the other half about this axis, which extends backward from the middle of the Seventh Avenue front. A typical floor plan of one-half of the building is shown in an accompanying illustration.

The main halls of the front portions of the building lead to two apartments each, and those toward the rear of the building to three apartments. Every apartment comprises a foyer within the main hall, a parlor, a dining room, one bathroom, a kitchen separated from the dining room by a pantry, a servant's room adjacent to the kitchen, and a varying number of chambers. Every kitchen is served from a freight elevator near by, these, together with a servants' stairway and hall, rising through the building from the basement. There are six of these halls and elevators altogether, and as shown in the half-floor plan referred to, one elevator suffices for the two front apartments, another for the two rear apartments, and the third for the side apartment. To reach these elevators, a tradesmen's entrance was provided leading downward underneath the building and the court from a point toward the rear on One Hundred and Seventeenth Street. Here wagons have abundant space to reach all elevators, moving vans disposing of their loads in the same way. This utilization of the basement is shown in an accompanying basement plan. Otherwise the floor is devoted largely to bins or lockers for the tenants, one corresponding to each apartment. These are built of hollow bricks in a substantial manner; and an opening is provided in the side walls near the top for ventilation. The rest of the basement floor space is taken up with the laundry and drying rooms and with the mechanical plant, the engines and boilers in vaults under sidewalks and the storage battery under the wagon driveway to the basement.

The boilers are located under the sidewalk of One Hundred and Seventeenth Street. There are two, of the Babcock & Wilcox manufacture, in separate settings facing each other, leaving a firing space 17 feet between them. Parallel with the boiler room is a long room used for coal storage, having a capacity for about 150 tons of coal. In addition to this, however, there is a smaller bin of 40 tons' capacity, built within the vault room between the boilers and the engine room (which occupies the vault under the same street but toward the front), this additional bin being principally to provide sufficient space to receive a full boatload of coal, but to be removed should an additional boiler be installed in the future. Buckwheat coal is burned, and steam pressure of 80 pounds per square inch is carried. Each boiler consists of 108 4-inch tubes 18 feet long, arranged in 12 sections nine tubes high. It has two steam drums, 3 feet in diameter and 22 feet 1 inch long. In the aggregate, the boilers have a total heating surface of 4,621 square feet and a grate surface of 1,026 square feet, a ratio of 4.5 to 1. They are designed to carry 200 pounds pressure, and the whole structure was tested by hydrostatic pressure to 300 pounds per square inch after being completely erected, the tube sections and mud drum having been furnished under a specification requiring a 400-pound test before leaving the boiler shop.

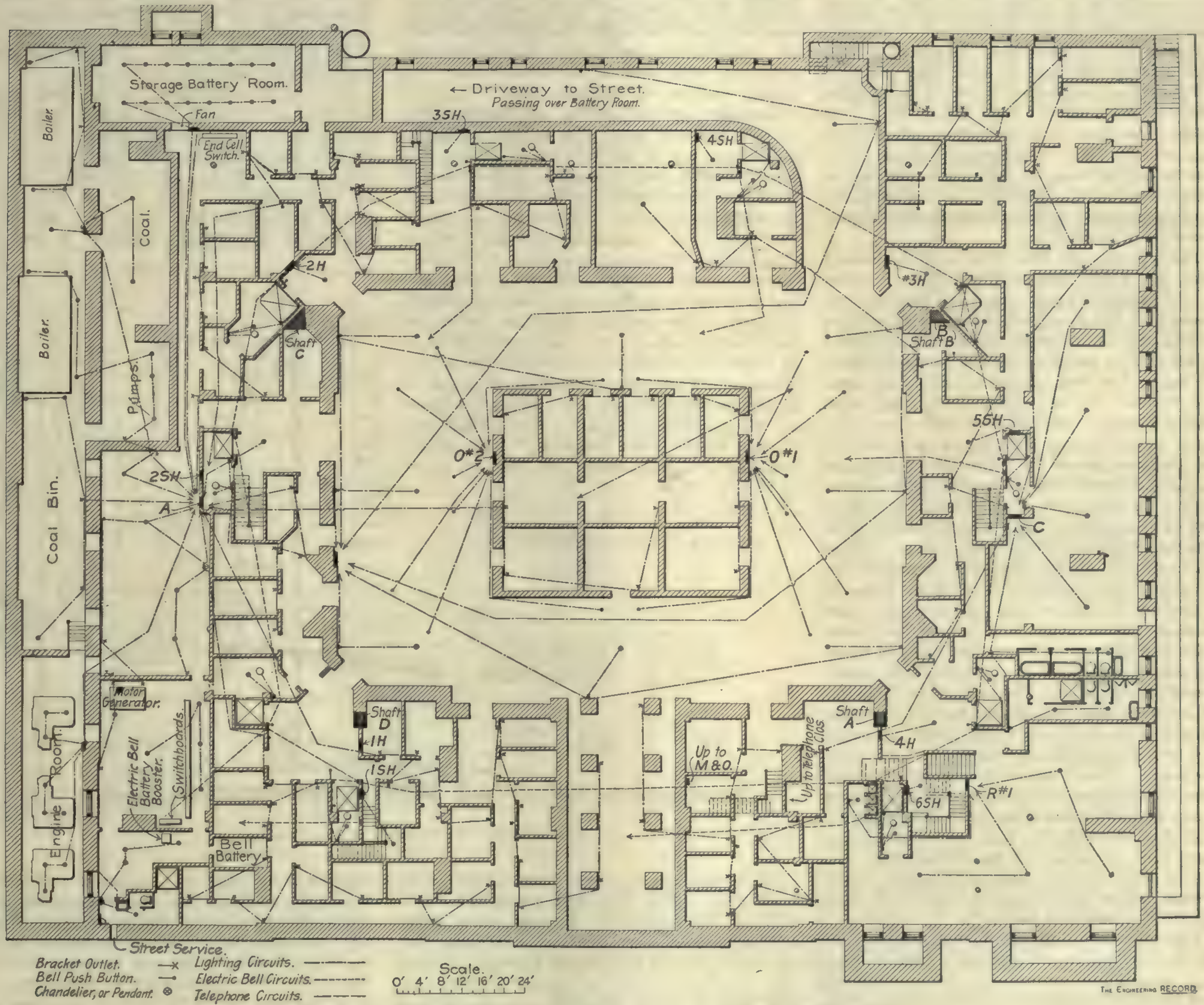


Half Plan of the Typical Floor.

The engines are three in number, of the Ames single-expansion high-speed automatic center-crank type, with 13 x 12-inch cylinders. They are direct connected to operate at a speed of 275 revolutions per minute with 125-volt 50-kilowatt direct-current dynamos made by the Western Electric Company. The friction horse-power of each engine, when running with armature attached, but brushes raised, was guaranteed not to exceed 7 horse-power. The generators are of the usual compound-wound design, and have equalizing connections for running in parallel.

The main switchboard is located in an adjoining room. The board extends along the inner wall and consists of seven panels, from left to right as follows: Power feeders, storage battery connections, three panels for the three generators, and two panels for lighting, one for public lights, as those in halls and public spaces are called, and the other for street lights, as the lights for the various apartments are called, being supplied from a street service. There are two sets of bus-bars, one for lighting and the other for power, and each generator switch is three-pole and double throw, so that any of them may be used for power or for lighting purposes. Toward the bottom of the panel there are in each case a circuit breaker and a recording wattmeter. Each panel has in its center a red light about flush with the surface of the board. Each panel has also an ammeter, and for the three generator panels there are two voltmeters, with nine-point switches. All bus-bars, switches, connections and in general, parts carrying current, were figured on the basis of 750 amperes per square inch of sectional area, 100 amperes per square inch nut contacts and 50 amperes per square inch sliding contacts.

Besides the arrangement of a double set of bus-bars and the feeding of any dynamo upon either or both power and light lines, connections are also arranged with the storage battery, so that either it or any or all of the dynamos, or both battery and any grouping of the dynamos, may be connected to either lamps or power or both; and moreover the street service can be connected to the plant. During the middle of the night the plant is thus operated from the storage battery alone. During the day the battery is run in conjunction with the plant, with a motor-driven generator or booster unit, comprising a 25-horse-power 125-volt motor running at a speed of 650 revolutions per minute, and driving the booster. The booster has a capacity of 400 amperes, with a range of 25 to 50 volts.



PLAN OF THE BASEMENT OF THE GRAHAM COURT, NEW YORK.

The battery panel contains the battery switches for connecting the battery with the booster and the main bus-bars and a switch for the booster motor, both this and the storage battery having circuit breakers on the panel face. There are two ammeters, one giving the current to the booster, and the other the current passing to and from the battery. There is a voltmeter with a multiple point switch, and a second voltmeter arranged to show on its scale the number of end cells of the battery cut in.

The battery, as stated, is located underneath the driveway near the boiler room. The end cells, of which there are twelve, are cut in and out at that point and for this purpose a screw type of switch has been installed. The sliding contact is carried on a traveling nut by means of a screw, which is turned in either direction, as desired, by a small series motor operated from the main switchboard. This motor is made to stop automatically when the desired number of cells have been cut in or out. The contact surfaces are figured at 50 amperes per square inch, and conductors at 750 amperes per square inch sectional area. The battery consists of 70 cells made by the Electric Storage Battery Company, of Philadelphia, and has a guaranteed discharge capacity of 124 volts as follows: 200 amperes for 8 hours, 280 amperes for 5 hours, and 400 amperes for 3 hours. This specification was required to be met when discharged to 1.8 volts per cell. The elements are carried in lead-lined wooden tanks of heavy ash, treated with acidproof paint. Each tank is supported on and insulated from the floor by means of triple-petticoat porcelain insulators, these resting on 6 x 6-inch yellow pine beams, painted with acidproof paint. The battery room is ventilated by means of a small fan, which draws air from the basement into the room, whence it escapes through a chimney flue.

The power panel contains 15 double-pole single-throw switches and a three-pole double-throw switch, the latter at the bottom. Ten of the power feeders supply the elevator machinery, which is of the Otis worm-gear type under electric control. One feeder runs to a motor for ventilating the laundry and another for ventilating the engine room. At present there are two blanks available. The large switch at the bottom is for connecting the power panel either with the building's plant or with the Edison street service. The public light panel of the board is similar, in that besides the single-throw feeder switches it has a three-pole double-throw switch, in one direction connecting with the main bus-bars of the plant and in the other with the street service. The feeder switches in this case are, however, three-pole, to accommodate a three-wire system of distribution, which is of convenience, particularly in the various panel boxes, and of necessity with the 220-volt three-wire street mains. There are sixteen feeders provided for, as follows: 4 for the roof, which it was thought might be used as a roof garden; 2, servants' halls; 2, basement lights; 2, main hall lights; 1 each, basement driveway, the driveway arch and the court lights; 3, blank; that is, as yet unassigned.

The lighting of the apartments is, as mentioned, independent of the building plant, receiving current from city mains and delivering to the various apartments, where individual meters are set. The street lights, as the apartment lighting is called, are divided into four sections, the northeast, northwest, southwest and southeast apartments, corresponding to the four main halls and passenger elevators. The four switches are of 500 amperes capacity each and are three-pole double-throw pattern, making it possible to connect them to the plant should it be desired. There are also two three-pole single-throw switches at the bottom of this board; these are intended to control the Edison current for the elevator and public light panels, connecting the current through separate meters to the switches already mentioned on the bottom of those panels.

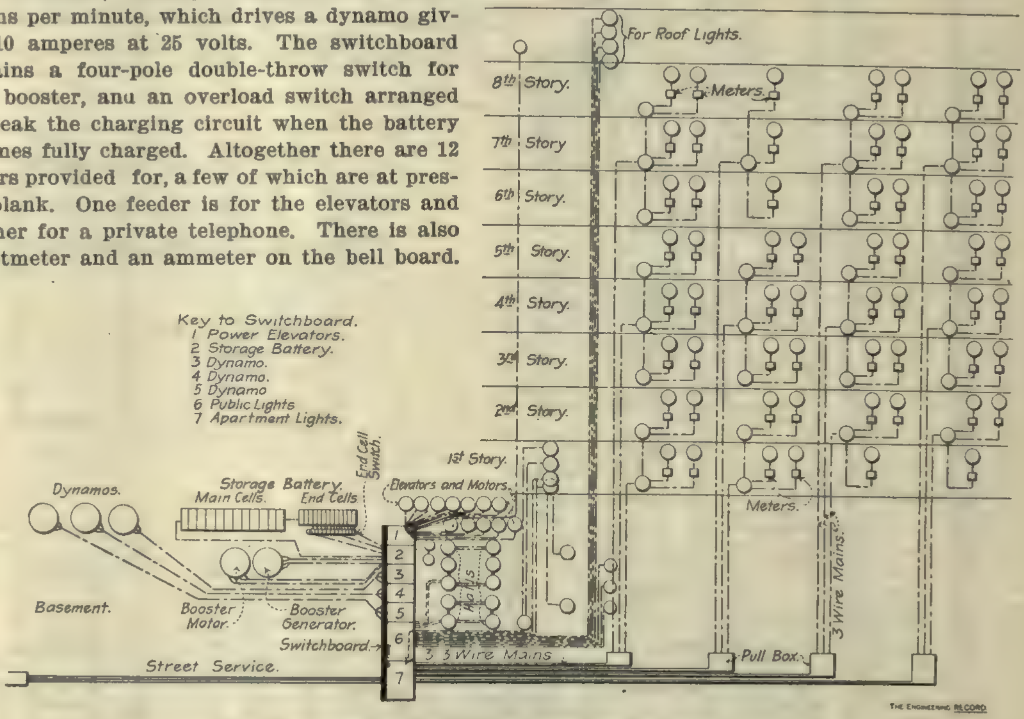
Four main riser shafts serve to carry the electric conduits upward through the building. These are located at convenient points adjoining the main halls, and for convenience may be lettered A, B, C and D; A and B are indicated on the half-floor plan already referred to. The distribution of this current by means of a large fuse panel at the base of each shaft is one of the particular features of the work, the replacement of a burned-out fuse being thus very readily done from such convenient points in the basement. This is different from an early scheme of distribution, as indicated in the accompanying wiring diagram. As indicated, the separate meters were provided in each apartment.

The conduits are run from the switchboard, some under the basement floor and the others on the ceiling. Those under the floor are enclosed in a box of creosoted wood with a filling of asphalt. Those on the ceiling are suspended by hangers, in the same manner that steam pipes are held. The fuse panels, to which the lighting feeders run, are made of ¾-inch white Italian marble. Two of them take care of as many as 24 circuits each, being those serving rear sections, where there are three apartments on eight different floors. The three-wire feeder coming to the panel is subdivided into three sets of bus-bars, of three bars each, the three sets placed across the rear of the panel. These are connected in each case to a horizontal row of copper studs, screwed into short pieces of copper on the face of the panel. From these, connections are tapped both upward and downward to a row of smaller copper studs to which the smaller feeders to the individual apartments are connected. For each of the three sets of bus-bars there are four groups of lugs running from the three bars to the face of the panel, and from each group two three-wire feeder connections. These are made through enclosed fuses on the panel face, one set upward from the group and the other downward. In brief, the main feeder subdivides into three sets of bus-bars, each of which is subdivided into four groups of three-pole connections, making twelve groups, each of which feeds two three-wire feeders, or 24 feeders all told.

The various branch circuits from these feeders are shown in the half-floor plan. Each apartment has a distributing panel, numbered and lettered to correspond with the rising shaft through which the conduits were brought. An interesting point is an arrangement by which one of the side apartments may take an extra chamber at the expense of the other. This is indicated in the floor plan, the partitions between apartments being tinted. When this room is added to one or the other apartment, it is necessary to disconnect it from the meter from which it was formerly supplied and join it to the circuits emanating from the other meter. This is accomplished by means of a lock switch, which is a double-pole double-throw knife switch on a marble base and placed in a slate-lined hardwood box with a heavy door and Yale lock and key.

The loss of potential is computed on the two-wire system, 120 volts, 3.1 watts per candle-power, and a maximum drop from the generator terminals on the switchboard to any outlet of 4 volts in public lights and of 3 volts in apartment mains. The requirements as to insulation resistance were 100,000 ohms between conductors and between conductors and ground, and 50,000 ohms when the fixtures were all connected to the system. The insulation resistance for the conductors of any one floor or any one circuit were required not to be less than 500,000 and 350,000 ohms, respectively.

The electric bell and annunciator system in the building is very extensive. It is operated from a separate storage battery in a room near the main switchboard, charged from a small booster set or transformer, and controlled by a separate switchboard at one end of the main board. Each apartment has a needle drop annunciator, and throughout the apartments there are push-buttons, including a waterproof floor outlet box in the floor of the dining room. The system includes the elevator bells. From the switchboard of this system one feeder is run up each servants' hall. The battery consists of a duplicate set of chloride accumulators, each set of 10 cells, with a capacity of 20 volts and 50 ampere hours, which is capable of operating the entire installation. The boosters are also in duplicate, each comprising a small Crocker-Wheeler motor, running at a speed of 1,500 revolutions per minute, which drives a dynamo giving 10 amperes at 25 volts. The switchboard contains a four-pole double-throw switch for each booster, and an overload switch arranged to break the charging circuit when the battery becomes fully charged. Altogether there are 12 feeders provided for, a few of which are at present blank. One feeder is for the elevators and another for a private telephone. There is also a voltmeter and an ammeter on the bell board.



THE ELECTRIC DISTRIBUTION IN THE GRAHAM COURT.

The apartments are steam heated, supplied by a two-riser system with main steam and return pipes in the basement. Exhaust steam, after passage through a grease extractor, is used, with the usual exhaust riser to the atmosphere fitted with back-pressure valve, so that only the excess of steam is allowed to go to waste; there is also the usual live steam connection through a pressure-reducing valve. The heating main is 12 inches in diameter at its largest part, and there are, extending from the basement to the top story, 60 sets of steam and 60 sets of return rising lines, with outlets on each floor for the radiators. These are of the direct type, comprising a total of about 10,000 square feet of surface. Air valves are provided throughout, with air piping leading to a drip sink in the basement. The water of condensation is returned by gravity, so far as the heating system itself is concerned, but it is returned to the boilers by a duplicate installation of Barr feed pumps, which work automatically under the control of a pump governor.

In connection with the laundry there are two dry rooms, with two drying coils furnished by the Chicago Clothes Dryer Works. Each contains about 800 linear feet of 1¼-inch pipe. For the exhaust of air from the laundry a 30-inch Seymour cone-case fan, with a rated capacity of 7,000 cubic feet of air per minute at a speed of 800 revolutions per minute, has been supplied. This is driven from a 10-horse-power electric motor. Another interesting feature of the building is the provision of a garbage room in the basement, where all refuse may be temporarily taken care of in the intervals between the visits of the city garbage removal wagons. This is provided with a fan exhaust, the fan being 42 inches in diameter and depended on to remove 10,000 cubic feet of air per minute when run at 600 revolutions per minute. The room has a large sink, in which the garbage cans can be turned upside down and cleaned by a jet of water or of steam, as desired. The fan mentioned takes air also from the engine room.

The auxiliary machinery of the steam plant includes a feed-water heater, a feed-water filter, a blow-off tank and various pumps. The feed-water heater is of the Berryman type, of 600 horse-power capacity; the feed-water filter of the same capacity. The blow-off tank is 42 inches in diameter and 8 feet long and has a condensing coil, which is required to cool the contents of the tank to 100 degrees Fahrenheit before its delivery into the city sewers, and which consists of about 100 feet of 2-inch brass pipe. As often done, fresh water for use in the boiler is led through the coil, utilizing the heat that would otherwise be wasted. During winter, when comparatively little fresh water is needed for the boilers, owing to the full utilization of the exhaust steam, the water from the blow-off tanks is discharged through a cooling coil carried on a wall in one of the vaults.

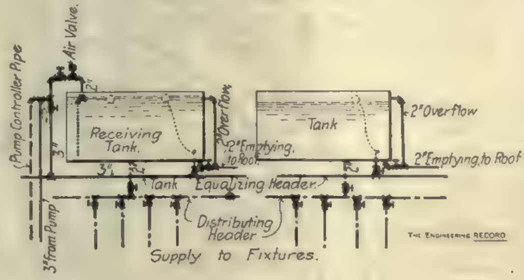
The Graham Court was built for Mr. W. W. Astor, from the plans of Messrs. Clinton & Russell, of New York. The mechanical plant, which has been described in part, was designed by Mr. J. Hollis Wells, engineer for the architects, the details of the electric work, however, being taken care of by Mr. A. E. Wells. Messrs. Gillis & Geoghegan, of New York, installed the boilers and steam power and heating work, and the Western Electric Company the electric work, Mr. Henry Krantz, of Brooklyn, building the switchboard. Mr. H. S. Thomas is the chief engineer of the plant.

Water Supply in a Block of New York Tenements.

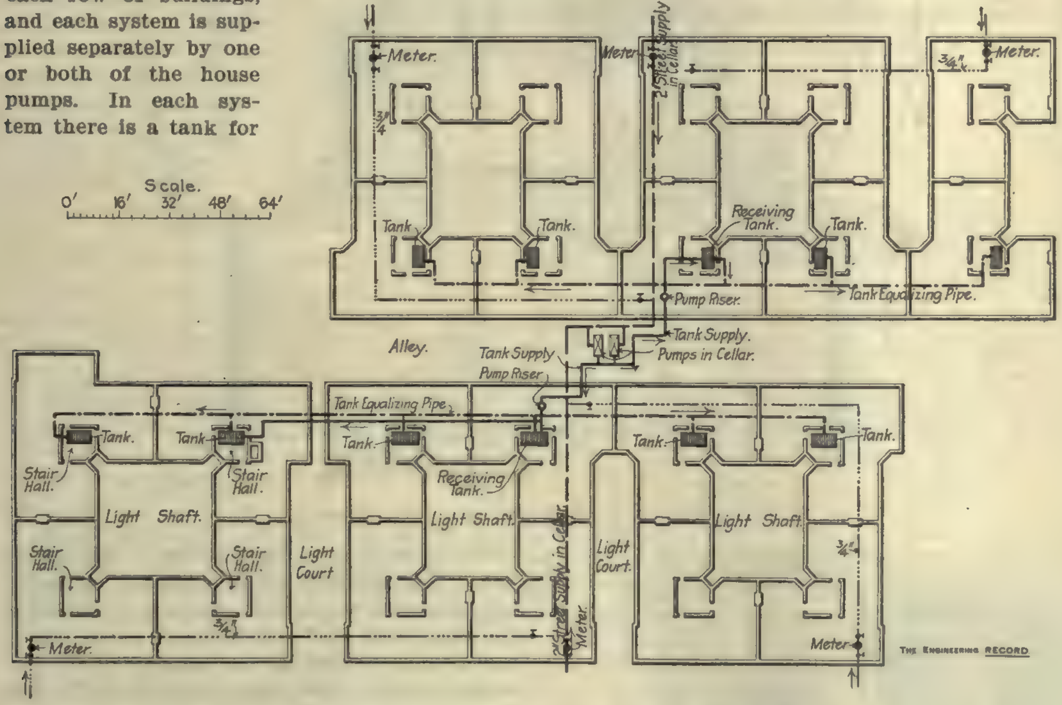
The New York Fireproof Tenement Association has recently built at 42d Street and Tenth Avenue a group of eleven seven-story fireproof tenement houses, with a single system of plumbing operated from a central point to serve all the buildings. The general plan of the houses and the arrangement of the suites is shown in the cuts.

Each building has an independent water supply from the street mains, and these services are arranged so that part of them supply street pressure to all the lower suites and the others are exclusively used for the supply to the common installation of boilers, pumps, heater and roof tanks. The street pressure supply is distributed through horizontal loops run around near the outer walls of each house on the cellar ceilng; the tank pressure supply is distributed through similar loops run on the ceilings of the upper stories. The whole mechanical and power plant, including boilers, suction tank, hot water heater, house and feed pumps and distribution drum, is installed at the basement level in a central position in the middle of the alley between the two rows of houses, as indicated on the general plan and shown conventionally to a larger scale in a sketch of the location of apparatus.

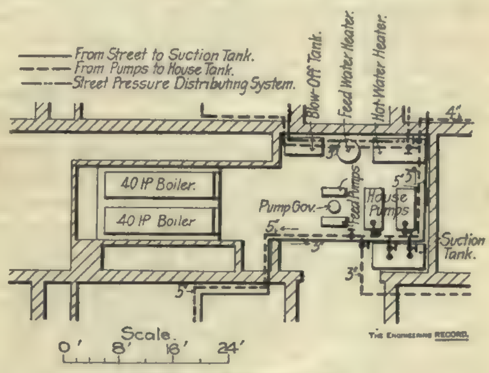
There are two systems of roof tanks, one for each row of buildings, and each system is supplied separately by one or both of the house pumps. In each system there is a tank for each house; the tanks are filled under pump pressure through ball cocks and are connected together by an equalizing pipe, so that they act as a single tank for storage and directly as separate tanks for supplies to fixtures, and so that any one can be cut out and its service maintained by the others.



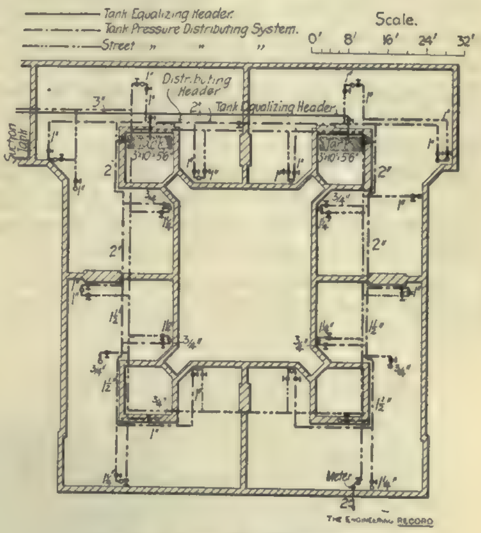
Roof Tanks.



Street Supplies and Pump and Tank Connections.



Central Pump Plant.



Cold Water Distribution.

There are 2-inch taps in the 42d and 41st Street mains near the centers of the two rows of buildings, and from them 3-inch service pipes are run without branches direct to the pump house, where they are connected over the suction tank and fill it through two branches, each with a 3-inch balanced float valve and a hush pipe extending to the bottom of the tank. Besides the 2-inch taps there are in each street two ¾-inch taps, each of which supplies the street pressure fixtures in one or two buildings; the buildings through which the pump supply is taken having their direct-pressure systems supplied from the adjacent buildings. From each ¾-inch tap a 2-inch service pipe is run to the distribution line on the cellar ceiling and branches from these loops supply the vertical risers, as is shown by a line broken with two dots in the plan of one building. These systems are not shown in the general pump supply plan, but the principle of the arrangement is indicated there by lines which show connections to the 3-inch supplies for the suction tank. These connections are valved and the valves are usually closed, but may be opened to allow either service to supply the other; normally the services for the pumps and boilers are kept entirely separate from those to the street pressure fixtures.

The 4 x 8-foot suction tank 4½ feet deep is made of ¼-inch iron with a tightly bolted cover of the same material, having over the ball cocks a hinged and locked hand-hole cover 18 inches square. The tank is supported above the pumps on an iron framework, and has no safe pan. All its connections are flanged, and it is provided with gauge glass, overflow and emptying pipes. From the suction tank there are two 4-inch valved suction pipes to the Barr house pumps and two 2-inch valved suction pipes to the boiler feed pumps, which are cross-connected with the former. The house pumps discharge into a 4-inch header, from which a 3-inch branch runs to the middle house in each row of buildings and thence rises vertically to the top story, where it discharges through a gate valve, 2-inch ball cock and hush pipe to the bottom of one of the house tanks.

The stand pipe has an air valve on the highest point, between the gate valve and a pressure pipe to the Kieley automatic regulators which control the pumps. A 3-inch valved branch is also taken from the top of the stand pipe to the horizontal equalizing pipe below the tanks, which connects all of them and maintains a uniform height of water in all except the first, or receiving tank, which is set at a higher level and is independently filled, as just described. Each tank has a bottom inlet from the equalizing pipe, which is controlled by a ball-cock with a float on a long curved arm, set so as to keep the valve open when the tank is not full and to close it only when the water rises to the overflow level, which is uniform in all but the receiving tank. Except when all the tanks are full, water can flow in either direction through all these valves and the tanks are filled through the equalizing pipe, which may be supplied either from the branch from the top of the pump riser or from the outlet in the bottom of the first tank, which is not closed until the water rises above the overflow of the other tanks and their ball-cocks have all been closed.

No supplies are taken from the equalizer pipe, but each tank has a second outlet into a distribution pipe that runs around two sides of the ceiling of the highest story in the house, the distribution pipes of the two floors in the same double building being connected. There are in all eleven roof tanks, with a combined capacity of 6,400 gallons. They are made of ¼-inch iron, with sectional covers of matched and dressed white pine, and are set without safes on I-beams across the upper parts of the stair halls.

In the accompanying diagram, which shows the arrangement of distribution mains in the basement and attic of one building, the mains are indicated by different conventions and are slightly separated horizontally, so as to distinguish both systems on the same plan. The vertical riser lines are valved top and bottom and have waste pipes and emptying valves, so that any one can be cut out and emptied without disturbing any other part of the service. Locked valves are set in the risers between the fourth and fifth story fixtures so that all below them shall be normally supplied from the street and all above them by the tank pressure system, and so that all may be supplied if necessary from either system.

All the hot water is under tank pressure supplied through a 2½-inch pipe from the attic, which is connected with a by-pass to the blow-off tank, so that the water may pass through its cooling coil and utilize the waste heat there before entering the hot-water heater in the pump room. The heater is fitted with a steam coil and thermostatic regulator and has valved outlets to a 3-inch header from which six valved lines, one for each building, are taken to the risers for all groups of hot water fixtures. The risers are valved top and bottom and have an emptying valve and waste pipe in the basement. From the top of each riser there is a down branch, with supplies taken from it at the successive floors to promote circulation.

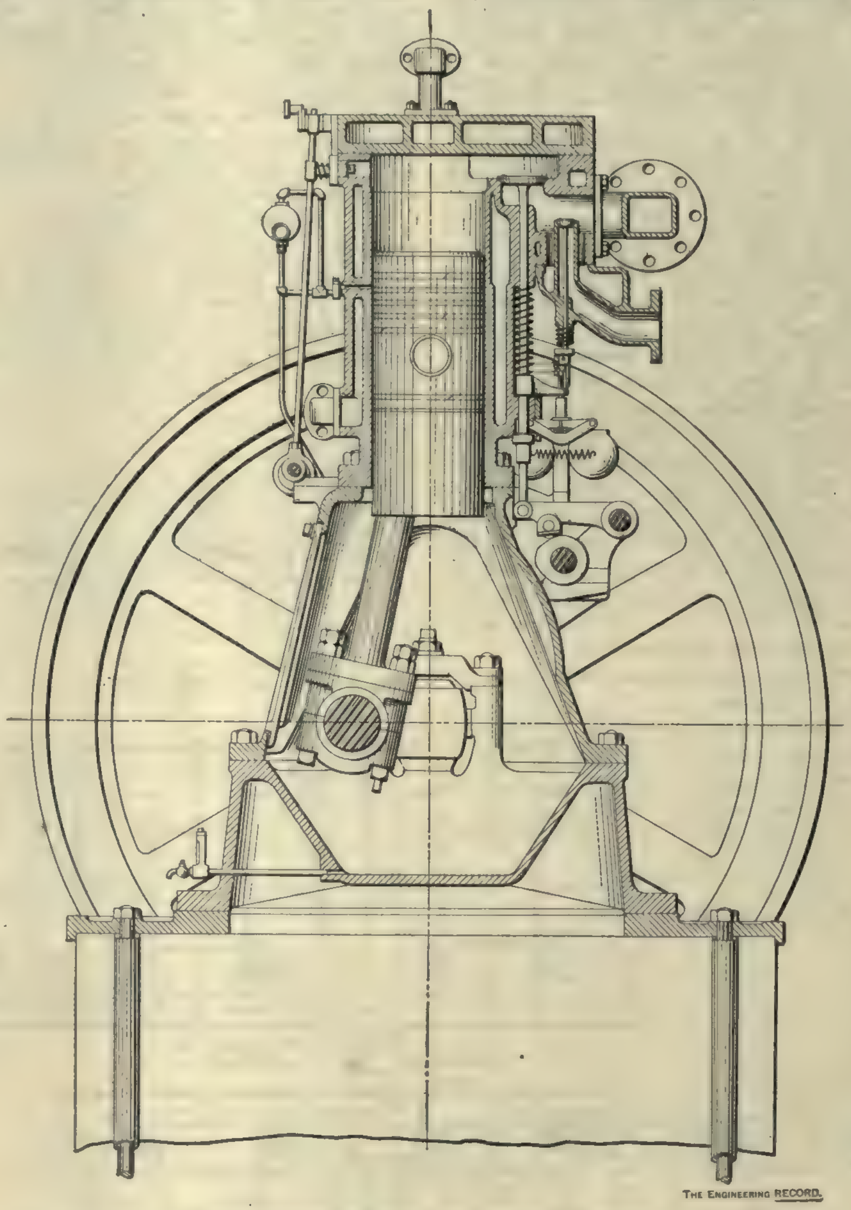
All hot and cold water pipes and fittings are of galvanized iron, exposed and painted, the main lines being carried as inconspicuously as possible near the walls. The cross sectional areas of the risers are equal to one-quarter the sums of the areas of all their respective branches, and all of them are furnished with air chambers and stop-valves near every fixture or group of fixtures. High class workmanship was required throughout, and the best grade of materials was specified. The water-closets are provided with syphon cisterns, brass flush-pipes and floor-slabs. The porcelain-enameled rolled-rim bath-tubs are 4½ feet long and painted white outside to match the exposed piping. The rain baths are 7½ feet high, with 5-inch showers in batteries of two and three, wasting through a common brass strainer outlet set in a cement floor. Their pipes have three coats of white enamel and the valves and showers are nickel plated. Wherever a sink and wash-tub are adjacent, a high-back 4-foot slate combination sink and tray on bronzed legs is used, with the ash covers for the tubs arranged to serve as drip boards for the sinks. Area drains have cast-iron boxes with detachable strainers, and are connected to the leader traps or have running traps and connect by 10 feet of extra heavy tarred galvanized wrought iron pipe with the blow-off tank.

Mr. Ernest Flagg was the architect of the buildings and Mr. O. F. Semsch of his staff was the engineer in charge of the plumbing, heating and mechanical installation. Mr. F. P. Kelley was the architect's superintendent, and Mr. John Boyd was the plumbing contractor.

A 125-Horse-Power Nash Gas Engine.

The latest improvements in the Nash gas engine and the details of its construction are shown in the accompanying illustrations, one a cross-section of a 125-horse-power engine and the other a view of its valve gear and working parts. The Nash engine is of the four-stroke cycle type.

The cross-sectional cut exhibits the working parts common to Nash engines of single-cylinder, two-cylinder and three-cylinder form. The engine is of the vertical, enclosed, self-oiling type. The cylinders are all separate castings, independent of one another, and are mounted on the crank case forming the upper part of a frame which encloses the pistons, main bearings, connecting rods and other working parts; all of these are lubricated by the oil contained in the base, which is dashed over them while the engine operates. Provision is made also for lubricating them independently by an automatic sight-feed oiler.

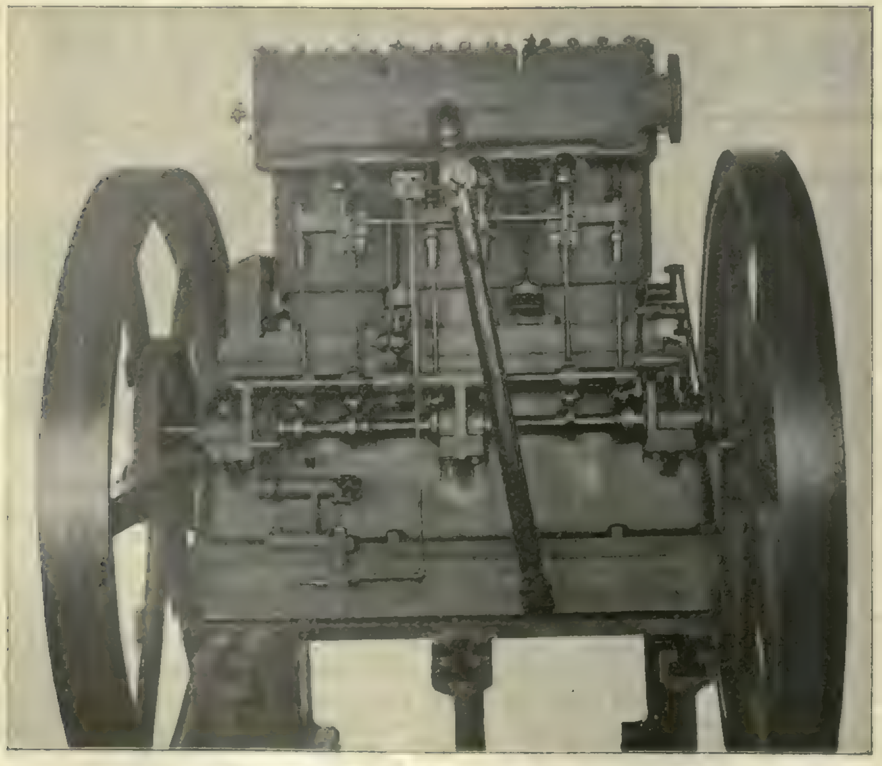


Cross-Section through One of the Cylinders.

The cylinders are water-jacketed on sides, heads and valve cases; they are drained at the lowest point. Trunk pistons, of simple single-acting form, are used, and since these act as cross-heads as well, they are made of proportionately great length to diameter, and, like the cylinders, of a special iron.

The crank shaft is in one piece of forged open-hearth steel, cut from the solid; the shaft is machined all over, and runs in adjustable bronze boxes, so arranged that each crank has a bearing on each side. The connecting rods are forged from open-hearth steel, the crank end being of the marine type, with adjustable boxes of a special hard bronze, while the end connected to trunk piston is formed into a solid eye bushed with bronze, arranged for easy renewal when necessary.

All the valves and the whole valve motion are



The Valve Gear of a 125-Horse-Power Nash Gas Engine.

conveniently located on the working side of the engine. A single cam shaft, driven by a pair of spur gears, operates all the valves through levers and rollers. Each cylinder has its own admission, gas and exhaust valves, the admission valve being shown with its cam, roller and lever, and the gas valve with a pawl, engaging a toe carried on the admission-valve stem, so that either these valves open both together, to admit a charge for the power stroke, or else the governor acts to disconnect the pawl, the gas valve remaining closed, and no charge entering until standard speed is restored, according to the principle of regulating by missed ignitions. Whenever a charge is missed, the admission valve still permits air to enter, which is compressed, expanded and exhausted, cooling the cylinder and cleaning it of any remaining products of combustion.

The exhaust valve is located immediately behind the admission valve, and the exhaust connection, with its flange, appears at the upper right-hand corner of the cylinder. Immediately below this is the flanged opening by which gas enters the mixing chamber, and surrounding the upper part of the gas connection is an annular opening through which air passes and is mixed with the entering gas for a charge. The valves are made of drop-forged steel, with long stems, fitted to bearings and guided at top and bottom to secure an accurate seating without any side springing to occasion wear and leakage. The National Meter Company, the manufacturer of the Nash engine, states that it has found that inserted valve castings become distorted by heat and either leak or break. It has designed the cylinder and valves so that after the first regrinding, performed some time after the engine is started, the valves wear so slightly and become so little coated with carbon as to require no further attention for sometimes a year or more.

Electric igniters of the make-and-break type are attached to each cylinder, as shown in cut, being operated by separate eccentrics carried on a shaft located on the side opposite to valve motion, and driven from the cam shaft by means of a cross shaft and two pairs of miter gears. The igniters are independent of each other, and are provided with means of adjustment to time the ignition accurately, as desired, without stopping the engine.

A special form of fly-ball governor, driven by bevel gearing from the cam shaft, operates by the method of missed ignitions. It does not operate the gas valves directly, but simply indicates by the position of a lever, to which it is connected, whether or not the lifting pawls shall act to open the gas valves or keep them closed, as demanded by the load upon the engine. Each cylinder has its own gas valves and is governed independently of the others.

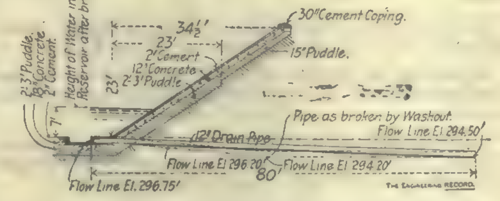
The 125-horse-power Nash engine has three cylinders, each 13½ inches diameter and 16 inches stroke, operating at a speed of 225 revolutions per minute. The manufacturers consider that satisfactory results in the way of lubrication, proper cooling of the cylinders, and general good working are secured by the moderate speed adopted, even though it necessitates more liberal cylinder dimensions for a given power than would otherwise be provided.

The engine is provided with a self-starting device, operated by compressed air. It consists essentially of an air compressor, an air reservoir and a valve mechanism to operate one of the cylinders by compressed air. The action is as follows: A single movement of the starting lever, shown at the left hand in the photograph, throws into action supplementary cams, so that the right-hand cylinder operates as a single-acting compressed-air engine, while the other two are placed ready to start up with gas. As soon as speed is attained, by means of the first cylinder, and ignitions occur in the other two cylinders, the starting lever is moved back to its normal position, the air-starting mechanism is disconnected, and the machine operates as a gas engine.

The Failure of the East Liverpool Reservoir.

On October 18, a reservoir at East Liverpool, Ohio, failed while being filled for the first time, and the circumstances were so unusual that the following facts concerning the accident have been furnished by a correspondent familiar with the details of the basin. The reservoir is located about 20 feet from the edge of a bluff which slopes downward at an angle of about 45 degrees. It is approximately rectangular in plan, about 275 feet long by 146 feet wide on the coping, and 23 feet deep. Its length is parallel to the edge of the bluff, and just to the south of it and only 16 feet farther along that edge is an old basin about 96 x 105 feet, also 23 feet deep.

The new reservoir was almost entirely in excavation and was lined on the bottom and sides with 15 to 18 inches of good puddle, well pugged and rammed with wide wooden rammers. This puddle was placed in three layers, which, owing to the frequent rains at the time the work was in progress, were compacted into one mass. The clay was then covered with concrete, 18 inches thick on the bottom and 9 to 15 inches thick on the slopes, rammed until it was compact. The basin was then given three to six weeks to harden, while the connecting pipes were being laid and other parts of the work brought to a finish. The supply main ran along the top of the bluff for the whole length of the reservoir, and was buried about 7½ feet deep on a line midway between the coping and the edge of the bluff. It ended at an inlet at one of the corners farthest from old basin. The outlet was at the corner diagonally opposite the inlet, while the drain pipe was at the southeast corner, nearest the bluff and the old reservoir. The details of the basin at the place where the drain pipe passes off are indicated in the accompanying sketch.



SECTION OF BANK AT DRAIN.

The last work on the reservoir was plastering a skim coat of cement, 2 inches thick, over the entire concrete surface. Owing to the time taken in doing this, the corner at which the break occurred had been in place at least two months.

The basin was gradually filled until the surface of the water stood about 17.4 feet above the bottom. When this elevation was reached, water was observed to be issuing from the hill below the reservoir, and ten minutes later the corner where the drain pipe was laid gave way, and the water rushed down the bluff, causing considerable damage. The axis of the crevasse in the bank corresponded with the diagonal through the corner and with the direction of the drain pipe. The slope lining was left in place from the bottom up to an elevation of about 7 feet; at that height a rectangular break about 11½ feet wide was washed through the lining. As the water rushed along it eroded a much larger trench, until, at a distance of about 40 feet from the toe of the reservoir lining, the channel was about 35 feet wide and 24 feet deep. The cause of the accident is not definitely known.

Trade Publications.

A voluminous catalogue of valves and other piping specialties has been issued by the Eddy Valve Co., Waterford, N. Y. It is a book of 256 pages, divided into nine sections, and while the publishers say they make many special valves not listed, it is certain that the great variety described covers all types in regular use by hydraulic and steam engineers.

A portable platform for use with gravity concrete mixers is described in a well-illustrated pamphlet issued by the Contractors' Plant Co., 174 Federal St., Boston. This platform reduces the cost of concrete by enabling the plant to operate so close to the work at all times that the handling of the mixed materials is reduced to a minimum.

A well-written description of the construction and use of steam economizers has been issued in attractive form by the Green Fuel Economizer Co., Matteawan, N. Y. The book is fully illustrated, parts of the company's apparatus and also plants in operation being shown, and there are many charts giving the results of tests of economizers at various places. The steam user will find the book of unusual interest.

Cameron & Co., Glenmore Ave. and Berriman St., Brooklyn, have issued a pamphlet showing briefly their line of overhead track, trolleys, chain hoists, automatic and special scales, dumping buckets and cars for industrial purposes.

A large line of pneumatic chipping, caulking and beading hammers, long and short-stroke riveters, holders, drills, painting apparatus and hoists, are described in a new catalogue of the Cleveland Pneumatic Tool Co., Cleveland. It is profusely illustrated with views of the apparatus in use in shops and on outside work.

The B. F. Sturtevant Co., Boston, has issued a new catalogue of the electric motors, generators and generating sets it now makes. The book is a well-illustrated 50-page publication which describes what the company considers its standard apparatus. As it has patterns for over 100 sizes and type of engines, ranging from 2 to 250 horse-power, and its motor designs are also very numerous, owing to the many requirements which are now made on fan equipments, it is not surprising that the electric department of the company is able to make such a good showing.

Hydraulic jacks of an astonishing variety of shapes and sizes are described in a 70-page book published by the Watson-Stillman Co., 204 East 43d St., New York. There are also lists of jack-screws and of the various appliances which go with such apparatus. Anyone who has heavy lifting to do will find this book of value.

The Pratt & Whitney Co., Hartford, has published a new edition of its catalogue of small tools for work of the highest accuracy, including dies, taps, milling cutters, punches, reamers, drills and the like. The data on general subjects relating to accurate machine work make the book one of special utility.

The United Telpherage Co., 20 Broad St., New York, has issued a new bulletin concerning its apparatus for handling materials in manufacturing establishments and power plants. It uses a motor trolley running on overhead cables or track and hauling trailer trolleys if additional capacity is needed.

The Positive Elevator Safety Co., Roe Building, St. Louis, has issued a folder describing a safety device for application to hydraulic and electric elevators to maintain automatically any desired speed of travel of the car, except when a break of the machinery or apparatus occurs, when it is designed to allow a comparatively slow and safe descent of the car without jar. It consists essentially of two hydraulic pumps on opposite ends of a winding drum, which are put in action when the car moves and circulate oil in a closed system through a valve with a variable area of flow and a specially arranged governor valve, the latter to close the outlet from the valve box when a break of the elevator equipment occurs and a tendency is produced to increase the pressure on the oil system due to more rapid pumping. A number of small openings are left open, however, through which enough oil escapes out of the valve box to provide for the desired slow descent of the car.

The Swain system of lubrication of journals, loose pulleys and crank-pins is described in a folder issued by W. B. Maull, 26 Cortlandt St. A solid lubricator is pressed against the shaft by a spring in a cup, which has an indicator showing the amount of lubricator remaining.

Tucker's combustion apparatus, for the accurate determination of the volatile ingredients and total ash of any organic matter, is described in a pamphlet just prepared by Baker & Co., Newark, N. J.

The Goheen Mfg. Co., Canton, O., has issued a folder giving in much detail the cost of painting a long viaduct in Denver.

Asbestos fire-felt non-conducting coverings are made in cylindrical sections for pipes, sheets for boilers and flues, and rolls for ground pipes and the like. These forms are fully described in a new pamphlet of the H. W. Johns Mfg. Co., New York, which also explains the best methods of applying them.

The Western Cement Co., Louisville, Ky., has prepared a 56-page book describing the uses and reliability of Louisville cement, and giving a large number of illustrations of notable structures in which it was used. The testimonials from prominent engineers and architects concerning the quality of work executed for them with such cement are particularly interesting.

Personal and Obituary Notes.

H. L. Marvin, chief engineer of the St. Louis, Kansas City & Colorado Railroad, died at Eldon, Mo., October 24.

Colonel Peter C. Hains, Corps of Engineers, U. S. A., in addition to his present duties, has been made a member of the Lighthouse Board.

Messrs. Lord & Hewlett, of New York, as the result of a competition for the purpose, have been selected to prepare plans for the new building for the Agricultural Department, Washington.

Prof. C. T. Johnson, assistant expert in charge at Cheyenne, Wyo., of the office of irrigation investigation for the Department of Agriculture, has been commissioned to proceed to Egypt to study irrigation methods.

Messrs. Carl L. Holmer and Walter Goodenough have opened an office at No. 508 Battery Park Building, New York, under the firm name of Holmer & Goodenough, for the practice of naval architecture and marine engineering.

Mr. H. A. Van Alstyne, Assoc. M. Am. Soc. C. E., has been appointed engineer of the eastern division of the New York State canals, succeeding Trevor McC. Leutze, whose decease was mentioned in this column October 19. He entered the State engineering department in 1890. Mr. William B. Landreth, M. Am. Soc. C. E., for some time special resident engineer, has been appointed resident engineer, to succeed Mr. Van Alstyne.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
ONTRACTORS BUILDERS, ENGINEERS AND
MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Boston, Mass.—Bids are wanted Nov. 21 by the Metropolitan Water & Sewerage Board for the construction of the open channel of the Weston Aqueduct, and of the Weston reservoir, as advertised in The Engineering Record.

Nevada, Mo.—J. B. Quigley, of the Mo. Water, Light & Traction Co., Nevada, writes that he proposes to expend about $60,000 in extensions, new machinery, etc., for the Nevada water-works.

Johnson City, Tenn.—The Johnson City Water Co. will receive bids at once for the construction of water-works, estimated to cost $35,000 to $50,000. Incorporators: J. B. Cox, Sam. T. Millard, L. P. Wood and others.

Dowagiac, Mich.—Bids are wanted Nov. 5 for furnishing 600 meters for metering the water system. H. L. Rutter, City Clk.

Gadsden, Tenn.—A movement is said to be under way for the construction of municipal water-works.

Wahpeton, N. D.—The Council is said to be considering the extension of water mains.

West Milton, O.—Village Clk. John Coote writes that on Oct. 26 it was voted to construct water-works.

Eureka, Ill.—The Fire and Water Committee is stated to have adopted a resolution to extend water mains in certain streets.

Lewiston, Idaho.—An election will be held Nov. 19 to vote on the issue of $80,000 bonds for the construction of new water-works, according to plans prepared by City Engr. Ernest McCullough.

Gillett, Wis.—Plans are stated to have been secured for a $5,000 system of water-works.

Hartford, S. D.—A vote will soon be taken on the proposition to issue $5,000 bonds for water-works.

Laurium, Mich.—Village Pres. W. L. Hager writes that it is proposed to build water-works and an electric light plant next season.

New Orange, N. J.—The New Orange Park Water, Heat, Light & Power Co., of New Orange, has been incorporated with a capital of $100,000. Incorporators: Richard C. DeArmond, James Arthur and Arthur Campbell.

Columbus, O.—Press reports state that the Directors of the water-works will have additional wells sunk near the West Side Station.

Sherburn, Minn.—Bids are wanted Nov. 9 for $4,500 bonds to be used to extend the water mains. C. M. O'Neill, Pres. Village Council.

Atchison, Kan.—At a meeting of the City Council, Oct. 28, a resolution was adopted instructing the City Attorney to prepare a petition to the District Court requesting the appointment of a commission on the purchase of the Atchison water-works by the city.

San Francisco, Cal.—The City Engr., C. E. Grunsky, through the Board of Public Works, has reported to Mayor Phelan that the Bd. of Pub. Wks. has acquired a water supply in the Sierras—the Tuolumne River—capable of providing the city with 150,000,000 gallons per day of pure mountain water.

Woodbury, N. J.—City Clk. D. F. Mathers writes that the new pump, for which the Water Committee is now preparing specifications, will probably be of horizontal triple expansion, condensing, direct-acting type, capacity 2½ or 3 million gallons.

Caruthersville, Mo.—The proposition to issue $26,000 water-works bonds is stated to have carried.

Searcy, Ark.—J. N. Rachels, Chmn. of the Water Com., writes that the city proposes to construct a system of water-works and an electric light plant. Estimated cost, about $25,000. Bids will probably be received in about 60 days.

Bridgeport, Ill.—Press reports state that the Canal Commissioner of Ill. will construct a pumping station at Bridgeport.

San Antonio, Tex.—The City Council has passed a new water contract ordinance, which requires the company to extend its mains, establishes the water rates and reserves to the city the right to purchase the water-works plant at any time it may desire to do so.

Atlantic City, N. J.—Supt. W. C. Hawley writes that the City Council, not having a quorum present Oct. 28 to receive bids for furnishing the Water Department with the following cast-iron pipe, 72 lengths of 20-in. ball joint pipe; 10 lengths of 20-in. ball and flange pipe and 10 lengths of 20-in. spigot and flange pipe, new bids will have to be asked.

Portland, Ore.—The City Water Committee will, until Nov. 18, receive propositions from any individual or corporation owning or controlling any water source, or supply, or plant covering that portion of the city formerly known as Albina, and adjacent territory, for the sale of all or any portion of the plant or works furnishing such supply. Frank T. Dodge, Supt., Operating Com.

Southampton, Ont.—Village Clk. Jas. Howe writes that bids will be opened Nov. 7 for the construction of water-works, estimated to cost $16,000. John Galt, of Toronto, Engr. in charge.

Barron, Wis.—Press reports state that the city has made a contract with the Barron Manufacturing Co. to purchase its water power for electric lighting and water-works purposes. Consideration, $6,000. The city will make improvements in the plant and also in its water and lighting system.

Allegheny, Pa.—The Committee on Water has under consideration the proposition to construct a reservoir with a capacity of 600,000,000 gallons.

Bay City, Tex.—The Stewart Canal Co., of Bay City, has been incorporated with a capital of $25,000. Purpose, to construct dams, reservoirs, lakes, canals, etc., to irrigate. Incorporators: A. C. Stewart, C. W. Burkhart and G. B. Culver.

Harrison, Ark.—The estimated cost of constructing water-works and a sewerage system is $27,000.

Westerville, O.—Local press reports state that plans are being prepared for a new system of water-works. D. S. Seeley, Jesse Miller and Prof. F. E. Miller have been nominated for the Water-Works Board.

Longmont, Colo.—The contract for work on the new water system has been let to R. P. McDonald, of Denver, for $18,000, the city having purchased the pipe for the 12 miles of main line.

Newark, O.—The city's contract with the Newark Water-Works Co. expires in 1905, and preliminary steps have been taken by the City Council for the construction of a new water-works system. L. E. Chapin, of Canton, O., has been engaged to prepare plans and specifications.

Spokane, Wash.—Local press reports state that surveys are now in progress for a large flume, to be built across Spokane River by the Spokane Land & Water Co.

Brockton, Mass.—The Common Council has killed the order providing for a loan of $10,000 to secure a preliminary survey for an additional water supply.

Cody, Wyo.—Press reports state that William F. Cody and Nate Salisbury are at the head of a company of Eastern capitalists who are preparing to build a power and irrigation canal 45 miles in length, which will irrigate 100,000 acres of land. The engineers are said to have completed surveys and estimates on the cost of construction. The canal will have its source at a dam across the Shoshone River, near Cody, where the power plant will be located. The cost of the power plant and canal will aggregate $700,000.

Geneva, N. Y.—The Board of Public Works has voted to extend the water mains through Jefferson avenue, Ontario and Lake Sts.

Charleston, S. C.—Press reports state that the Mercantile Trust and Deposit Co. of Baltimore has secured options on the property of the Charleston Water-Works Co. and a large amount of land at Ten Mile Hill, and is negotiating for the construction of a new water supply system here which will cost $1,500,000. Gen. John Gill, Pres.

Suffield, Conn.—It is stated that the Springfield Street Railway Co. has purchased the plant of the Suffield Water Co. in Mapleton. The plant will be enlarged and remodeled, and will furnish power for the trolley extension being built.

Lemoore, Cal.—It is stated that bids will be received about Dec. 2 for constructing a combined water and electric light plant. W. F. Holser, City Clk.

Lafayette, Ind.—The contract for the erection of an auxiliary water-works pumping station at Columbian Park has been awarded to H. C. Sense, of Lafayette, for $10,538.

Chicago Heights, Ill.—It is stated that bids are wanted Nov. 4 for constructing a reservoir 175 x 100 ft., and 20 ft. deep, furnishing material and laying 6-in. water pipe, and sinking and casing four 10-in. drilled wells, not less than 200 ft. in depth. P. F. Jirtle, City Clk.

Camden, N. J.—The General Water Supply Co. with a capital of $1,000,000, has filed articles of incorporation. The incorporators are Paul T. Shinn, Thomas G. Coulter and John M. Kelly, all of Camden.

Jersey City, N. J.—The Union Hill Board of Education is considering the installation of water filters in the schools.

Cleveland, O.—It is stated that bids are wanted Nov. 20 for furnishing 5,000 ⅝-in. meters, with privilege of 10,000 meters, four 6-in. meters, 200 1-in., and 800 ¾-in. C. P. Salen, Dir. Pub. Wks.

Orange, N. J.—City Engr. F. T. Crane is said to be preparing maps and plans for a new water main from Campbell's Pond to the city limits.

Baraboo, Wis.—Press reports state that the city will engage R. D. Salisbury of the University of Chicago to recommend the best place from which to secure a city water supply.

Houston, Tex.—It is stated that bids will be received by E. B. Cushing, of Houston, until about Nov. 9, for sinking artesian wells in four different towns.

Centennial Heights, P. O. Calumet, Mich.—E. Lumpus, Secy. of the Centennial Heights Water Co., writes that bids will be received April 1, 1902, for the construction of water-works estimated to cost $20,000. Capt. J. Smith, Engr. in charge.

Troy, N. Y.—Bids are wanted Nov. 12 for furnishing f. o. b. cars 9,156 lin. ft. of 20-in. cast-iron pipe and 15.000 lbs. of special castings. John Phelan, Commr. of Pub. Wks. Jas. M. Riley, Clk. pro tem. Bd. of Contract & Supply.

Madisonville, O.—Mayor Dittgen has appointed a committee, of which Geo. Hock and W. B. Shattuc are members, to urge the water-works bond issue of $25,000.

Osborn, O.—G. Shortle, Pres., writes that it is proposed to construct water-works and an electric light plant, to cost about $75,000. Bids will be received for same about Jan. 1.

St. Cloud, Minn.—Frank L. Randall, Gen. Supt. Minnesota State Reformatory, writes that water-works will be constructed at the Reformatory and work may be largely done by prisoners. A press report states that the work will cost about $10,000.

Versailles, O.—Bids are wanted Nov. 20 for $10,000 bonds, for the extension of the water and light plant. A. Calderwood, Mayor.

Green Island, N. Y.—J. Leland Fitzgerald, of Schenectady, has estimated the cost of constructing a system of municipal water-works at $80,300.

Hannibal, Mo.—It is stated that a number of additional water mains will be laid by the city.

Norwood, O.—The Water-Works Trustees are about to make improvements to the water-works plant at a cost of $15,000. These improvements will include a smoke stack 100 ft. high, and new boilers.

St. Paul, Minn.—Plans are being prepared, under the direction of Secretary Caulfield, for extension of the water system.

Sault Ste. Marie, Mich.—The Board of Public Works has accepted the plans of Robt. C. Sweatt for the proposed new pumping station for the city water-works.

New Kensington, Pa.—It is stated that the New Kensington Water Co. will construct a water plant at a cost of $100,000.

Washington, D. C.—Supt. Water Dept. W. A. McFarland writes that the contract for constructing a pumping station on Trumbull St. was awarded, Oct. 12, to Geo. A. Fuller Co., of Baltimore, Md., for $314,282.

Bids opened Oct. 19 by the Commissioners D. C., for 1,400 ft. of 30-in. cast-iron water pipe were as follows: Warren Foundry & Machine Co., New York, $24.90 per ton; U. S. C. I. Pipe & Foundry Co., Phila., $26.40; M. J. Drummond & Co., New York, $26.90; R. D. Wood & Co., Phila., $25.90.

SEWERAGE AND SEWAGE DISPOSAL.

Durham, N. C.—Bids are wanted Nov. 20 for constructing pipe sewers and furnishing sewer pipe, as advertised in The Engineering Record.

Moorestown, N. J.—Bids are wanted Nov. 14 for the completion of a system of sewers and sewage disposal, as advertised in the Engineering Record.

Harrisburg, Pa.—Bids are wanted Nov. 4 for constructing a sewer in a portion of 16th St. Geo. B. Stucker, Highway Commr.

W. Homestead, Pa.—Bids are wanted Nov. 9 for constructing about 4 miles of sewers in W. Homestead, requiring about 17,952 ft. of 8, 10, 15, 18, 24 and 30-in. pipe sewer, together with manholes, flush tanks and inlets. R. L. Smith, Boro. Engr., 1011 Park Bldg., Pittsburg.

Ft. Dodge, Ia.—Bids are wanted Nov. 4 for constructing storm water sewers in certain streets. D. A. Weller, City Clk.

Washington, Ia.—Bids are wanted for 1,000 ft. of 30-in. double strength sewer pipe, also for constructing, except the excavation, 1,000 ft. of 30-in. brick sewer laid in Portland cement. Chas. Hebener, Chmn. Sewer Com.

Auburn, Ind.—Bids are wanted Nov. 19 for constructing an 8-in. tile sewer, laid to a depth of from 5 to 6 ft.; also 2 catch basins in connection with said sewer. J. J. Van Auken, City Engr.

Norwood, O.—Bids are wanted Nov. 25 for $17,415.74 sewer bonds. W. E. Wichgar, Village Clk., c/o W. R. Collins, Rm. 505 Johnston Bldg., Cincinnati.

Evanston, Ill.—Bids are wanted Nov. 7 for constructing a sewer in a portion of Darrow Ave. Jas. A. Patten, Pres. Bd. Local Improvement.

Marshall, Mo.—Bids are wanted Nov. 4 for constructing a sewer with manholes, flush tanks and appurtenances in sub-district No. 3 of sewer district No. 2. A. R. James, City Clk.

Kokomo, Ind.—Bids will be received by the City Council until Nov. 18 for constructing 600 ft. 18-in., 900 ft. 15-in. and 2,300 ft. of 12-in. tile sewers. Jackson Morrow, City Engr.

Newark, N. J.—Bids are wanted Nov. 8 for making certain test borings along the line of the proposed outlet or trunk sewer for the joint municipalities of Newark, Irvington, Milburn, W. Orange, S. Orange, Summit and Vailsburg. Wm. Rollinson, Secy., Joint Meeting, Century Bldg.; Alexander Potter, Ch. Engr., 150 Nassau St., N. Y. City.

Mapleton, Minn.—Bids are wanted Nov. 4 for constructing 3,434 ft. of sewer in Main, Second and Church Sts. C. J. Laurisch, Village Recorder.

Fairmont, Minn.—Alvord & Shields, Hartford Bldg., Chicago, Ill., are designing a sewerage and sewage disposal system for Fairmont.

Wyandotte, Mich.—City Clk. H. O. Maloch writes that the question of constructing a new sewer system, estimated to cost $59,000, is under consideration. Mason L. Brown, Engr. in charge.

Columbia, S. C.—The Sewerage Commission has submitted a report to the Council stating that J. L. Ludlow, of Winston, N. C., had commenced surveys for the proposed sewerage system and that it was hoped to have plans and specifications in January.

Wilkesbarre, Pa.—The Joint Finance Committee has reported with a favorable recommendation an ordinance authorizing the increase of the indebtedness of the city $60,000, which amount is to be expended as follows: $30,000 for sewer work, $12,000 for repaving streets and $15,000 for the erection of a fire engine house, etc.

Los Angeles, Cal.—Local press reports state that surveys are now being made under the direction of City Engineer Stafford for the proposed new outfall sewer, from a point in Hyde Park to the Pacific Ocean. According to the preliminary estimates the cost will be $726,000.

New Rochelle, N. Y.—Bids are wanted Nov. 12 for constructing a surface water drain in Residence Park. Patrick E. O'Connor, Clk. & Secy., Bd. of Sewer Commrs.

Ft. Leavenworth, Kan.—Bids are wanted Nov. 6 for constructing a sewer, manholes and flush tanks, and changing water main at this post. Address D. E. McCarthy, Q. M.

Charlotte, Mich.—The Common Council has adopted the report of the committee authorizing the construction of 4 miles of sanitary sewer and 1½ miles of storm water sewer.

Youngstown, O.—Bids are wanted Nov. 9 for constructing a sewer in Burke St. C. E. Cross, Clk. City Commrs.

Portland, Ore.—The Brooklyn Sub-Board of Trade has voted to ask the Mayor and City Council to take action for the construction of a sewer system for Brooklyn.

St. Louis, Mo.—As a result of charter amendments voted for Oct. 22, it is stated that there will be constructed 30 miles of new sewers and 50 miles of new streets.

Lancaster, Pa.—The Council has appropriated $10,000 for the construction of sewers in certain streets.

Harrison, Ark.—See "Water."

Brockport, N. Y.—The taxpayers have under consideration the question of sewerage.

Michigan City, Ind.—It is stated that bids are wanted Nov. 11 for constructing sewers in 2 streets. H. M. Miles, City Engr.

Jacksonville, Ill.—Pub. Engr. C. W. Brown writes that 6,545 ft. of pipe sewer is about to be built on two streets.

Marquette, Mich.—It is stated that bids are wanted Nov. 4 for constructing an 8-in. tile sewer, with 4-in. Y's, in Pine and Crescent Sts. Franklin E. Bay, City Compt.

Milwaukee, Wis.—A measure has been introduced into the Common Council for the purification of the Menomonee River. Local press reports state that to accomplish this result an entire new sewerage system would have to be built.

Kansas City, Kan.—The matter of improving the sewerage of this city is under consideration.

Geneva, O.—The contract for furnishing plans and estimates for the construction of a sewer system and reduction plant has been awarded to Riggs & Sherman, of Toledo.

Sandy Hill, N. Y.—It is stated that bids are wanted Nov. 12 for $65,000 sewer bonds. Address Village Clerk.

Gladstone, Mich.—The Council is stated to have had plans prepared for a sewer system estimated to cost $23,200.

Kansas City, Mo.—It is stated that bids are wanted Nov. 6 for constructing a sewer in District No. 197. Robt. W. Waddell, City Engr.

Washington, D. C.—Bids are wanted Nov. 9 for constructing sewers in the District of Columbia. Lansing H. Beach, Commr. D. C.

New York, N. Y.—Bids are wanted Nov. 13 for constructing 2,097 lin. ft. of 3-ft. 6-in. x 2-ft. 4-in. and 3,569 ft. of 4-ft. x 2-ft. 8-in. brick sewers, 3,700 lin. ft. of 15-in. vitrified salt-glazed stoneware pipe sewers, 310 lin. ft. 12-in. vitrified salt-glazed stoneware pipe culvert, etc., in portions of 4 streets. Jas. Kane, Commr. of Sewers.

Little Rock, Ark.—It is stated that bids are wanted Nov. 9 for constructing sewers in District No. 31. L. C. Balch, Chmn. Bd. Commrs.

Brooklyn, N. Y.—Bids are wanted Nov. 13 for constructing 17,182 lin. ft. of 12, 15, 18 and 24-in. vitrified stoneware pipe sewers, 159 manholes, etc., in several streets in the Borough of Brooklyn. Jas. Kane, Commr. of Sewers, N. Y. City.

Omaha, Neb.—Bids are wanted Nov. 8 for constructing pipe sewers in Sewer Dist. No. 267. Wm. Coburn, Secy. Bd. Pub. Wks.

Glenville, O.—Bids are wanted Nov. 20 for constructing storm-water sewers in Eddy Road. Ira C. Farley, Village Clk.

Croswell, Mich.—It is stated that a sewerage system is contemplated.

Sheridan, Ind.—Bids are wanted Nov. 18 for constructing a sewer system. David J. McMath, Town Clk.

Chicago, Ill.—Bids are wanted Nov. 16 for furnishing material and constructing the uncompleted portion of the tunnel section of the main conduit for intercepting sewers in Lawrence Ave. Address Commissioner of Public Works.

Wallingford, Conn.—Contracts are to be let at once for the construction of a sewer on North Elm St.

San Francisco, Cal.—The Street Committee of the Board of Supervisors has decided to recommend the purchase of the rights of way for the extension of the Potrero Ave. sewer.

Hyde Park, Mass.—A. D. Nickerson, Engr. to Sewer Commissioners, writes that the following bids were opened Oct. 23 for sewer construction, the work to include 6,060 ft. of 8 to 20-in. pipe sewer, with 25 manholes; the trench to vary from 8 to 16 ft. in depth, and be excavated in sand, gravel and ledge, also a crossing of Neponset River, 120 ft.: H. A. Hanscom & Co., Boston, Mass., $18,810 (awarded); C. E. Trumbull & Co., $21,346.

Havana, Cuba.—Lieut. W. J. Barden, Corps of Engrs., U. S. A., Ch. Engr., City of Havana, writes that the following bids were opened Oct. 23 for constructing the sewerage system: A, Estimated cost + 25 per cent.; B, McArthur & Co.; C, Havana Contractors' Co.; D, The Pan-American Construction Co. and M. J. Dady; E, McGivney & Rokeby. For paving bids received at the same time see "Paving and Roadmaking."

Sections.	A	B	C	D	E
East side marginal	$395,461	$505,042	$421,351	$553,994	$433,560
North side marginal	723,501	986,916	833,538	940,768	929,508
South side high level	208,541	282,509	282,355	372,984	294,271
North Matadero	190,634	218,504	206,425	274,161	221,234
Matadero drainage	436,058	522,723	459,465	484,035	488,742
South Matadero	87,390	96,808	99,280	124,778	117,412
Jesus del Monte	63,644	73,555	80,696	83,087	86,265
Cerro	173,851	199,353	253,314	234,705	281,132
Vedada	402,315	474,026	390,595	398,309	456,649
Manholes and connections	874,558	910,877	742,617	1,012,394	972,553
Pumping stations and accessories	711,935	764,964	650,713	720,809	906,426
Extra work	311,437	383,537	354,100	527,150	275,950

Newark, N. J.—Bids for the construction of section 2 of the central relief sewer were received Oct. 24, and the contract was awarded to the Harrison Construction Co., of Newark, for $9,857.50. Other bids received were as follows: Patrick Reynolds, $11,499; Bernard J. Sullivan, $11,775, and Headley & Christie, $10,908.75.

Rochester, Ind.—Wm. H. Stacy, Pres. Bd. of Village Trustees, writes that the following bids were opened Oct. 24 for sewer construction work to include 12,020 ft. of 20 to 10-in. pipe sewers, 33 manholes and 4 flush tanks; the trench to average 13-ft. in depth and be excavated in gravel and sand: C. G. H. Goss, Engr.: M. A. Talbott & Co., Logansport, Ind., $20,029; Jos. Derheimer, Ft. Wayne, Ind., $19,614; Brumbaugh & Miller, Elkhart, Ind., $21,234; E. Woods & Co., Decatur, Ind., $19,499 (awarded); Green, Onstett & Carter, Rochester, Ind., $21,733; W. W. Hatch & Sons, Goshen, Ind., $20,883.

BRIDGES.

Jamestown, N. Y.—The construction of a bridge across Chautauqua Lake, between Jamestown and Mayville, is contemplated.

Kansas City, Kan.—Press reports state that Engineers Tuttle & Pike, of Kansas City, Mo., are preparing plans and specifications for a bridge to cross Kaw River, near its mouth, and an elevated railway structure, to be built along Missouri River, from 3d St. and Minnesota Ave., Kansas City, Kan., to 6th and Bluff Sts., Kansas City, Mo. The projected structure is for the use of the Kansas City & Leavenworth Ry. Co. in extending its interurban electric railway from the present terminus in Kansas City, Kan., to the business center of Kansas City, Mo.

Charlestown, Md.—Press reports state that Assistant Engineer Weston, of the Philadelphia, Wilmington & Baltimore, R. R., is making a survey at Charlestown for an overhead iron bridge and roadway.

Ludington, Mich.—A $15,000 steel bridge is to be constructed across Pere Marquette Bayou, at Ludington.

Bridgeport, Conn.—Local press reports state that plans and specifications have been accepted, and bids will soon be asked, for the construction of a roller lift bridge across Pequonoc River, at Bridgeport, on the Consolidated R. R. W. H. Moore, Bridge Engr., New Haven, Conn.

Latham, Ill.—The citizens are in favor of constructing an iron bridge across Rock River, at Latham.

Marlin, Tex.—A petition is being circulated in the southern part of the county asking the Commissioners Court to construct a bridge across Brazos River, near the falls, about 5 miles southeast of Marlin.

Westmoreland, Kan.—Bids are wanted Nov. 9 for constructing a steel bridge across Cross Creek. Address A. P. Scritchfield.

Kansas City, Mo.—Geo. E. Kessler, Secy & Engr., Park Bd., writes that new bids will be opened Nov. 6 for furnishing and constructing the steel work for Benton Boulevard bridge.

Boston, Mass.—City Engr. Wm. Jackson writes that the contract for rebuilding the piers of Broadway bridge over Ft. Point Channel has been awarded to Patrick McGovern, of Boston, for $22,300.

Victoria, B. C.—C. H. Topp, City Engr., writes that the time for receiving bids for constructing the Point Ellice bridge has been extended to Nov. 11. Estimated cost, $85,000.

Waterville, O.—Press reports state that permission has been granted by the Commissioners of Wood and Lucas counties to the Toledo, Waterville & Southern Ry. Co. to construct a bridge across Maumee River, near Waterville.

Andover, B. C.—The Dominion Bridge Co. has secured the contract for building bridge across St. John River at Andover. The bridge is to have 5 spans, each 188 ft. long, also 4 piers and 10 abutments, built of granite masonry; total length of bridge, 1,050 ft.

Swampscott, Mass.—Samuel K. Hamilton, of Wakefield, John E. Hannigan, of Cambridge, and Railroad Commissioner Clinton K. White, of Melrose, have been appointed as Commissioners to apportion the cost of constructing a bridge across the tracks of Boston & Maine R. R. at Essex St., Swampscott.

Lockhaven, Pa.—The residents of Wayne Township are circulating a petition for the construction of a bridge at Quiggle ferry.

Pasadena, Cal.—The Board of Supervisors contemplates the construction of a bridge across San Gabriel River, between Pasadena and Asusa, at a cost of about $10,000.

Chicago, Ill.—City Engineer Ericson has decided to ask the Finance Committee of the Council to appropriate $160,000 for the construction of a bridge at North Western Ave.

Local press reports state that new plans will be prepared for a bridge at Harrison St.

Columbus, Ga.—Press reports state that plans and specifications are being received for a bridge to be constructed across Chattahoochee River, for which bonds to the amount of $40,000 were recently voted.

Duluth, Minn.—The Common Council has accepted a proposal from the Duluth Canal Bridge Co. to construct the proposed aerial bridge across the Ship Canal, at a cost of $100,000.

Cattaraugus, N. Y.—It is stated that the Directors of the Buffalo, East Otto & Cattaraugus Electric Ry. Co. are about to let contracts for building and equipping the road. There will be 5 steel bridges needed, the largest to cross the Cattaraugus Creek at the dam, and to be 680 ft. long and 219 ft. high. Two power houses are to be constructed, one at Cattaraugus dam, the other at Cattaraugus.

Washington, D. C.—The Secretary of War has approved the plans of Baltimore & Potomac R. R. Co. for bridge to be constructed across Potomac River, to take the place of Long Bridge. These plans are for bridge proper; action on plans for approaches, to be constructed across Potomac Park, having been deferred.

Brooklyn, N. Y.—The Robert Gair Manufacturing Co. has made application to the Municipal Assembly for permission to construct a steel bridge, at a probable cost of $10,000, across Washington St., for the purpose of connecting the present factory with the one now under construction.

Cedar Rapids, Ia.—Local press reports state that the following bids were received Oct. 18 for constructing a viaduct at A Ave., including the excavation of the avenue to a grade level with the tracks in 4th St. back to the east abutment of the proposed structure, with concrete and stone footings 3 ft. below that grade: American Bridge Co., represented by A. Y. Bayne, Minneapolis, Minn., $37,700; W. S. Hewitt & Co., Minneapolis, Minn., $37,987; Standard Bridge Co., Omaha, Neb., $39,000; Fort & Snouffer, Cedar Rapids, Ia., $38,000.

Pittsburg, Pa.—Contracts have been awarded as follows for the construction of a viaduct 1,000 ft. long, to connect the township of Turtle Creek Valley with the new town of Trafford Park: For steelwork, to McClintic-Marshall Construction Co., and masonry work to Patton & Gibson, both of Pittsburg; total amount of contracts said to be about $50,000.

Zanesville, O.—Co. Aud. Jas. L. Starkey writes that the following bids were opened Oct. 24 for the construction of a masonry lift bridge to cross lateral canal of Muskingum River: *a*, excavation per cu. yd.; *b*, masonry or concrete per cu. yd.: Adams Bros., Zanesville, *a*, $2.25; *b*, $7.60. F. M. Townsend, Zanesville, O., *a*, $2.20; *b*, $7.35.

Buffalo, N. Y.—Frank V. E. Bardol, Ch. Engr., Grade Crossing Commrs., writes that the contract for constructing the substructure of Van Rensselaer St. bridge has been awarded to the German Rock Asphalt & Cement Co., Ltd., Morgan Bldg., Buffalo, for $53,957. New bids will be received Nov. 11, for the superstructure of above bridge, as advertised in The Engineering Record.

PAVING AND ROADMAKING.

Cleveland, O.—Julius C. Dover, Clk. of the Board of County Commrs., writes that bids will be opened Nov. 6 for improving Noble Road with brick or macadam, at an estimated cost of $50,000. Wm. H. Evers, Co. Surveyor.

Lorain, O.—Bids are wanted Nov. 11 for furnishing material and draining, grading, curbing and paving with brick on a portion of E. Erie Ave. J. J. Mahoney, City Clk.

Kansas City, Mo.—Bids are wanted Nov. 6 for paving with brick on Main St. Robt. Waddell, City Engr.

Jeffersonville, Ind.—Bids are wanted Dec. 3 for 370 squares of Granitoid sidewalks, 5,600 lin. ft. curbing and 5,600 lin. ft. vitrified brick gutter on Chestnut St. Victor W. Lyons, City Engr.

Oskaloosa, Ia.—Bids are wanted Nov. 4 for 4,219 sq. yds. brick paving, 788 lin. ft. cement curbing on portions of 3 streets. C. Leighton, City Clk.

Wilkesbarre, Pa.—See "Sewerage and Sewage Disposal."

New York, N. Y.—Bids are wanted Nov. 12 for regulating, grading, setting curbstones, flagging sidewalks, etc., in Trinity Ave., requiring 30,000 cu. yds. rock excavation, 11,100 sq. ft. new flagging, etc., and in Boston Road, requiring 2,200 cu. yds. rock excavation, 11,300 sq. ft. new flagging, etc., in Boro. of Bronx. James P. Keating, Commr. of Highways.

Pekin, Ill.—City Engr. D. H. Jansen writes that the contract for paving streets around Court House Square has been awarded to Wolf, Maupin & Curdle, of Alton, Ill., at $1.23 per sq. yd. for 3,650 sq. yds., paving on a 6-in. concrete foundation; 25 cts. per cu. yd. for excavating; total, $4,895.

Pomona, Cal.—City Clk. Azra Crabb writes that the Board of City Trustees is about to purchase a road roller for about $2,000.

Cohocton, N. Y.—The proposition to purchase a stone crusher will be submitted to a vote of the people.

Omaha, Neb.—Wm. Coburn, Secy. Bd. of Pub. Wks., writes that the contract for repaving Howard St., 2,485 sq. yds. of sheet asphaltum, with 5-year guarantee, has been awarded to the Grant Paving Co., Omaha, Neb., at $1.75 per sq. yd.

Shreveport, La.—It is stated that bids are wanted Nov. 7 for asphalt paving in Fairfield Ave. N. B. Murff, City Compt.

St. Louis, Mo.—See "Sewerage and Sewage Disposal."

Jacksonville, Ill.—Pub. Engr. C. W. Brown writes that two streets are to be paved with brick; total, 33,262 sq. yds.

Wellsville, O.—Bids are wanted Nov. 11 for 6,632 sq. yds. brick paving on Liverpool St. J. W. McQueen, City Clk.

Youngstown, O.—Bids are wanted Nov. 9 for grading, draining and improving Caledonia St. C. E. Cross, Clk. City Commrs.

Chicago, Ill.—The Board of Local Improvements is in favor of the construction of a municipal asphalt plant, estimated to cost $300,000.

Trenton, N. J.—Ordinances have been passed providing for paving State St. with sheet asphaltum on Belgian block outside the rails and with brick on a concrete base inside the rails; also for paving a portion of Passaic St. with sheet asphaltum on a 6-in. concrete base. C. Edward Murray, City Clk.

Columbus, O.—Plans and estimates of the city engineer, showing cost of improving a portion of Central Ave., have been approved. Estimated cost, $9,810.

Baltimore, Md.—An ordinance is before the City Council for the repaving of a portion of North Ave. with trap rock asphalt block. The estimated cost is $100,000, to come out of the levy of 1903.

St. Joseph, Mo.—The Council has passed an ordinance providing for the paving of Francis St. with asphalt.

Greenwich, Conn.—Bids are wanted Nov. 6 for constructing a macadam road in the town. Nathaniel A. Knapp, 1st Selectman.

Worcester, Mass.—See "Miscellaneous."

Mobile, Ala.—Bids are wanted Nov. 14 for 17,000 sq. yds. asphalt paving, with the necessary curbing, grading and storm drainage. R. B. Owen, Jr., Secy. Bd. Pub. Wks.

Havana, Cuba.—Lieut. W. J. Barden, Corps of Engrs., U. S. A., Ch. Engr., City of Havana, writes that the following bids were opened Oct. 23 for paving: Estimated cost + 25 per cent.: $5,932,367. The McArthur Co., $6,063,961; The Havana Contractors' Co., $6,473,642; The Pan-American Construction Co. and Michael J. Dady, $5,713,550; McGivney & Rokeby, $5,185,920.

The total bids for both paving and sewerage are as follows: Estimated cost + 25 per cent., $10,511,752; McArthur Co., $11,482,782; Havana Contractors' Co., $11,248,096; The Pan-American Construction Co. and M. J. Dady, $11,440,730; McGivney & Rokeby, $10,649,626. For sewer bids received at the same time see "Sewerage and Sewage Disposal." A press report states that the Municipal Council of Havana has rejected all bids.

Towson, Md.—Road Engineer W. W. Crosby has reported to the Commissioners of Towson that the cost of macadamizing a portion of Slade Ave. will be about $3,000.

Huntington, N. Y.—Highway Commissioner Denton has presented a petition to the Town Board for an appropriation to construct a shore drive, 20 miles long, in the town of Huntington.

Atchison, Kan.—The following bids were received Oct. 28 for grading, curbing, paving and arch culvert on Atchison St.:

Items and quantities.	Thos. Beattie.	O. E. Seip & Co.
12,663 cu. yds. grading	$.27	$.25
1,070 cu. yds. sub grading	.30	.27
8,035 lin. ft. curbing	.48	.39
130 lin. ft. curbing reset	.15	.15
12,844 sq. yds. paving	.88	.79
6,400 pounds iron plates	.02	.01½
4 large catch basins	20.00	18.00
3 large catch basins rebuilt	12.00	8.00
40 lin. ft. 15-in. tile	.65	.37
Brick sidewalk: 12,290 sq. ft.	.06	.05¼
26,598 sq. ft. relaid	.02	.01¼
430 ft. B. M. oak plank	.03	.02½
128 cu. yds. Portland cem. concrete	8.00	5.75
97 cu. yds. rubble masonry	6.00	3.50
39 ft. brick arch masonry	15.00	14.00
214 cu. yds. rock excavation	1.00	.75
1,200 lin. ft. piling	.50	.37
Total	$23,476	*$20,176

Paving one course vitrified brick on 3-inch sand. Cement curb, 5½ inches x 20 inches. Brick arch, 15-foot span, 4 rings. *Contract awarded.

Muskegon, Mich.—The lowest bids received Oct. 17 for paving in three streets were as follows: Houston Ave., Geo. H. Kneal, at $19,854, with Bolen's brown granite or Athens block; Amity St. and Myrtle St., Chas. Schoenberg & Co., with Trimble block, at $8,925 and $6,846, respectively.

Louisville, Ky.—Thos. P. Craig, Secy. Bd. of Pub. Wks., writes that the lowest bid received Oct. 22 for reconstructing with asphalt the pavement in several streets was from the Ohio & Kentucky Asphalt Co., of Cincinnati, O., at $1.75 per sq. yd. in all 30,600 sq. yds. of asphaltum; total length of work (12 pieces), 1 2/5 miles; total amount of bid, including excavating, curbing and paving, $73,894.

Atchison, Kan.—The following bids were received October 28 for grading, curbing, paving and culverting Laramie St.:

Items and quantities.	L. Wines & Co.	Thos. Beattie.	Seip & Co.
14,673 cu. yds. grading	$.28	$.29	$.24
983 cu. yds. sub grading......	.29½	.35	.27
7,314 lin. ft. cement curbing..	.44	.48	.39
103 ft. curb. reset..............	.10	.15	.15
11,789 sq. yds. paving...........	.86	.90	.80
6,500 pounds iron plates........	.02	.02	.01½
Catch basins: 2 large	18.00	20.00	18.00
2 small	15.00	15.00	15.00
4 reset	9.00	12.00	8.00
Piling: 100 lin. ft. 21-in.......	.80	.85	.58
100 lin. ft. 18-in.	.65	.75	.48
142 lin. ft. 15-in.	.50	.65	.37
Sidewalk: 21,530 sq. ft. brick..	.06½	.06	.05¼
15,434 sq. ft. relaid	.02	.02	.01¼
450 ft. oak lumber..............	.02½	.03	.02½
157 cu. yds. conc. Port. cem....	5.60	9.00	5.75
252 cu. yds. hyd. cem. conc....	5.05	6.00	4.90
52 cu. yds. rubble masonry..	5.00	6.00	3.25
182 lin. ft. arch masonry......	4.25	9.00	7.00
Total	$23,118	$25,725	*$21,355

Paving one course of vitrified brick on 3 inches sand. Curbing, cut stone, 5½ inches x 20 inches. Brick arch 11 feet span, 3 rings. Bidders all of Atchison. *Contract awarded.

POWER PLANTS, GAS AND ELECTRICITY.

Westerville, O.—The Council is stated to have granted W. H. Crawford and C. E. Thompson, representing the Toledo Gas Co., a franchise to extend the gas line through the village and supply both heat and light.

Quebec, Que.—Local papers state that the Jacques Cartier Water Power Co. will install an auxiliary steam plant.

Kansas City, Kan.—See "Government Work.'

Columbia, Pa.—Local press reports state that bids will be received by the Lamp Committee until Nov. 26 for lighting the city for one year from June 1, 1902.

Elba, Ala.—The Elba Power Co. is reported incorporated, with a capital of $25,000, to utilize the water-power in that section, by establishing an electric light plant, a cotton mill, and other manufacturing plants.

Laurium, Mich.—See "Water."

Miamisburg, O.—A press report states that the report of the expert who examined the electric light plant is to the effect that a new plant is needed.

Houston, Tex.—Electrical Engr. W. W. Reed writes that the contract for installing a 300-kw. 500-volt generator has been awarded by the Citizens Electric Light Co. to the General Electric Co.

Ft. Adams, R. I.—See "Government Work."

Houghton, Mich.—A press report states that the Peninsula Light & Power Co. will increase its capital from $300,000 to $400,000, the additional funds to be used in constructing a new plant.

Urbana, O.—The Council is stated to have passed on second reading an ordinance granting J. F. Brand a franchise for the establishment of a central heating station.

Cody, Wyo.—See "Water."

Seattle, Wash.—The Mutual Light & Heat Co has been incorporated, with a capital of $200,000, to manufacture, sell and distribute electricity for light, heat and power purposes. Incorporators: Chas. E. Crane, Geo. E. Sackett and others.

Versailles, O.—See "Water."

Hillsboro, Ill.—The Council is stated to have granted J. P. Brown and J. J. Frey a franchise to lay a system of pipes for heating purposes.

Hooversville, Pa.—E. Crissey, of Hooversville, is reported interested in the construction of an electric light plant.

La Crosse, Wis.—The Central Electric Co., of La Crosse, has been incorporated, with a capital of $25,000, and if granted a franchise, will manufacture electricity for city lighting purposes.

Osborn, O.—See "Water."

Southampton, L. I., N. Y.—The Southampton Electric Light Co. has voted to increase its capital from $25,000 to $50,000, the increase to be used for improvements.

Newport News, Va.—A press report states that the Consumers' Light, Heat & Ice Co. will expend about $250,000 enlarging its electric light plant and building an ice plant and cold-storage warehouse.

Lemoore, Cal.—See "Water."

Handley, Tex.—It is stated that the Northern Texas Traction Co. will erect a 2,000-H.-P. steam and electric plant at Handley.

Suffield, Conn.—See "Water."

Columbus, Ga.—Geo. J. Baldwin, of Savannah, and Stone & Webster, of Boston, Mass., are stated to have secured a controlling interest in the Chattahoochee Falls Co., of this city, which owns the Clapp factory falls property on the Chattahoochee River, about 2 miles north of Columbus. It is understood that they will in the near future improve the property, constructing an electric plant to develop about 14,000 H. P.

Searcy, Ark.—See "Water."

Zion City, Ill.—It is stated that bids will be received about Nov. 23 for constructing a steam power station at this city for Rev. John Alex. Dowie. R. W. Hargrave, Ch. Engr., 1201 Michigan Ave., Chicago.

Barron, Wis.—See "Water."

Louisville, Ky.—The Lower Board of the Council is stated to have passed an ordinance providing for the placing of wires underground.

Charlestown, W. Va.—Howell & Taylor, 12th and F Sts., N. W., Washington, D. C., the engineers in charge, write that the proposed development of Shenandoah River near Charlestown, by the Shenandoah Electric Light & Power Co., will cost about $125,000. Work will probably not be started before the spring.

Mt. Carmel, Ill.—Theodore G. Risley, Attorney for the Mt. Carmel Improvement & Development Co., writes that bids will be wanted about Jan. 1, 1902, for the construction of an electric plant at Grand Rapids dam, estimated to cost $125,000. Eugene Gibbs, of Dayton, O., Engr. in charge. For further information address A. B. Trentman, of Ft. Wayne, Ind.

Hartford, Conn.—The contract for wiring the Capitol is stated to have been awarded to the New England Engineering Co., of Waterbury, for $10,000.

Ritzville, Wash.—C. O. Greene is stated to have received a franchise for an electric light plant.

Cincinnati, O.—The Cincinnati Suburban Light, Gas & Electric Co. has been incorporated with a capital of $10,000. Incorporators: Fred W. Keam, Henry Ottermann and others.

Corona, Cal.—C. W. Rogers, of Los Angeles, is reported interested in the construction of an electric light and power plant.

Scotland, S. D.—A. E. Parmenter is stated to have recived a franchise for an electric light plant.

Lafayette, Ind.—Vice-Pres. Chas. A. Meeker, of Lafayette, writes that plans and specifications are being prepared for the proposed power plant to be constructed on Tippecanoe River at Horse Shoe Bend; estimated cost, $300,000. The plant to generate 6,000 to 8,000 H.-P. Address Allen R. Jewett, 1512 Great Northern Bldg., Chicago, Ill. L. B. Fuller, Engr. in charge.

Rosebud, Tex.—The Rosebud Light & Power Co., of Rosebud, has been incorporated; capital, $10,000. Incorporators: M. M. Kemp, T. S. Henderson and others.

Baker City, Ore.—Wm. Pollman is reported to be interested in the development of water power in Rock Creek for operating an electric light plant, estimated to cost $60,000.

Worcester, Mass.—See "Miscellaneous."

Waldoboro, Me.—Geo. Bliss, Pres. Water & Electric Light & Power Co., writes that the contract for the electric light plant has been awarded as follows: For line wires, etc., to Sargent, Conant & Co., and for horizontal Hercules turbines to the Holyoke Machine Co., of Worcester. The plant, according to reports, will cost about $10,000.

ELECTRIC RAILWAYS.

Peterboro, Ont.—E. M. Block, of Buffalo, N. Y., is stated to have purchased the Peterboro & Ashburnham Electric Ry. It will be extended to Lakefield, Ont., a distance of 7 miles.

New Haven, Pa.—The Pittsburg, McKeesport & Connellsville Ry. Co. is stated to have purchased a site just south of here for a power plant, which will supply electricity for the coke region system of the company. Work on the plant will commence at once, and when completed will cost about $500,000. M. R. McAdoo, Mgr., Pittsburg.

Ventura, Cal.—A. C. Denman, Jr., of San Bernardino, is reported interested in the construction of an electric railway at this place.

Geneva, N. Y.—P. W. Tuttle and associates are stated to have received a franchise to construct and operate an electric railway in Geneva. The power house will also be erected here.

Mt. Holly, N. J.—The power house of the Mt. Holly & Burlington Traction Co., which is owned and operated by the Pennsylvania R. R. Co., is reported to have been destroyed by fire Oct. 29.

Tarrytown, N. Y.—The Tarrytown, White Plains & Mamaroneck Ry. Co. is stated to have filed in the County Clerk's office a certificate of extension of its line in Tarrytown.

New York, N. Y.—The State Board of R. R. Commissioners is stated to have recommended that the Union Ry. Co. construct a branch in Morris Ave., Boro. of Bronx, construction to be commenced at the earliest possible moment.

Cincinnati, O.—The Cincinnati, Blanchester & Columbus Electric R. R. Co. has been incorporated, with a capital of $10,000, to operate in the counties of Hamilton, Clermont, Warren, Clinton, Green, Fayette, Madison and Franklin. Incorporators: E. D. Smith and Roy J. Rice, of Blanchester, O.; Simon G. Smith, of Wilmington, O., and others.

Augusta, Ga.—Plans are stated to have been completed for the proposed power plant of the Aiken-Augusta Ry. Co., to be erected near Clearwater. Jas. U. Jackson, of Augusta, is one of the incorporators.

Salamanca, N. Y.—The Salamanca & Little Valley R. R. Co., has been incorporated, with a capital of $400,000, to construct an electric road 14 miles long, to connect Salamanca and Little Valley. Directors: A. E. Darrow, of Little Valley; Hudson Ansley and Fred R. Adams, of Salamanca; and others.

Williamsport, Pa.—E. H. Davis, Mgr. of the Williamsport Passenger Ry. Co., is reported interested in the construction of a trolley line between Williamsport and Lock Haven.

Logansport, Ind.—Petitions are before the Council from the Wabash River Traction Co. asking for a franchise over the streets of the city and from the Wabash Valley Traction Co. for an interurban road from Ft. Wayne to Lafayette.

Natchez, Miss.—Harry K. Johnson, of Vicksburg, is stated to have secured the contract for constructing and equipping 3½ miles of electric railway for the Natchez Electric St. Ry. Co.; the road will cost about $50,000.

Piedmont, W. Va.—The Piedmont & Keyser Electric R. R. Co. is reported incorporated, and will construct an electric railway from West Virginia Junction through Luke and Piedmont to Keyser. Directors: Howard Richardson, Piedmont; Wm. McDonald, Keyser, W. Va., and others.

Coldwater, Mich.—The Council is stated to have passed on first reading an ordinance granting Hawks & Angus a franchise to construct a line to this place from Jackson via Jonesville.

Kokomo, Ind.—The Council is stated to have granted the Union Traction Co., represented by Geo. McCullough, of Muncie, a franchise for the construction of an electric road from Indianapolis to Kokomo, via Noblesville and Tipton.

Worcester, Mass.—The State R. R. Commissioners are stated to have granted the Worcester & Southbridge St. Ry. Co. permission to extend its charter to build in the towns of Leicester and Auburn. C. E. Culver, Ch. Engr., Worcester.

Newtown, Pa.—A charter is stated to have been granted to the Newtown & Yardley St. Ry. Co., capital $50,000. Geo. Worstall, Pres., Horace Reeder, Secy.

Saco, Me.—The State R. R. Commissioners are stated to have approved the location of the Saco Valley Electric Ry. Work will probably begin in the Spring. J. O. Bradley is reported interested.

Waterford, N. Y.—The State Board of R. R. Commissioners is stated to have granted permission to the Hudson Valley Ry. Co. to issue a mortgage for $4,000,000, of which $50,000 will be expended for betterments. The road extends from Waterford to Caldwell, a distance of about 70 miles, and later on it is proposed to run a branch to Troy. J. H. Armstrong, Ch. Engr., Glens Falls.

Mineola, L. I., N. Y.—The Nassau County Supervisors are stated to have granted a franchise to the Mineola, Hempstead & Freeport Traction Co. over the Hempstead and Jamaica boulevard from Hempstead to the city line of New York City, near Queens.

Rockhampton, Queensland, Australia.—The New York "Journal of Commerce" states that the Council of the Municipality of Rockhampton will receive applications until March 31, 1902, from parties desirous of constructing and operating a system of electric tramways. For particulars address Mayor H. W. Johnson.

East St. Louis, Ill.—The Murphysboro & Carbondale Electric Ry. Co. is reported incorporated, with principal office at East St. Louis; capital, $50,000. It will construct a line from Murphysboro, Ill., to Carbondale, Ill. Incorporators: Thos. M. Logan, Murphysboro; Chas. L. Ritter, Carbondale, Ill.; E. F. Harper, East St. Louis, and others.

Manchester, N. H.—The Boston & Maine R. R. Co. is stated to have filed with the New Hampshire R. R. Commissioners a request for authority to issue $500,000 bonds, to construct the Concord, Manchester & Nashua electric railway. H. Bissell, Ch. Engr., Boston, Mass.

Princeton, N. J.—The ordinance granting the Trenton & Lawrenceville Trolley Co. the right to lay tracks on Witherspoon St. is reported to have passed first reading in Council.

Watertown, N. Y.—The Council is stated to have granted a 50-year franchise to the Watertown & Carthage St. Ry. Co. on Water St., from the intersection of Pearl St. to the city limits.

Monterey, Mex.—Mackin & Dillon, civil engineers, architects and builders, of Monterey, are reported to have received a concession from the State for the purpose of installing a system of electric street railways in Monterey and beyond that city's limits. All the rails, cars and other equipment, etc., will probably be purchased in the United States. Some of the orders are expected to be given out within the next 5 weeks.

Flint, Mich.—The Flint, Bay City & Saginaw Ry. Co. is reported organized, with a capital of $200,000, by M. J. Brennan, Robert Oakman, and others, to construct an electric line from Bay City to Saginaw and Flint.

Cattaraugus, N. Y.—See "Bridges."

Ardmore, Pa.—The Township Commissioners are stated to have granted a franchise to the Ardmore & Llanerch St. Ry. Co.

Frankfort, Ind.—The Frankfort & Indianapolis Electric Ry. Co. is reported organized with a capital of $50,000, to construct an electric railway between Frankfort and Indianapolis. David F. Allen, Pres.; Jas. A. Hedgcock, Secy.

Decorah, Ia.—O. H. Chase, of Fountain, Minn., is stated to have been engaged to survey the proposed electric railway from Decorah to Chatfield, by way of Preston.

Norwood, O.—The Council on Oct. 28 is stated to have granted the Cincinnati Traction Co. permission to extend its line to South Norwood. R. A. Weisenecker, Ch. Engr., Cincinnati.

Ft. Sill, Okla. Ter.—A charter is reported to have been granted to the Lawton & Mt. Scott Transportation Co. to construct an electric line from Lawton to Mount Scott, in the new national park, with a branch to Fort Sill and one to Sulphur Springs. Capital, $50,000. Incorporators: E. F. Mitchell, of El Reno; J. C. Robb, Kingfisher; Geo. Stockton, of Kansas City, Mo., and others.

Ft. Wayne, Ind.—The Chase Construction Co., of Detroit, Mich,, is reported to have secured the contract for constructing the Ft. Wayne, Hartford City & Muncie Interurban Ry.

Monterey, Cal.—The Del Monte, Monterey & Pacific Grove Ry. Co. has been incorporated, with a capital of $200,000, to construct and operate a railway in the cities of Monterey and Pacific Grove, and in the county of Monterey. Directors: J. D. Carr, of Salinas, and Charles Carr and R. F. Johnson, of Monterey.

Lebanon, O.—The Lebanon & Franklin Traction Co. has been incorporated, with a capital of $10,000, by Chas. H. Bosler and S. E. Kemler, of Dayton, to construct an electric railway extending from Lebanon to Franklin by the way of Red Lion.

RAILROADS

Augusta, Me.—The Maine Central R. R. Co. is stated to have petitioned the State R. R. Commissioners for permission to extend the road from Augusta to Winthrop, a distance of about 14 miles. Estimated cost of construction, $500,000. Theo. L. Dunn, Ch. Engr., Portland.

San Diego, Cal.—Geo. Marston and H. P. Wood, of San Diego, are reported interested in the construction of a railroad from San Diego to Yuma and Phoenix, Ariz.

Eldon, Ia.—A press report states that the Rock Island R. R. will soon let contracts for $3,000,000 of construction work on the cut-off from Eldon to Trenton, Mo. The new line will be 85 miles in length. W. E. Dauchy, Ch. Engr., Chicago, Ill.

Yucatan, Mexico.—The National Yucatan Southeastern R. R. Co. is reported organized, with a capital of $1,250,000, to construct a railroad about 275 miles in length. It is stated that 25 miles have already been constructed. The New York people said to be interested are Henry Booth, of the Ward Steamship Line; W. D. Munson, Pres. of the Munson Steamship Line, Jas. M. Motley, of the Thornton N. Motley Co., and Felipe G. Canton, Columbia Bldg.

Birmingham, Ala.—The Ry. & Construction Improvement Co., of New Jersey, is stated to have purchased the Birmingham Belt R. R. and a block of ground in the central part of the city. H. M. Atkinson, of Atlanta, the Frisco System (C. D. Purdon, Ch. Engr., St. Louis, Mo.), and the Seaboard Air Line (W. W. Gwathmey, Jr., Ch. Engr., Portsmouth, Va.), are in the Construction Co. Terminal facilities and depots are to be constructed for joint purposes. The Seaboard is to extend the East and West R. R. of Alabama to Birmingham, connecting with the Frisco system here.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Dundas, Ont.—Bids are wanted Nov. 7 for furnishing and installing a heating apparatus at the Armories, Dundas. Fred Gelinas, Sec'y, Dept. Pub. Wks., Ottawa, Ont.

Decatur, Ill.—Bids are wanted by the Building Committee until Nov. 9 for erecting a library. Wm. J. Quinlan, Chmn.; Mauran, Russell & Garden, Archts., St. Louis, Mo.

Boston, Mass.—Bids are wanted Nov. 4 for erecting a House of Correction building at Deer Island, Boston Harbor. Alpheus Sanford, Penal Institution Commissioner; A. Warren Gould, Archt., 1 Somerset St. Appropriation, $400,000.

St. Louis, Mo.—Bids are wanted Nov. 5 for erecting a storehouse for the Fire Department. Hiram Phillips, Pres. Bd. Pub. Improvements.

Sharon, Pa.—Frank H. Buhl, ex-Pres. of the Sharon Steel Co., is reported to have promised to give $200,000 for a public building at Sharon The town must provide for its maintenance.

Chicago, Ill.—Mrs. T. B. Blackstone, widow of the late president of the Chicago & Alton R. R., is stated to have offered the city $100,000 for a branch library, to be constructed at once. Architect, S. S. Beman, Pullman Bldg.

Columbia, S. C.—George I. Lovatt, 424 Walnut St., Philadelphia, Pa., is stated to be preparing preliminary plans for a stone edifice to be erected at Columbia for St. Peter's R. C. Church, to cost about $45,000.

San Antonio, Tex.—It is stated that the First Baptist Congregation will erect a $20,000 church.

Saco, Me.—The Trustees of Thornton Academy are stated to have voted to accept the gift of a $20,000 library offered by Mrs. Annie C. Thornton, of Magnolia, Mass.

Trenton, N. J.—The State Military Board is stated to have approved the rough plans for the Trenton Armory submitted by Gifford & Field, and have instructed them to prepare the completed plans; probable cost, $150,000.

Baltimore, Md.—It is stated that the Shearith Israel Congregation is to erect a $20,000 synagogue on McCulloch St. Dr. S. Schaffer, Rabbi

Paris, Ky.—The Bourbon County Magistrates are reported to be considering the erection of a new court house to replace the one recently burned.

Milwaukee, Wis.—It is stated that the Capuchin Fathers of this city have had plans prepared for a $50,000 church to be erected on 2d and Burleigh Sts.

Des Moines, Ia.—Co. Aud. Fred A. Cope writes that the Supreme Court has recently dissolved the injunction which prevented the County Board of Supervisors from asking bids for the new court house, estimated to cost $400,000. Architects, Proudfoot & Bird, of Des Moines.

Asheville, N. C.—Bids will be received by the County Commissioners at Asheville until Nov. 20 for erecting a court house. Marcus L. Reed, Chmn.

Philadelphia, Pa.—Bids are wanted Nov. 8 for erecting 3 buildings, namely: children's hospital, maternity house and venereal and contagious skin disease hospital, on 34th and Pine Sts. Total cost, $80,000. John V. Shoemaker, Pres., Dept. of Charities and Correction, Bureau of Charities.

Williamson, W. Va.—It is stated that bids are wanted Nov. 11 for erecting a court house. Jas. Dawson, Co. Clk.

Paducah, Ky.—Andrew Carnegie is stated to have offered this city $35,000 for a public library.

West Hartford, Conn.—The plans of Edw. T. Hapgood, 141 Trumbull St., Hartford, are stated to have been accepted for a town hall to be erected on Main St. and Farmington Ave., to cost $60,000. It is stated that $18,000 has been appropriated for the construction at once of the south wing.

Louisville, Ky.—Greiner & Son are stated to have secured the contract for erecting the 6-story Polytechnic Library.

Lincoln, Neb.—Bids are wanted Nov. 11 (extension of date) for constructing 60 steel cells in the State Penitentiary at Lincoln. Geo. D. Follmer, Pres. Bd. Pub. Bldgs.

Guthrie, Okla. Ter.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Cincinnati, O.—Bids are wanted Nov. 8 for reconstructing the Findlay market house, located on Elder St. Geo. F. Holmes, Clk. Bd. Pub. Service.

Greensburg, Pa.—The contract for excavating and foundation work on the Westmoreland County court house at Greensburg is stated to have been awarded to the Lindsay Construction Co., for $27,985.

Oswego, N. Y.—It is stated that plans have been accepted for a hospital addition, to cost $25,000. Mrs. Carrington McFarlane, Pres.

New Brunswick, N. J.—The Board of Freeholders is stated to have approved plans for a new jail, to cost about $40,000.

Washington, D. C.—The contract for erecting a power house and nurses' home on Providence Hospital grounds, has been awarded to the Brennan Construction Co., Washington Loan & Trust Bldg., for $49,850.

San Juan, Porto Rico.—Andrew Carnegie is stated to have offered this city $100,000 for a public library.

Brooklyn, N. Y.—The Armory Board is stated to have authorized Horgan & Slattery, 1 Madison Ave., N. Y. City, to prepare plans and estimates for an armory for the 2d Naval Battalion in South Brooklyn.

BUSINESS BUILDINGS.

Newport News, Va.—See "Power Plants, Gas and Electricity."

Mobile, Ala.—Geo. G. Johnson, 54 N. Royal St., is preparing plans for railroad shops, roundhouse and office building for the Mobile, Jackson & Kansas City R. R. at Mobile. Cost, $60,000.

Reading, Pa.—It is stated that Seymour Davis and Paul A. Davis, 3d, 907 Walnut St., Philadelphia, will be ready for bids in about 2 weeks for a 3-story fireproof packing house and abattoir, to be erected here for the Reading Cold Storage & Ice Co.

Crowley, La.—The plans of W. L. Stephens are stated to have been accepted by the officials of the Arcadia Bank for a brown stone building to be erected on Parkerson Ave. and 3d St.

Philadelphia, Pa.—It is stated that Geo. C. Boldt will erect a hotel on the S. W. cor. of Broad and Walnut Sts., to cost about $1,000,000. John T. Windrim, 1107 Walnut St., will probably prepare the plans.

La Crosse, Wis.—The Green Bay R. R. Co. is stated to have decided to erect a depot here.

Kansas City, Mo.—It is stated that a 6-story warehouse, to cost about $90,000, will be erected by the General Storage & Warehouse Co., at 8th and Henning Sts., in the West bottoms.

Seattle, Wash.—Sam'l Rosenberg, of Seattle, is reported interested in the construction of a 10-story hotel on 3d Ave. and Cherry St.

North Tonawanda, N. Y.—It is stated that the New York Central will erect a $30,000 depot at North Tonawanda. J. P. Bradford, Supt. Western Div., Buffalo.

Grand Rapids, Mich.—Foster, Stevens & Co. are stated to have purchased a site at Campau and Pike Sts., and will erect an 8-story building for warehouse purposes.

McKeesport, Pa.—It is stated that Jas. N. Wampler, of McKeesport, will erect a 4-story brick business building on 5th Ave., to cost about $40,000.

Philadelphia, Pa.—The Horn & Hardart Baking Co. will erect a 6-story store and factory 32 x 145 ft. on 9th and Filbert Sts.; will have freight and passenger elevators and a hot water heating system. Frank Hardart, Treas., 1302 Filbert St.

Sheridan, Wyo.—The Masonic order of this city is stated to have decided to erect a brick and stone Masonic temple.

Jacksonville, Fla.—It is stated that the Seminole Club will erect a $15,000 building on Hogan and Duval Sts.

Chicago, Ill.—The picture frame factory of Peterson & Co., on Union St. and Augusta Ave., is reported to have been destroyed by fire Oct. 30.

Niagara Falls, N. Y.—The Odd Fellows of Niagara Falls are reported to have in contemplation the erection of an Odd Fellows home in that city, to cost about $20,000.

Atlanta, Ga.—W. F. Denny, Prudential Bldg., has prepared plans for a $22,000 brick block of 5 houses, to be erected for Dr. J. L. Hopkins, at Forsyth and Grant Sts.

New York, N. Y.—Plans have been filed for the new Hanover National Bank to be erected at the S. W. cor. of Nassau and Pine Sts. It will be 22 stories high, and cost $1,000,000. Jas. B. Baker, 156 5th Ave., is the architect.

Philadelphia, Pa.—The 8-story building at 1219 Market St., occupied by Hunt, Wilkinson & Co., furniture makers, was burned Oct. 25.

Pittsburg, Pa.—A press report states that plans have been completed for forty 7-story warehouses, to cost about $10,000,000, to be erected on land bounded by Penn Ave. and the two rivers, for the Estate of Mrs. Mary Schenley. W. A. Herron & Son, Local Agents.

St. Louis, Mo.—A 7-story commercial building is soon to be erected by Adolph Lopez on 11th St., north of Washington Ave., to cost about $30,000. Architect, C. Clymer, Wainwright Bldg.

Dayton, O.—Richard Grieser, 109 Randolph St., Chicago, Ill., is stated to be completing plans for a brewery for the Thomas Brewing Co., of Dayton, to cost about $75,000.

Homestead, Pa.—It is stated that S. Hudson Vaugh will erect a $75,000 business building.

Boston, Mass.—Building Commissioner Damrell has issued permits as follows:

Carlton Hotel, 6-stories, first-class fireproof, 144 x 120 ft., Boylston and Hemenway Sts.; estimated cost, $300,000; builder, Geo. A. Fuller Co., 27 State St.

Office building, 11 stories high, to be bounded by India, State, Broad and Central Sts., first-class steel construction; Builder, Geo. A. Fuller Co.

Warehouse, 5 stories, brick, at 62-72 Chardon St. and 61 Pitts St.; builder, Whidden & Co., 43 Milk St.

Office building, 122-132 State St., 4 stories, brick, limestone and terra-cotta, 72 x 442 ft., steel frame, fireproof construction; Architects, Peabody & Straus, 19 Exchange Bldg.; owners, Moses Williams Estate, 18 Post Office Sq.

Stores and office building, 11 stories, fireproof, steel frame construction; granite, brick and limestone, 6 Beacon St., 66 x 143 ft.; L. P. Soule & Son, 166 Devonshire St.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

Madison Ave & 27th St, br hotel; c, $145,000; o, Jos Wolf; a, Chas Brenden & Co.

540 E 76th St, br club; c, $48,000; o, East Side House Settlement; a, Howell & Stokes.

163d St & Melrose Ave, br factory and foundry; c, $20,000; o, a & b, Francis Keil.

21 to 25 Jane St, 4-story extension; c, $25,000; o, P E Guerin; a, C H Caldwell.

DWELLINGS.

Louisville, Ky.—Dodd & Cobb, Equitable Bldg., are stated to have completed plans for a $100,000 residence, to be erected on 3d Ave. for Edw. Ferguson, of the Kentucky Refining Co.

Chicago, Ill.—Wm. C. Kreig, 84 Washington St., is stated to have prepared plans for a 3-story, 60 x 100 ft., brick and stone apartment house, to be erected on Evanston Ave. and Ainslie St., to cost $40,000.

Boston, Mass.—Building Commissioner Damrell has issued permits for the construction of a block of 3-story brick dwellings, at Chauncy Place, West Roxbury; estimated cost, $68,000; builder, Henry Greene; also for a 5-story dwelling house, to be built at 403 Commonwealth Ave., from plans by Shepley, Rutan & Collidge; estimated cost, $60,000; builder, John J. Mainland, 166 Devonshire St.

Plans have been drawn for a 10-story non-housekeeping apartment house, to be erected on Mount Bowdoin, Dorchester, and to be known as Hotel Radcliffe. The ground area is 33,000 sq. ft. Estimated cost, $450,000. The building contract has been awarded to the Thompson-Starrett Co., 183 Essex St. It will contain 100 apartments, private theater, swimming tank, tennis court, gymnasium, roof garden, etc. Architect, W. H. McGinty, 53 State St.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

5 & 7 E 75th St, 2 br & stone dwell'gs; c, $200,000 all; o, Wm Hall's Sons; a, Welch, Smith & Provot.

150 to 160 E 91st St, 2 br flats; c, $180,000 all; o, Chas Buckley; a, M Bernstein.

SCHOOLS.

Brooklyn, N. Y.—Bids are wanted Nov. 11 for erecting an addition to and alterations in school No. 92, Boro. of Brooklyn. Richd. H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Milwaukee, Wis.—Bids are wanted Nov. 14 for erecting a school on Prairie and 7th Sts., including plumbing, heating, sewering, etc. Chas. J. Poetsch, Commr. of Pub. Wks.

Kingston, Ont.—Bids are wanted Nov. 18 for the central heating, power and electric plants for the Queen's University and School of Mines buildings, Kingston. G. Y. Chown, Register, Queen's University; Symons & Rae, Archts., Toronto.

San Marcos, Tex.—Bids are wanted Nov. 15 for erecting a normal school. E. Northcraft, Archt., San Marcos; Jos. D. Sayers, Gov.

Flint, Mich.—A correspondent writes that the contract for erecting a $30,000 school at Flint will be awarded Jan. 1. Clark & Munger, Archts., Bay City.

Oneida, N. Y.—The Board of Education is stated to have recommended the erection of a high school, to cost $32,000.

Schenectady, N. Y.—Bids are wanted Nov. 18 for erecting a high school. S. B. Howe, Secy. Bd. Educ.

Butte, Mont.—Bids are wanted by the County Trustees of School Dist. No. 1 Nov. 5 for erecting a 2-story and basement brick school. Thos. Richards, School Clk.; H. M. Patterson, Archt., Owsley Blk.

Waxahachie, Tex.—The plans of Hubble & Green, of Dallas, are stated to have been accepted for a $50,000 building for the Trinity University.

Topeka, Kan.—Washburn College is stated to have received a gift of $50,000 for the erection of an astronomical observatory.

Lexington, Ky.—E. E. Albus, 506 W. Jefferson St., Louisville, has prepared plans for a school to cost $40,000.

Philadelphia, Pa.—Geo. W. Pierson, Lippincott Bldg., is stated to have secured the contract to erect the school on 8th and Clearfield Sts., for $70,990.

Stanford University, Cal.—Plans are stated to have been completed for a building to be erected at the University for the departments of mechanical, electrical and civil engineering. An appropriation of $50,000 is reported to have been made to begin work with.

East Cleveland, O.—Bids will be received by Leman Hunter, Clerk of the Board of Education of East Cleveland Township, at Fairport, until Nov. 30, for $20,000 bonds.

Stapleton, S. I., N. Y.—The following bids were opened Oct. 28 by the Committee on Buildings, Bd. of Educ., New York City, for installing ventilating and heating apparatus, also gas and electric fixtures, in school 32, Boro. of Richmond: Francis Bros. & Jellett, Incp., $6,745; John Hankin & Bro., $7,347; Blake & Williams, $5,572; Frank Dobson, 218 E. 42d St., $5,445 (awarded); Baldwin Engineering Co., $6,675; Williams & Gerstle, $6,458; United Engineering & Contracting Co., $6,115.

STREET CLEANING AND GARBAGE DISPOSAL.

Vincennes, Ind.—The new garbage plant, just outside the town, is stated to have been destroyed by fire.

Milwaukee, Wis.—City Engr. Chas. J. Poetsch writes that contracts for furnishing and installing necessary machinery to operate the garbage plant now being erected on Jones Island have been awarded as follows: Traveling hoists to Danl. H. Squier for $2,900; pump and connections to C. B. Kruse Heating Co., for $694; electric wiring to Geo. F. Rohn, for $475; engines and dynamos to Mechanical Appliance Co., at $4,143 for Skinner engines and Northern Electrical Co.'s generators.

GOVERNMENT WORK.

Washington, D. C.—The plans of Lord & Hewlett, 16 E. 23d St., New York, N. Y., have been selected for the new building for the Department of Agriculture, to cost about $2,000,000.

Kansas City, Kan.—Bids are wanted at the Treasury Dept., Washington, D. C., until Nov. 20, for the installation of a conduit and wiring system for the U. S. Post Office at Kansas City, as advertised in The Engineering Record.

Ft. Morgan, Ala.—Bids are wanted Nov. 7 for erecting an addition to a hospital. Address Joseph Matson, Q. M.

Parkersburg, W. Va.—Press reports state that the preliminary survey for Government dam No. 18 in Ohio River, 3 miles above here, is about completed. Estimated cost of dam, $1,000,000.

New York, N. Y.—Final plans and specifications for the proposed coaling plant to be erected in Cob Dock, in the Brooklyn Navy Yard, have been forwarded to the Naval Bureau at Washington, by Civil Engineer Goodrich, acting head of the department, and it is expected the work will begin some time this month.

San Francisco, Cal.—The contract for the complete mechanical equipment of the U. S. Post Office at San Francisco has been awarded to Jas. McWilliams & Co., of Louisville, Ky., for $220,517.

Ft. Adams, R. I.—Capt. Herman C. Schumm, Q. M., writes that the contract for installing electric lighting at Ft. Adams has been awarded to A. E. Burland & Co., of Newport, R. I., for $6,945.

Boston, Mass.—Bids are wanted Nov. 18 for laying a water main from Gallup's Island to Ft. Standish, Lovell's Island, Boston Harbor. Address, Capt. A. M. Palmer, Depot Q. M.

Milwaukee, Wis.—Bids are wanted Dec. 11 for the construction of a stone and brick wagon shed for the U. S. Post Office, Court House and Custom House, at Milwaukee, as advertised in The Engineering Record.

Galveston, Tex.—The following bids were opened Oct. 1 by Capt. C. S. Riche, Corps of Engrs., U. S. A., for furnishing 74,750 tons of large riprap, 24,900 tons of small riprap and 22,850 tons of broken stone: J. W. & R. D. Lauderdale, Somerville, Tex., $259,468; J. P. Nelson, San Antonio, Tex., $268,257; The Parker-Washington Co. and M. Sullivan, San Antonio, Tex., $291,070; Suderman, Dolsen & Co., Galveston, $284,447; Isaac Heffron, Galveston, $239,813 (recommended for award). Isaac Heffron's alternative bid, which calls for 49,000 tons of small riprap and 74,750 tons of large riprap, was $230,837.

Boston, Mass.—The following bids were opened Oct. 26 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing a fireproof brick and stone entrance building at the Navy Yard. Appropriation, $23,500: J. H. Colson & Son, Boston, $28,900, $26,000; G. W. Harvey, Boston, $25,240, $23,240.

Washington, D. C.—The following bids were opened Oct. 26 at the Bureau of Yards and Docks, Navy Dept., for constructing a plant for receiving, storing and delivering coal at the Navy Yard, Washington: *a*, bid in accordance with plans and specifications, and within appropriation now available; *b*, bid for plant and extension which may be built if additional appropriation is made by Congress: C. W. Hunt & Co., W. New Brighton, N. Y., *a*, $38,750; J. H. Mead Mfg. Co., New York City, *a*, $33,505, $39,459 and $39,105; *b*, $99,000, $99,455 and $99,320.

MISCELLANEOUS.

Leavenworth, Kan.—It is stated that bids are wanted Nov. 6 for constructing about 500 cu. yds. of retaining wall on the south side of Three Mile Creek. W. G. Neely, City Engr.

Two Rivers, Wis.—It is stated that bids will be received by the Board of Public Works until Nov. 6 for constructing a dock at Pine St. and for dredging in front of the dock.

New York, N. Y.—The Mayor has approved the resolution providing for a public park between 35th and 36th Sts. and 1st and 2d Aves.

Jersey City, N. J.—The contract for the improvement of South Cove basin and the building of a 700-ft. bulkhead 30 ft. wide, is stated to have been awarded by the Street & Water Board to the Metropolitan Construction Co., at 104 per cent. of the standard cost, which was $45,000.

Portsmouth, O.—An ordinance is before the Council declaring it necessary to issue bonds, not less than $35,000, for the purpose of constructing levees and embankments to protect the city.

New York, N. Y.—The contract for furnishing 10,000 barrels of Portland cement has been awarded to the John P. Kane Co., 287 Fourth Ave., New York City, at $1.425 per barrel for slow setting, and $1.425 per barrel for quick setting, under classes 1 and 2, respectively.

Greenville, Miss.—C. H. West, Ch. Engr. of the Miss. Levee Dist., writes that the contract for constructing a levee in Issaquena County has been awarded to Wm. Bates, care Geo. Arnold Co., Memphis, Tenn., at 12 cts. for the 1st and 2d sections, and 12⅝ cts. for 3d section. Length of levee, 8,600 ft.; volume about 310,000 cu. yds.

New Orleans, La.—The State Board of Engineers is stated to have awarded levee contracts as follows: Alsatia enlargement, amounting to 75,000 cu. yds., to Robert Nicholson, at 22 cts. per cu. yd.; Claggett, new levee, 55,000 cu. yds., to M. L. Linnan, at 18½ cts. per cu. yd.; the Glen Mary to Yellow Bayou enlargement, 80,000 cu. yds., to M. L. Linnan, at 16½ cts.

Burlington, Ia.—The Citizens' Harbor Committee is in favor of the adoption of a plan for the improvement of the harbor, at a cost of $30,000.

Worcester, Mass.—The Finance Committee recommends additional appropriations as follows: $25,000 for walling Middle River from Southbridge St. to Holmes St., $10,000 for street maintenance and $6,500 for the Street Lighting Department.

Sioux City, Ia.—Bids will be received by the City Council until Nov. 5 for changing the channel of the Floyd River, a distance of 2,200 ft. Approximate amount of excavation, 66,000 cu. yds. The material excavated to fill old channel; also for pile and rock protection at the cut-off and mouth of new channel. Estimated cost, $17,000. Plans are being prepared for a flushing dam on said stream. J. M. Lewis, Acting City Engr.

Port Allen, La.—Bids will be received by the Board of Commissioners of the Atchafalaya Basin Levee District at the office of the Board of State Engineers, Cotton Exchange Building, New Orleans, until Nov. 16, for constructing 5 miles of levee on the east bank of Atchafalaya River, approximately 400,000 cu. yds. A. D. Barrow, Secy., Port Allen.

NEW INDUSTRIAL PLANTS.

The M. Campbell Fanning Mill Co., Detroit, Mich., will erect a 3-story, 200 x 90-ft. building, to contain elevators, steam heating plant, 25 woodworking machines, 2 dry kilns, fans for delivering shavings and a 150-H.-P. engine.

The Dwiggins Wire Fence Co., Anderson, Ind., has been reorganized with a capital stock of $50,000, and intends to build a new plant, the location of which has not yet been decided.

The Rolling Mill Co. of America, Connellsville, Pa., intends to build a 20-mill sheet-mill plant, open-hearth steel works and a bar mill, to include the following buildings: A 110 x 500-ft. sheet mill, a 140 x 45-ft. boiler house, a 250 x 60-ft. warehouse and a 400 x 120-ft. steel plant.

The H. & C. Corset Co., Bridgeport, Conn., is erecting a 50 x 150-ft. building and will install a power plant of about 15 H.-P.

John C. Moore, 35 St. Paul St., Rochester, N. Y., will erect a 3-story, 64 x 133-ft. blank-book factory, and use direct-connected motors on each machine. The Rochester Gas & Electric Co. will furnish power.

The Sturgess Governor Engineering Co., West Troy, N. Y., is equipping a 100 x 50-ft. machine shop, which it expects shortly to duplicate, and may also add a foundry and other shops.

The Ash-Harper Co., Lyons, Mich., is building a 40 x 150-ft. factory to make Ash gas and gasoline engines. The capacity of the power plant will be 35 H.-P.

R. Cooper, Welland, Ont., is erecting a 125-bbl. flour mill.

The James Quirk Milling Co., Minneapolis, Minn., contemplates installing one or two boilers and a 250-H.-P. compound Corliss engine in its mill at Waterville, Minn.

S. C. McCandless, Jackson, Ga., contemplates erecting a 25-bbl. roller flour mill, to be run by water power.

The plant of the American Washboard Co., Cleveland, O., which was recently burned, will be rebuilt. The engine, boilers, machine shop, lumber yard, pattern vault and office were saved, but all the woodworking machinery was burned.

The Indiana Scale Truck Co., Bluffton, Ind., is in the market for a 50-H.-P. gas or steam engine and other machinery.

The plant of the Miles Lamp Chimney Co., Arcadia, Ind., recently burned, will probably be rebuilt, although the matter has not been definitely decided.

E. M. Scofield, Groton, N. Y., is superintending the construction of a new plant for the Groton Bridge Co., having an annual capacity of 12,000 tons; the power plant has already been constructed, but additional boilers of 175 H.-P. and a compressor plant having a capacity of about 1,000 cu. ft. per minute, have yet to be installed. He is also working upon a larger plant to be located in Pittsburg.

The Kansas Ice & Storage Co., Salina, Kan., will erect a 40-ton ice-making and 120,000 cu. ft. refrigerating plant. The power plant will have a capacity of 375 H.-P.

The White Mountain Paper Co., 149 Broadway, New York, will build a large ground-wood, sulphite and soda pulp paper mill at Portsmouth, N. H. Both steam and water power, aggregating 45,000 H.-P., will be used. The hydraulic plant will include 18,000 H.-P. under 20, 40, 62, 65 and 72-ft. heads. There will be 22,000 H.-P. in steam boiler capacity, with a stoker and an economizer equipment. Steam engines aggregating 19,200 H.-P. will be installed as follows: 20 single-cylinder engines of 300 H.-P. capacity, 9 compound condensing engines, 2 of 1,800 H.-P. and 7 of 1,200 H.-P., and 2 engines for driving two electric units of 600 H.-P. capacity each. There will be but little electric transmission in the mill proper, according to present plans, but additional electric machinery may be added for overland power transmission. Hon. Wm. B. Plunkett and Chas. E. Locke are interested, and it is proposed to elect J. C. Morgan Genl. Mgr. Jos. H. Wallace, Temple Court Bldg., New York, is the engineer.

Plans are being prepared for a 28,000-spindle mill for the Mollohon Mfg. Co., Newberry, S. C. The initial installation, however, will be 14,000 spindles.

C. B. Cummings & Sons, Bemis, Me., will erect a new mill to contain a 185-H.-P. boiler, a 160-H.-P. engine and a fire pump. A 35-H.-P. independent steam plant will be installed for hauling logs.

The Cold Spring, Minn., Brewery Co. will build a new malt house and install a 70-H.-P. boiler and a small engine.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the following sales: A 450 and a 700-H.-P. vertical cross-compound engine for the Minneapolis General Electric Co.; a 500-H.-P. engine for the electric plant at Bangor, Me.; two 450-H.-P. tandem compound direct-connected engines for the Brown Hoisting Machinery Co., Cleveland, and a 450 and a 600-H.-P. horizontal cross-compound engine for the Chicago University.

The capital stock of the Empire Bridge Co., Horseheads, N. Y., recently incorporated with a capital of $1,000,000, has been increased to $3,000,000. The directors are O. A. Billings and William C. Post, of Brooklyn, and Arthur L. Davis, of New York City.

Jenkins Bros., 71 John St., New York, have been awarded gold medals at the Pan-American Exposition for valves and their '96 packing, and two silver medals for rubber specialties.

The sales offices of the Shelby Steel Tube Co. will be consolidated and transferred to the Empire Building, Pittsburg, Pa., on Nov. 1 The New York and Chicago sales offices will be discontinued.

The Best Mfg. Co., Pittsburg, Pa., has opened a sales office at 39 Cortlandt St., New York.

The American Cement Co., 22 South 15th St., Philadelphia, Pa., has been awarded a gold medal at the Pan-American Exposition for their "Giant" Portland cement, which has been used on many of the largest engineering undertakings in the country, including the Cornell dam of the Croton Aqueduct System, the Rapid Transit Underground Railway in New York, the Niagara Falls tunnel and many others.

The Massillon Iron & Steel Co., Massillon, O., has contracted with the Massillon Bridge Co. for a building 100 ft. square to be fitted with electric crane and other apparatus useful in pipe casting. The company will build a 150 x 100-ft. jobbing foundry later.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Nov. 4.	Phoenixville, Pa Adv. Eng. Record, Oct. 26.	Oct. 26
Nov. 4.	Chicago Heights, Ill	Nov. 2
Nov. 5.	Meters, Dowagiac, Mich	Nov. 2
Nov. 5.	Clarinda, Ia	Oct. 26
Nov. 6.	Topeka, Kan	Oct. 26
Nov. 7	New York, N. Y	Oct. 19
Nov. 7.	Southampton Ont	Nov. 2
Nov. 9.	Kirkwood, Mo	Oct. 26
Nov. 9.	Houston, Tex	Nov. 2
Nov. 11.	Water-works franchise, Yazoo, Miss	Sept. 14
Nov. 12.	Grand Rapids, Mich Adv., Eng. Record, Oct. 12, 26.	Oct. 12
Nov. 12.	Troy, N. Y	Nov. 2
Nov. 15	Cincinnati, O	Oct. 19
Nov. 18.	Portland, Ore	Nov. 2
Nov. 20.	Scammon, Kan Adv., Eng. Record, Oct. 26.	Oct. 26
Nov. 20.	Meters, Cleveland, O	Nov. 2
Nov. 21.	Boston Mass Adv., Eng Record, Nov. 2.	Nov. 2
Nov. —.	West Lebanon Ind	Oct. 19
Nov. —.	Farmersville, Tex	Oct. 12
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 4.	Sale of pumping works Chicago, Ill Adv., Eng. Record, Oct. 12.	Oct. 12
Dec 17.	New York, N. Y	Oct. 19
Jan. 1.	Osborn, O.	Nov. 2
Jan. —.	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
——	Johnson City, Tenn	Nov. 2
	SEWERAGE AND SEWAGE DISPOSAL	
Nov. 4.	Harrisburg Pa	Nov. 2
Nov. 4.	Ft. Dodge, Ia	Nov. 2
Nov. 4.	Marshall, Mo	Nov. 2
Nov. 4.	Mapleton, Minn	Nov. 2
Nov. 4.	Marquette, Mich	Nov. 2
Nov. 5.	Decatur, Ill	Oct. 26
Nov. 6.	Ft Leavenworth, Kan	Nov. 2
Nov. 6.	Kansas City, Mo	Nov. 2
Nov. 7.	Evanston, Ill	Nov. 2
Nov. 8.	Hudson, N. Y	Oct. 19
Nov. 8.	Newark, N. J	Nov. 2
Nov. 8.	Omaha, Neb	Nov. 2
Nov. 9.	Little Rock, Ark	Nov. 2
Nov. 9.	Washington, D. C	Nov. 2
Nov. 9.	Youngstown, O	Nov. 2
Nov. 9.	W Homestead, Pa	Nov. 2
Nov. 11.	Sewerage franchise, Yazoo, Miss	Sept. 14
Nov. 11	Michigan City, Ind	Nov. 2
Nov. 12.	New Rochelle, N. Y	Nov. 2
Nov. 13.	Brooklyn, N. Y	Nov. 2
Nov. 13	New York, N. Y	Nov. 2
Nov. 14.	Moorestown, N J Adv., Eng. Record, Nov, 2.	Nov. 2
Nov. 16.	Chicago, Ill	Nov. 2
Nov. 16.	Roswell, N. Mex	Oct. 19
Nov. 18.	Sheridan, Ind	Nov. 2
Nov. 18.	Kokomo, Ind	Nov. 2
Nov. 19.	Auburn, Ind	Nov. 2
Nov, 20.	Durham, N. C Adv., Eng. Record, Nov. 2.	Nov. 2
Nov. 20.	Glenville, O.	Nov. 2
——	Washington, Ia	Nov. 2
	BRIDGES.	
Nov. 5.	Princeton, Ind	Oct. 5
Nov. 6.	Fowler, Ind	Oct. 26
Nov. 6.	Kansas City, Mo	Nov. 2
Nov. 7.	Wilkesbarre, Pa	Oct. 26
Nov. 9.	Westmoreland, Kan	Nov. 2
Nov. 11.	Superstructure, Buffalo, N. Y Adv., Eng Record, Nov. 2.	Nov. 2
Nov. 11.	Victoria, B. C	Nov. 2
Nov. 12.	Fargo, N. D	Oct. 19
Nov. 12.	Sherbrooke, Que Adv., Eng. Record, Oct. 26, Nov. 2.	Oct. 26
Nov. 16.	Lake Charles, La	Oct. 26
Dec. 17.	Saginaw, Mich	Oct. 26
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Nov. 4.	Oskaloosa, Ia	Nov. 2
Nov. 5.	Wellsville, O	Oct. 12
Nov. 5.	Washington, Ind	Oct. 26
Nov. 5.	Trenton, N. J	Oct. 26
Nov. 6.	Greenwich, Conn	Nov. 2
Nov. 6.	Cleveland, O	Nov. 2
Nov. 6.	Kansas City, Mo	Nov, 2
Nov. 7.	Shreveport, La	Nov. 2
Nov. 8.	Freemont, O	Oct. 19
Nov. 9.	Youngstown, O	Nov. 2
Nov. 11.	Camden, N. J	Oct. 19
Nov 11.	Lorain, O	Nov. 2
Nov. 11.	Wellsville, O	Nov. 2
Nov. 12.	New York, N. Y	Nov. 2
Nov. 12.	Troy, N. Y	Oct. 26
Nov. 12.	Wellsville, O	Oct. 26
Nov. 13.	Toledo, O	Oct. 19
Nov. 14.	Mobile, Ala	Nov. 2
Nov. 18.	Toledo, O	Oct. 26
Dec. 3.	Jeffersonville, Ind	Nov. 2
	POWER, GAS AND ELECTRICITY.	
Nov. 11.	El. light plant franchise, Yazoo, Miss	Sept. 14
Nov. 18.	Franchise, Oakland, Cal	Oct. 26
Nov. 20.	Wiring post-office, Kansas City, Mo Adv., Eng Record, Nov, 2.	Nov. 2
Nov. 23.	Zion City, Ill	Nov. 2
Nov. 26.	Columbia, Pa	Nov. 2
Dec. 2.	Lemoore, Cal	Nov. 2
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
	GOVERNMENT WORK.	
Nov. 6.	Fitchburg, Mass Adv. Eng. Record, Oct. 5, 12.	Oct. 5
Nov. 7.	Ft. Morgan, Ala	Nov. 2
Nov. 7.	New York, N. Y Adv., Eng Record, Sept. 28, Oct. 5.	Sept. 28
Nov. 8.	Htg. P. O. bldg., Altoona, Pa Adv., Eng. Record, Oct. 19, 26.	Oct. 12
Nov. 9.	Portsmouth, N. H	Oct. 26
Nov. 9.	Governor's Island, N. Y Adv., Eng. Record, Oct. 26, Nov. 2.	Oct. 26
Nov. 14.	Portland, Ore	Oct. 19
Nov. 18.	Boston, Mass	Nov. 2
Nov. 19.	Ft. Terry, N. Y Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Nov. 20.	Ft. MacKenzie, Wyo	Oct. 26
Nov. 20.	Wiring, Kansas City, Kan Adv., Eng. Record, Nov. 2.	Nov. 2
Nov. 21.	Savannah, Ga	Oct. 26
Nov. 21.	Mobile, Ala	Oct. 26
Nov. 22.	Sullivans Island, S. C	Oct. 26
Nov. 23.	San Francisco, Cal	Oct. 26
Nov. 27.	Annapolis, Md	Oct. 26
Nov. 30.	San Francisco, Cal	Oct. 12
Dec. 2.	Htg. apparatus, Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 3.	Wiring, etc., Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
Dec. 11.	Milwaukee, Wis Adv., Eng. Record, Nov. 2.	Nov. 2
	BUILDINGS.	
Nov. 4.	Pub. bldg., Boston, Mass	Nov. 2
Nov. 5.	Pub. bldg., St. Louis, Mo	Nov. 2
Nov. 5.	School, Butte, Mont	Nov. 2
Nov. 6.	Hospital, Des Moines, Ia	Oct. 26
Nov. 7.	Jail, Akron, Pa	Oct. 12
Nov. 7.	Htg. pub. bldgs., Dundas, Ont	Nov. 2
Nov. 8.	Pub. bldgs., Philadelphia, Pa	Nov. 2
Nov. 8.	Market house, Cincinnati, O	Nov. 2
Nov. 8.	Htg. post office, Digby, N. S	Oct. 26
Nov. 9.	School addition, Washington, D. C	Oct. 19
Nov. 9	Library, Decatur, Ill	Nov. 2
Nov. 11.	School, Brooklyn, N. Y	Nov. 2
Nov. 11	Cells in the penitentiary, Lincoln, Neb	Nov. 2
Nov. 11.	Court house, Williamson, W. Va	Nov. 2
Nov. 11.	Hospital, Johnson City, Tenn Adv., Eng. Record, Oct. 12 to Nov. 2.	Oct. 12
Nov. 11.	Court house, Reidsville, Ga	Oct. 5
Nov. 11.	Court house plans, Crowley, La	Sept. 21
Nov. 11.	Htg court house, Mauston, Wis	Oct. 19
Nov. 11.	Elevator in school, Cleveland, O	Oct. 26
Nov. 14.	Pub bldg., National Soldiers Home, Va	Oct. 26
Nov. 14.	Add'ns, etc., to Capitol, Tallahassee, Fla	Oct. 5
Nov. 14.	School, Milwaukee, Wis	Nov. 2
Nov. 15.	School, San Marcos, Tex	Nov. 2
Nov 18	Htg. school, Kingston, Ont	Nov. 2
Nov. 18.	School, Schenectady, N. Y	Nov. 2
Nov. 18.	Court house, Jackson, Miss	Oct. 19
Nov. 20.	Court house, Asheville, N. C	Nov. 2
Nov. 22.	Court house, Greenville, Ga	Oct. 12
Nov. 30.	Capitol plans, Harrisburg, Pa	Aug. 31
Dec. 1.	Library plans, Fresno, Cal	Oct. 26
Dec. 2.	Court House, Hazelhurst, Miss	Oct. 19
Jan. 1.	School, Flint, Mich	Nov. 2
——	Machine shop, Niagara Falls, Ont Adv., Eng. Record, Oct. 26.	Oct. 26
	MISCELLANEOUS.	
Nov. 5.	Sioux City, Ia	Nov. 2
Nov. 6.	Dock, Two Rivers, Wis	Nov. 2
Nov. 6.	Retaining wall, Leavenworth, Kan	Nov. 2
Nov. 6.	Canal, New Orleans, La	Oct. 19
Nov. 11.	Dock, Michigan City, Ind	Oct. 19
Nov. 11.	El. Ry. franchise, Whittier, Cal	Oct. 12
Nov. 11.	El. Ry. franchise, Yazoo, Miss	Sept. 14
Nov. 16.	Garb. crematory, Canton, O	Oct. 26
Nov. 16.	Levee work, Port Allen, La	Nov. 2
Nov. 19.	Shed, New Orleans, La Adv., Eng. Record, Oct. 26, Nov. 2.	Oct. 26
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 2

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Civil Engineering Features of Modern High Buildings.

The civil engineering work called for in the design and construction of a modern high building is, like all more or less complicated affairs, the result of natural development, but a development in classes of work of far greater variety than is often contemplated. The largest building of thirty or forty years ago involved practically no engineering work of an advanced grade. The foundations were formed of simple masonry walls on footing courses sufficiently wide to produce a pressure which would generally be considered safe in the judgment of a mason. The opinion of a civil engineer was seldom considered necessary, and consequently seldom sought. Although real estate in spots was held at a high valuation, it had not then reached that point of value at which it becomes necessary to go as far heavenward or as deep as possible in the opposite direction to obtain the maximum rental space. Hence foundation loads were, in all cases, small, and foundation problems had practically not yet arisen. The same general observations can be applied to the superstructure. Simple brick or cut-stone walls, carried to a height of about five stories at most, required no engineering design; it was simply the work of a mason to build an enclosing wall of moderate thickness, whose carrying capacity would ordinarily be far in excess of the loads to come upon it if laid up with reasonably good mortar. Within these walls were found the simplest arrangements of timber floors, carried either on timber columns, or possibly those of cast iron, no feature of which, save possibly the cast-iron columns, was ever subjected to any very serious process of engineering design.

All this has been radically changed; the elevator and the steel frame have done their work most effectively. Floors to the number of twenty or twenty-five rise into space, and, with their loads, are carried on steel frames, which also support the exterior walls. The latter no longer support themselves, for sufficient thickness at the lower floors to perform that function would trench far too largely upon the available floor space of the building. The walls simply serve to protect the interior from the weather, and play the part of curtain walls only. The loads carried by the steel frame include the total weights of the entire structure and its contents above the supporting pedestal blocks at the bases of the columns. These loads are necessarily enormously heavy. They may be uniformly distributed by devices arranged to accomplish that distribution over a considerable part or all of the foundation site; or they may be concentrated at suitable points where the columns rest, usually either upon pneumatic caissons or upon pile foundations.

The building proper is a piece of structural work involving some of the nicest questions of design in steel. All parts of the metal frame being concealed by the interior and exterior finish of the building, there is absolutely no evidence of the amount or quality of thought and care expended upon the disposition of the steelwork in order to meet the exacting demands of good design in the most effective and economical manner. This class of engineering work has always been considered of an elementary character, as it involves only rather simple combinations of beams and columns constantly under similar conditions. While this is true in many cases, as a matter of fact there are some questions involved in the design of columns for high buildings which have not yet been treated in a perfectly satisfactory manner. Whether the columns are cast iron or of built-up steel sections, the loads which they carry are seldom or never applied at the centers of column section. The ends of the rolled or built beams which convey loads to the columns usually rest upon cast-iron brackets, or are bolted to cast-iron columns, or finally they may be riveted to steel columns. Even in the latter instance they can seldom reasonably be considered as centrally applied. This is a point which rarely receives the attention which it deserves. Occasionally a detail equivalent to a diaphragm between the two sides of a column is employed, but without such a saving device heavy bending will be imposed upon the member designed to carry vertical loads only.

Great niceties of theory have been employed to compute the stresses induced by eccentric column loads. The trouble with such refined processes lies in the fact that the conditions assumed are practically never realized, and in spite of the utmost theoretical care no little stress uncertainty results. The highest grade of engineering design work is required to meet such exigencies, and it must usually consist in the introduction of conditions which avoid the causes of uncertainties and afford a design of unqualified strength and stiffness for a practically central load.

No less advanced engineering work is done in the foundations of these high buildings. Wherever they can be built directly upon rock, as north of about Fourteenth Street in New York City, all foundations are obviously the simplest possible, but in the lower part of Manhattan Island foundation problems arise which call for the most skilful treatment. Although some of the heaviest buildings have been supported in an eminently satisfactory manner on piles or on plates of concrete reinforced in some places by imbedded steel, it has become the fashionable method to employ pneumatic caissons. The latest advances in this latter class of work are most interesting. The caissons not only carry the vertical loads, which is their normal function, but they act as dams as well. The row of caissons around the boundary lines of the lot are so constructed and placed as to constitute a water-tight enclosure. The result is that the basement volume below the water-level, as well as that above it, may be used for power, storage or other purposes. In the addition to the Mutual Life Building now approaching completion in New York, this water-tightness of the caisson dam or enclosure was secured by placing the caissons about a foot apart and then sealing this opening by the process of stock ramming, a considerable amount of clay in cartridges having been used for the purpose. It was a rather novel as well as successful application of the process, but it has rendered available basement space to a depth of about 60 feet below the natural surface of the ground. In the foundation of the Stock Exchange Building, the rectangular pneumatic caissons placed along the exterior lines of the lot were sunk end to end practically in contact with each other, provision having been made for an oblong well to be filled with concrete, half of which is formed by opposite recesses in the adjoining ends of two caissons. The details of these foundation constructions have been given in full in The Engineering Record, and a reference to them cannot fail to impress one with the value of these improvements in building foundations, which constitute a distinct advance in the application of pneumatic caissons to this class of engineering work.

An Explanation of Septic Action in sewage, which is interesting even if divergent from current scientific opinion, recently appeared in a newspaper in a town where a septic tank is under construction. The editor explained its purpose thus: "In the septic tanks are gathered a large quantity of bacteria, and the sewerage comes into the tank polluted with all manner of microbes. These microbes act as the germs for various kinds of diseases, and upon their entrance into the vats, the fight for existence between the microbes and the bacteria commences. The contest is an unequal one, because it is known in advance how it will come out—the bacteria will win and before they cease will have eaten up or killed all of their adversaries. The bacteria hang around the top of the vats in a kind of scum, and when the microbes come to the surface for a little fresh air they are either eaten up or killed and dropped to the bottom of the tank, forming a sediment that is absolutely harmless to the outside world."

The Long Cantilever Bridge across the Monongahela River at Pittsburg, will be, if completed, one of the most notable structures of its type. It is to be a double-track bridge with a 360-foot suspended span 60 feet deep, two 226-foot cantilever arms 126 feet deep and two 346-foot anchor arms. The anchor piers will be built on shore and the main piers on 66 x 33-foot wooden pneumatic caissons sunk to rock at a depth of about 40 feet. The bridge was designed by Messrs. Boller & Hodge, New York, for the Pittsburg, Carnegie & Western Railway, Mr. J. W. Paterson, chief engineer, and is intended to furnish the Wabash road an entrance into Pittsburg. The leading contracts for the work have been awarded to the American Bridge Company and Arthur McMullen & Company. The same railway will also place contracts in a short time for another noteworthy bridge of about 700 feet clear span across the Ohio near Wellsburg, Ohio. It will have pneumatic caisson foundations in shallow water, and there will be two long viaduct approaches. Between this site and Pittsburg four large viaducts will also be erected. The construction of these bridges, important as the work will be, is but an incident in the important railway project of the Wabash system now being developed under President Joseph Ramsey, Jr., M. Am. Soc. C. E.

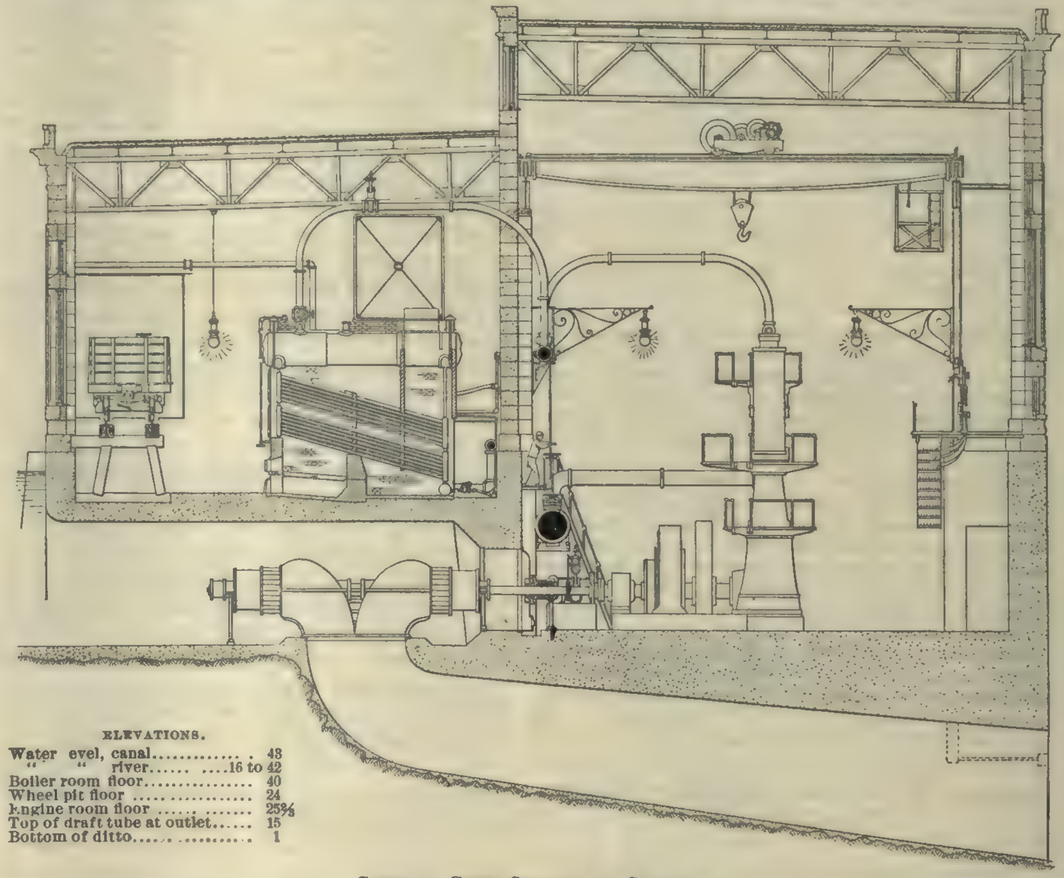
The New Plant of the Virginia Electrical Railway & Development Co., Richmond, Va.

The city of Richmond is situated on the James River, at the head of tidewater and about one hundred miles from its mouth. Within three miles of the limit of the tidal ebb and flow the fall of the James River is 84 feet, and within nine miles the fall is 112 feet. Above this point the watershed of the river is 6,900 square miles, and its low summer flow seldom falls below 1,500 cubic feet per second. With the larger fall this amount of water is capable of producing 15,000 horse-power, and a much greater quantity may be obtained for a large portion of the year. This power is divided among a number of independent, and sometimes opposing interests, none of which formerly obtained the best results from the portions they utilized. This was the natural outcome of the lack of means for distributing the power developed at one plant to many users, such as is now afforded by the agency of electricity.

Among these various owners of water power were the Haxall-Crenshaw flouring mills, which at one time were very successful, but, owing to changed conditions of transportation and improvements in the process of manufacture, were forced to suspend operation. Their property was placed on the market in 1898 and purchased by the Virginia Electrical Railway & Development Company. This company was formed chiefly through the efforts of Mr. F. C. Todd, of Baltimore, and the necessary financial aid was furnished through Messrs. John L. Williams & Company, of Richmond, and Middendorf, Oliver & Company, of Baltimore. A very large portion of the securities is held by the citizens of Richmond.

A few statistics with regard to the manufacturing interests in Richmond will be found interesting in conjunction with the description of the new plant. Some of the largest tobacco factories in the world are located in Richmond. The number of iron and steel industries situated at Richmond is not generally appreciated. Among the largest concerns are the Tredegar Iron Works, employing about one thousand men, and the Old Dominion Iron & Nail Works Company, with a plate mill, bar mill, nail department, roofing plate department, etc. The Cardwell Machine Company and Richmond Locomotive Works are also located there, the latter works having a capacity of two hundred and fifty locomotives per year and employing over two thousand men. The Wm. R. Trigg Company, ship builders; Virginia-Carolina Chemical Company, manufacturers of fertilizers; the Southern Manufacturing Company, baking powders, and the Richmond Cedar Works, wooden wares, may also be mentioned. The following summary will show the importance of the manufacturing interests in this city:

	No. of plants.	No. of hands.	Capital in business.	Sales of the year.
1900	1,318	25,563	$19,125,980	$48,861,864
Increase over 1899.	73	4,340	1,793,640	7,494,941



ELEVATIONS.

Water evel, canal................	43
" " river...... ....16 to	42
Boiler room floor..................	40
Wheel pit floor	24
Engine room floor	25⅔
Top of draft tube at outlet......	15
Bottom of ditto......	1

General Cross-Section of Station.

View of the Power Station during Construction.

The population of Richmond, according to the latest census, was 85,000, but the urban and contiguous suburban population served by the post offices of Richmond and Manchester is estimated at 125,000 people, and these form practically one community for all purposes except the levying and expending of municipal taxes.

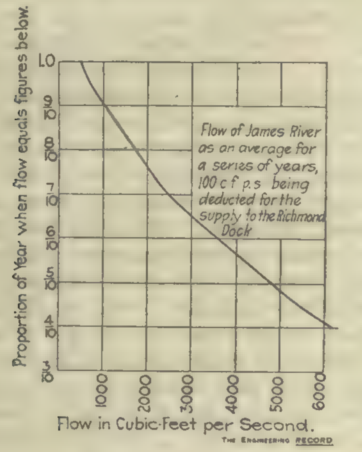
The plant of this company, which will supply electrical energy for any purpose for which it may be desired and to any distance within the limits of economical electric transmission, comprises at present: A dam across James River controlling the entire flow; a canal leading from the north end of this dam to the power house, a distance of 2,200 feet; the station or power house, with its machinery, having a total present installation of 5,600 horse-power, and the distributing system, consisting of the installation of underground conduits and Edison tubes and several pole line routes with overhead feeders.

The accompanying diagram shows the proportion of the year during which a given yield from the river may be expected. This diagram was prepared from stream flow records taken at Bosher's dam, four miles above the site of the present dam. Another diagram gives the power yield of the river at the development company's plant. The diagram is very simple and self-explanatory. With a diversion to the Manchester Canal of 700 cubic feet per second, 10,000 horse-power may be developed for six months and the interruption from back water will be about seven days. The Manchester Canal property includes about thirty acres of land on the south bank of the river immediately opposite the new plant, together with a dam which is below the new dam. It was bought by the development company in 1899. There are now on this property several large mills and factories, using in all approximately 700 cubic feet of water per second. It will not, however, be the policy of the development company to add to the use of water power on this level, since the head and fall on the north side of the river is considerably greater.

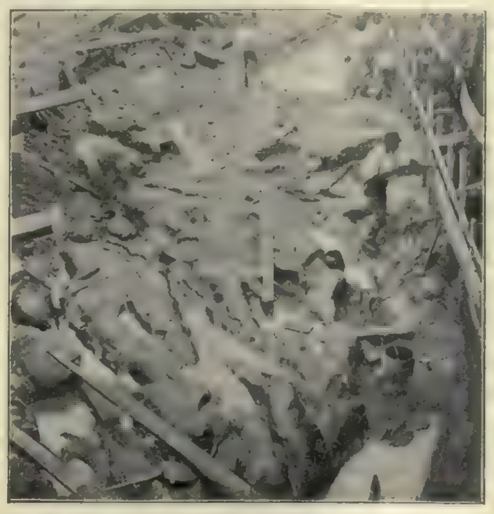
The report on water supply by Mr. C. C. Vermeule, published by the Geological Survey of New Jersey, gives the minimum flow of the James River at Richmond as 1,300 second-feet, or 0.191 second-foot per square mile. This quantity was the result of a gauging made by Col. W. E. Cutshaw in 1878, at a time when the river was said by the "old inhabitant" to be as low as ever before. Since that time, however, on several occasions it has been lower, and the minimum flow is given by Mr. Shirreffs, chief engineer of the development company, as not exceeding probably 600 to 650 second-feet, or about 0.095 per square mile. In February, 1899, Mr. Shirreffs estimated the flow at 125,000 second-feet, and in the highest freshets the discharge is perhaps 150,000 to 160,000 second-feet, or about 22 second-feet per square mile.

The average yearly rainfall in the James River basin for twenty-six years is given by the United States weather bureau as 43.1 inches, the minimum precipitation occurring in December, when it averages 2.9 inches for the month.

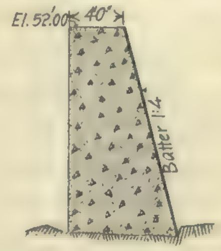
The James River is formed by the junction of the Cowpasture and Jackson rivers. These branches, with their affluents and the tributaries to the main streams as far down as Richmond, drain a series of very narrow valleys lying between the parallel ranges which form the system of the Alleghany Mountains in that region. Their fall is, as a rule, not very large, their declivities uniform, and their beds gravel and sand. Their chief peculiarity lies in the fluctuation to which their flow is liable. The rain falling on the mountains is shed rapidly into the water courses by the steep side slopes leading to the narrow valleys below, and there being few lowlands to overflow and so to store the freshet water, and no lakes whatever in the region, these streams and with them the James River are subject to very heavy freshets, while in dry seasons their discharge becomes small. The bed of the James River is chiefly of rock and boulders, as shown in the view of the bed at the dam. Under these conditions it was necessary to build a dam with special features which are very interesting, and also to use a novel method of construction at the power station, which will be described later.



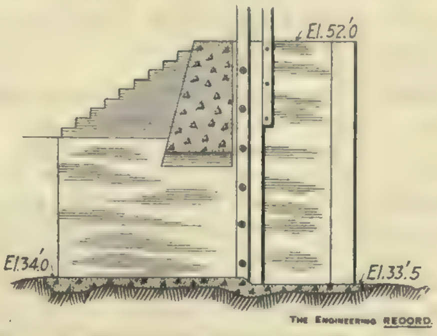
STREAM-FLOW DIAGRAM.



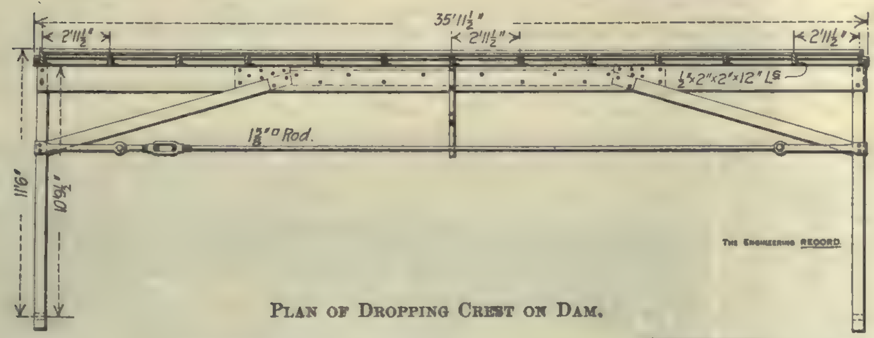
RIVER BED AT SITE OF DAM.



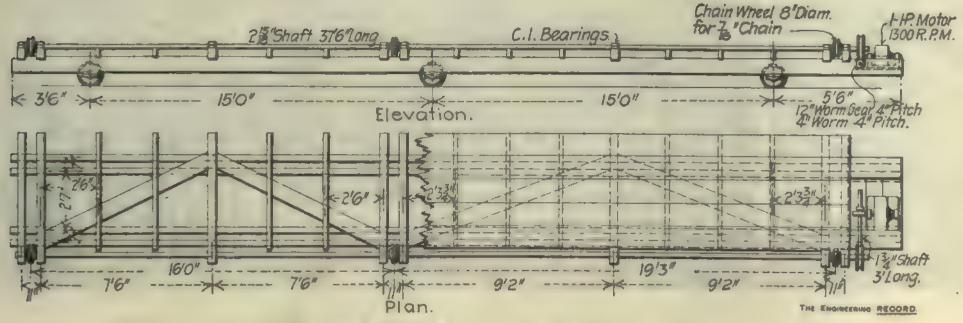
GUARD WALL.



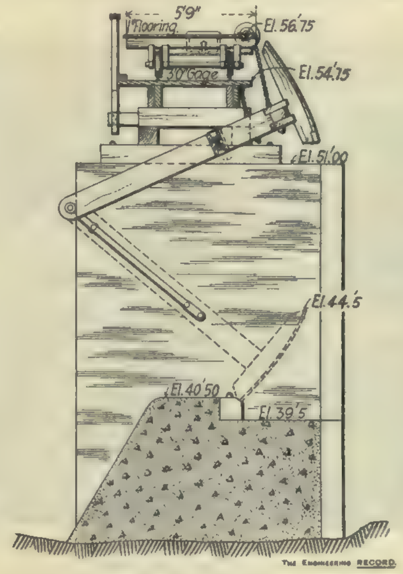
SECTION THROUGH HEAD GATES.



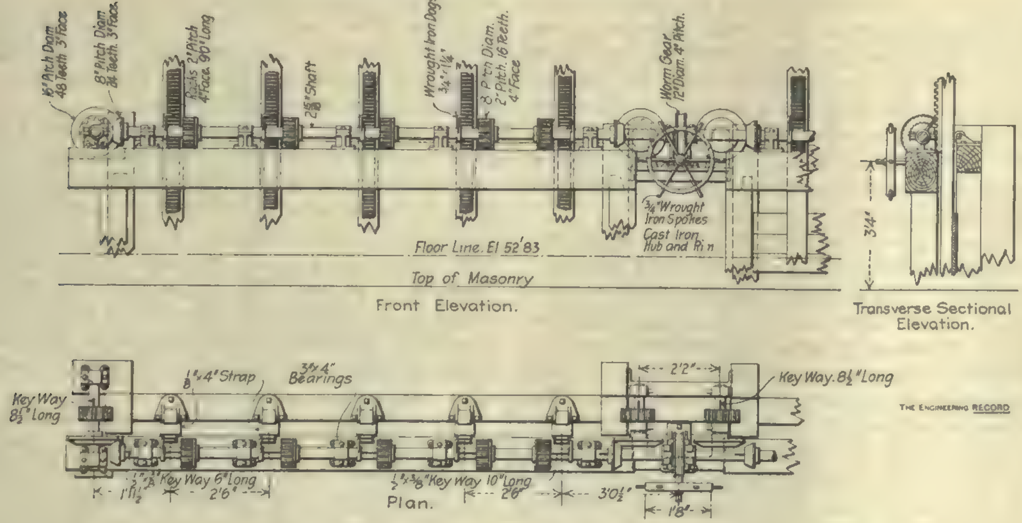
PLAN OF DROPPING CREST ON DAM.



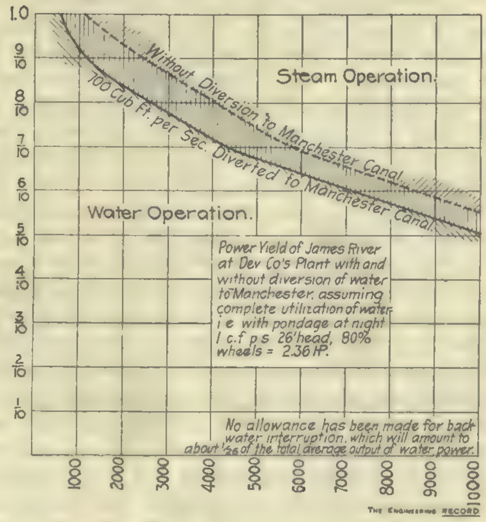
HOISTING CAR FOR RAISING CREST OF DAM.



SECTION OF DAM.


16" Pitch Diam 48 Teeth 3" Face
8" Pitch Diam 24 Teeth 3" Face
Racks 2" Pitch 4" Face 9'0" Long
2 15/16" Shaft
Wrought Iron Dogs 3/4"×1¼"
8" Pitch Diam. 2" Pitch. 16 Teeth. 4" Face
Worm Gear 12" Diam. 4" Pitch.
3/4" Wrought Iron Spokes Cast Iron Hub and Rim
Floor Line. El 52'83
Top of Masonry
Front Elevation.
3'4"
Transverse Sectional Elevation.
Key Way 8½" Long
⅛"×4" Strap
3/4"×4" Bearings
2'2"
Key Way. 8½" Long
Key Way 6" Long
½"×⅜" Key Way 10" Long
1'11½
2'6"
2'6"
3'0½"
1'8"
Plan.
THE ENGINEERING RECORD

GENERAL ARRANGEMENT OF HEAD-GATES MECHANISM.



POWER-YIELD DIAGRAM.

The dam is a concrete masonry structure about 1,700 feet long, exclusive of of the guard wall at the upper end of the channel. The average height of the crest is only 5 feet above the solid granite bed of the river, upon which the dam is built. The maximum height is about

8 feet. It was desired to carry a greater head of water in the canal than would have been afforded by a dam of the same height as the old Haxall dam, which was purchased with the property, and a higher dam would probably have caused serious damage to property above the dam at times of extreme freshets. The plan shown in the drawing of the site was therefore adopted. Piers were built at intervals of 40 feet along the top of the dam. These piers are built sufficiently high to extend above the highest freshet levels and to them are hinged timber gates, which are capable of being lifted above the freshet levels in floods, but which, when resting on the masonry dam, will maintain the surface of the water 4 feet above the masonry crest. These movable sections are constructed of heavy pine timber and plank, and are faced with cotton duck heavily coated with North Carolina tar.

The gates are manipulated by a 3-horse-power electric motor on a car moved by hand power from gate to gate on a bridge supported by the piers of the dam. Although the height of dam even with the addition of the movable gates is small, the fall of the river is sufficiently rapid to give a maximum head of 27 feet at the power house 2,200 feet below. There are 43 of these hoisting gates on the dam.

A signal station is maintained at Columbia, sixty miles upstream, which is connected with the power station by telephone, and reports are sent to Richmond twice daily of the water levels at that point. Flood notices are transmitted in like manner. The notices are thus received at the power station about twelve to eighteen hours in advance of any unusual rise, and the men immediately start raising the gates in anticipation of high water.

The upper 900 feet of the canal is a natural channel, enlarged by excavation of earth and rock to an average area of waterway of 1,200 square feet. The remaining 1,300 feet, however, consists of a canal with concrete masonry side walls, and a smooth lining of concrete masonry on the bottom. The masonry walls were necessary to hold the banks, since for the greater part of the distance the width available was limited. The lining of the bottom was put in solely to increase the capacity to carry water, the lower part of the excavation being in solid rock for the entire length of the canal. The dimensions of the canal are 50 feet width by 13 feet depth of water. It was estimated that the canal would deliver to the power station 5,500 to 6,000 cubic feet of water per second without a loss of more than twelve to fifteen inches in the whole length. The velocity of the current under these conditions is about 9 feet per second, or over 6 miles per hour.

In determining the slope to be given the bottom of the lined portion of the canal (which was fixed at 0.1 foot in 300 feet) the coefficient c in the Chezy formula $v = c \sqrt{RI}$ was computed by the Kutter formula, assuming a value for n (the coefficient of roughness) of 0.030. While the quantity of water drawn through the canal has not as yet been large enough to allow the correctness of the resulting value of c (180) to be ascertained at all definitely, it is apparent that it is somewhat less than given by the above assumption.

The elevation of the top of the dropping crest on the dam is 44 feet 6 inches, and the maximum intended water level in the canal at the power station is 43 feet.

An unusually large amount of gateage has been provided at the upper end to diminish the loss of head at this point. There are ten openings, each 12 feet wide by 8 feet high. These openings are provided with heavy timber frames, each of which supports five small gates. These small gates will be used to regulate the supply of water when the river is high, but when the river is low the frames and gates may be raised entirely out of the water, leaving the large openings unobstructed. The mechanism of the head gates is shown in one of the drawings.

Like the canal excavation, the excavation for the power house foundations was chiefly in solid rock, the rock excavation done within the lines of the power house and in the tail race to allow a free discharge of the water amounting to 19,000 cubic yards. On account of the great weight of the machinery installed, on the one hand, and the very great upward pressure of the water in extreme freshets, which reach a level 20 feet above the engine-room floor, on the other, the foundations of the power house have been made unusually massive.

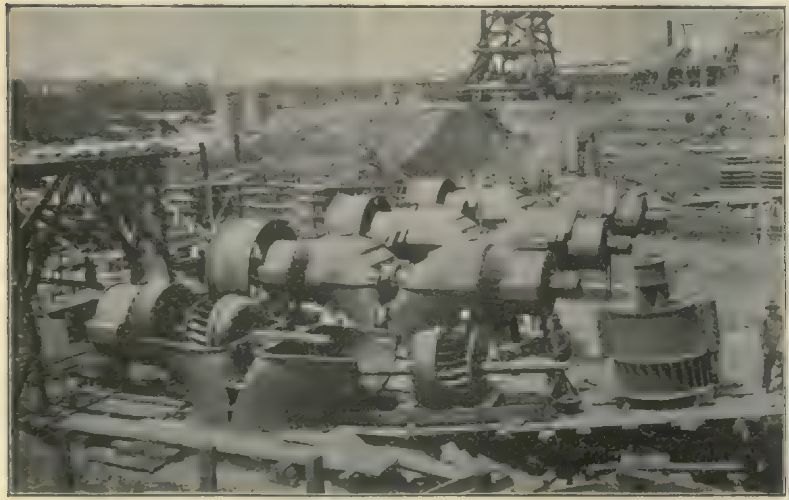
Under the engine room the entire space excavated is solidly filled with concrete masonry, except for the circular tunnels (draft tubes), which carry off the discharge from the turbines. These draft tubes are circular in section, 10½ feet diameter at the outlet of the wheels, enlarging to 14 feet at the river end. The wheel chambers are arched so as to carry the boilers, which are placed over that section of the power house, as shown in the cross-section of the station. The elevations of the different portions of the structure are given on the cut. The reference datum used was that of the Coast Survey, and the elevation at the bottom of the outlet of the draft tubes referred to this datum is 1.00. The maximum freshet height of the river up to the present time is elevation 42.4. As the elevation of the engine-room floor is 25 feet 8 inches, it is seen that in such a freshet it would be 16.7 feet below the water outside. In May of this year the river was 9 feet above this floor. The low water elevation of the stream surface is about 16.0. Two of the accompanying views show the manner of setting the turbines and arching over the wheel pits. The turbines were set in place on the wheel-pit floor, and then the wooden forms on which the arches were built were placed over the wheels.

The extensive use of concrete masonry is noticeable in this work, not only the dam, canal masonry and power house foundations being constructed of it, but also the walls and roof of the power station, the switchboard gallery floor, and even the outer shell of the chimney. For the most part, Portland cement was used in forming the concrete, but in some places, where only mass or weight was required, natural cement was used. The stone from the various excavations furnished an excellent aggregate, although it would have been unsuitable for stone masonry. The use of concrete, therefore, reduced the cost of the foundation work, and in the construction of the house and chimney made architectural effects possible at a cost not greatly exceeding that of good brick masonry, which would have been too costly in stone. The foundation concrete was built as a monolith, in forms built up for the purpose, and the shaft of the chimney was constructed in the same way. The walls of the superstructure were built of blocks of concrete, previously moulded in boxes and laid up in the walls precisely as stone ashlar would be laid. All the concrete blocks were prepared, each for its place, and numbered before the erection of the superstructure was begun.

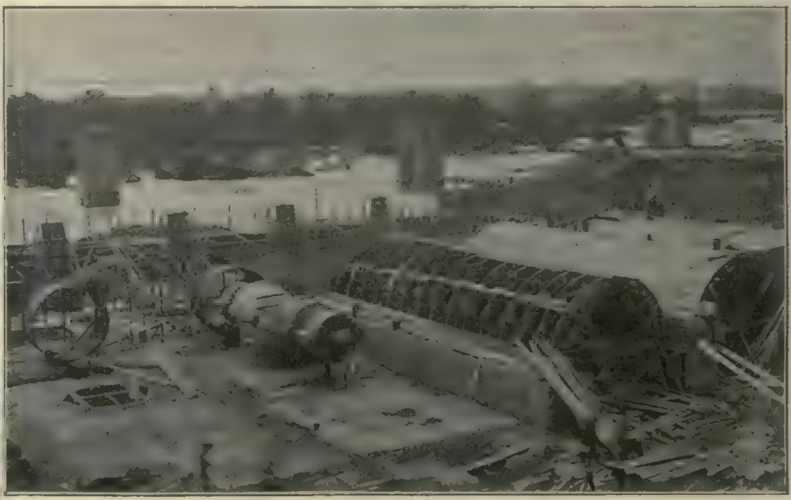
The section of the power house which has been completed represents about one-third of the plant which it is ultimately designed to build. The present power house is about 110 feet square. The height of the chimney is 175 feet above the boiler grates and its internal diameter is 11 feet. The height from the floor of the engine room to the roof is 64 feet. The length of the house when completed will be nearly 300 feet, and there will be a second stack of the same size as the first.

The rock excavation necessary for the extension of the station to this size has been done and a portion of the river wall constructed for the entire length, so that the extensions may be made without interruption to the operation of the turbines in the portion of the plant now installed. When the plant is finished there will have been removed 36,000 cubic yards of earth and 43,000 cubic yards of stone, and 22,800 cubic yards of concrete masonry will have been put in place.

As the industries which use the power generated in this plant must be protected against any possible interruption to operation from lack of



Setting the Turbines in Place.



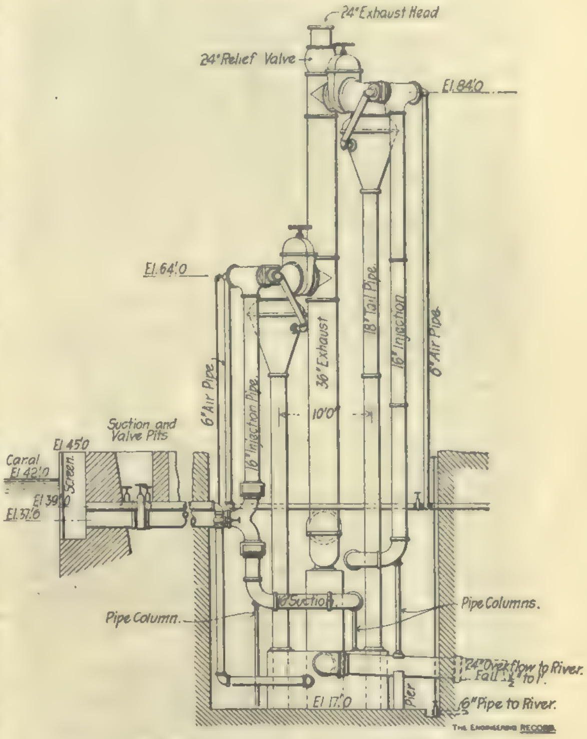
Building the Concrete Arches over the Turbines.

power, the necessity for the installation of an auxiliary steam plant is very evident from the curves giving the stream flow and power yield of the river at the location of the station, as well as from the facts stated in regard to freshet heights. These extreme heights result from the location of the plant at the head of tidewater and at the very foot of the great falls. Such occasions, however, are very rare and last but a few days at a time. They have obtained only five times in the past forty years, viz.: in 1870, 1877, 1885, 1899 and 1901.

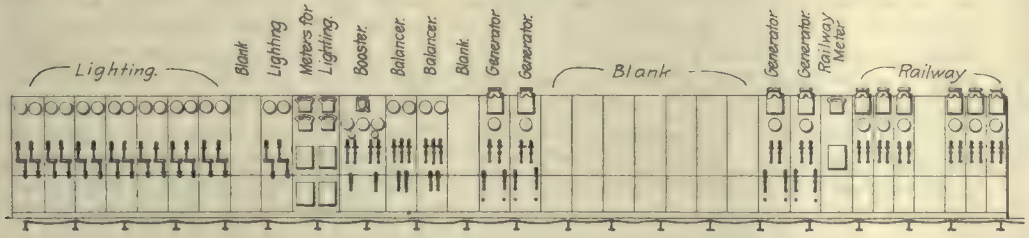
The present installation of machinery comprises four units, each unit consisting of a pair of 51-inch turbine wheels on the same shaft, a 700-kilowatt continuous current generator direct-connected to it, and a steeple tandem compound engine, also direct-connected to the generator. Only three engines are at present installed, but provision has been made for the fourth. The engines will run condensing or non-condensing and are rated at 750 horse-power at best economy, but are capable of delivering 1,500 horse-power. The pair of wheels will develop 1,400 horse-power under the maximum head of 27 feet.

The turbines were built by the Stilwell-Bierce & Smith-Vaile Company and are equipped with Lombard governors. The generators and other electric apparatus were made by the General Electric Company, and the engines by the Edward P. Allis Company, of Milwaukee. The cylinders are 18 and 36 inches, with a 42-inch stroke. They are equipped with Reynolds valve gear and ball governors. A bolted flange-coupling effects the connection between the turbines and the generators. The engine fly-wheel, which weighs 80,000 pounds, is mounted between the generator bearings and runs with the generator when driven by the turbine or engine. The engines are disconnected by uncoupling the connecting rods from the crank pins. To change from water to steam power eight bolts are removed from the flange couplings and the connecting rod is connected to the crank pin. To change from steam to water power the operation is reversed. The time consumed in making the change is about forty-five minutes. The best economy of the engines is based on the low rating of 750 horse-power for the reason that the engines will be depended upon to operate alone for a very small portion of the year. They will be used principally to supplement the wheels in times of low water and to maintain the proper speed in the turbines at high water. The ultimate capacity of the plant will call for eleven units of the same size, or an aggregate of about 15,000 horse-power, and it is the present intention to install two alternating-current machines of the same capacity as the direct-current machines for long-distance service. At present the alternating current is generated by two motor-driven generators directly connected to the motors.

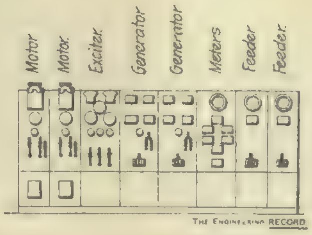
The condensing plant consists of two Worthington elevated injector condensers, set at different levels. The lower one is operated normally under the head from the canal to the river. The second condenser, at a higher level, is provided with an electrically-driven centrifugal pump with a capacity of 1,600 gallons per minute, to meet the conditions of high water when the natural head alone might be insufficient. The condenser plant installed is of 6,000 horse-power capacity. In addition to the circulating pump there is installed one double-acting Worthington dry vacuum pump, with cylinders 10 and 18 inches in diameter and 18-inch stroke.



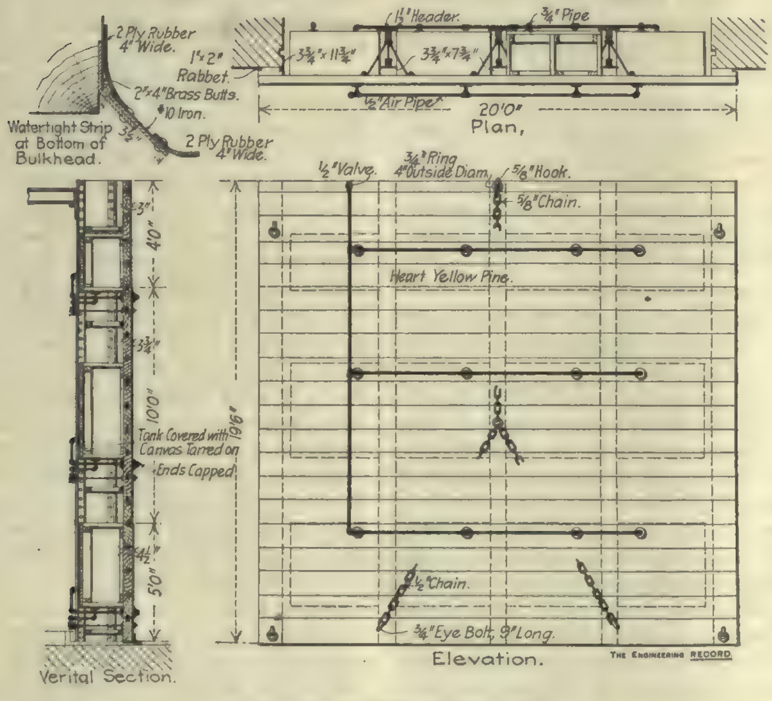
Condensers and Suction Pit.



Direct Current Switchboard Arrangement.



A. C. Switchboard.



Bulkhead for Wheel Chambers.

In addition to the main plant, there is installed in the engine room a booster set consisting of a motor direct-connected to two generators. The wiring is so arranged that these machines may be thrown on any of the power circuits which may be overloaded. There are also two balancer sets to control the three-wire distribution of the incandescent circuits.

The present boiler installation consists of two batteries of Babcock & Wilcox water-tube boilers, each having three steam drums 3½ feet in diameter and 20 feet 4 inches long, and 252 tubes 4 inches in diameter and 18 feet long, and rated at 500 horse-power. The boilers are rated on the basis of 10 square feet of heating surface per horse power and 0.2 square foot of grate surface per horse-power, the ratio of grate area to heating surface being 50. There will be eight boilers installed when the plant is completed, giving 4,000 horse-power.

Semi-bituminous coal is used. The boilers are hand-fired, as labor is cheap and their operation is not continuous. The coal is delivered in front of them on cars, and there is storage capacity at present for 240,000 pounds. The feed water is drawn from the canal, and connection is also made with the city mains, so that in times of roily water the boilers may be kept free from scale. There are two boiler feed pumps of the Knowles duplex type, with 6 and 10-inch cylinders and 12-inch stroke. The feed water passes through the pumps and thence through a 36-inch Berryman feed-water heater to the boilers. A by-pass around the heater is installed for both the exhaust steam and feed water. The only steam passing through the heater is that from the dry vacuum pump and feed pumps. The temperature of the feed water delivered to the boilers is 140 degrees. Double blow-off valves are used.

The steam pressure carried is 150 pounds per square inch, and extra-heavy wrought iron flanged pipe is used for all steam mains. The steam header is 14 inches in diameter, and the exhaust header 36 inches. Chapman valves are used throughout, and the piping was erected by the Thos. C. Basshor Company, of Baltimore, Md. All steam mains and steam pipes drain into the boilers, the Holly system being used. This system is connected up at the boilers with the blow-off pipes inside the blow-off valves, a check being provided in the piping of the Holly system.

A pressure oil system is used, and oil for lubrication is returned through filters to the storage tanks. A traveling crane spans the engine room, with a capacity of 50,000 pounds, built by the Whiting Foundry & Equipment Company. In addition to the above machinery, two drainage pumps are installed on the engine-room floor, with a combined capacity of 600 gallons per minute, to handle any water which may percolate through the masonry during freshets.

On account of the variety of the service from the station, the switchboard is quite extensive. For the continuous-current service there are at present four generator, eight railway feeder, two balancer, one booster, nine light and power and two wattmeter panels, the last for the railway feeder and lighting panels respectively. There are two high and two low bus-bars and one common neutral bus on the lighting panels. The alternating-current switchboard contains two generator, two feeder, two motor, one exciter and one meter panel. The switchboards are situated on a gallery running around the engine room.

The station is situated almost at the center of its load, a feature unusual with water-power stations, and two-thirds of its load is situated within a radius of one and one-half miles. The company therefore adopted the three-wire system for light and power distribution at 235 to 470 volts, reserving the alternating system for service outside the zone above indicated. They also furnish power to the street railways at 550 volts. The voltage used on the alternating current circuits is 2,300, which is transformed to 115 volts for distribution.

There has been laid in the street 41 duct-miles of underground conduit, starting from the power house with 64 ducts and decreasing to 36, 24, 16, 12 and 10 ducts at the most distant points. These ducts carry about 25,000 feet of rubber-covered, lead-encased feeders furnished by John A. Roebling's Sons Company, ranging in size from 250,000 to 600,000 circular mils, although their ultimate capacity is far greater than this. The underground mains are Edison tubes, of which about 13 miles have been laid. The overhead feeders, ranging from 250,000 to 500,000 circular mils, aggregate at present 50,000 feet, and there are also about 30,000 feet of overhead mains.

The design and construction of the hydraulic portion of the work and the construction of power house was in charge of Mr. Reuben Shirreffs, M. Am. Soc. C. E., chief engineer of the development company, while Mr. J. F. Apsey superintended the work on the part of the construction company. The steam and electrical features were designed by Mr. Edward J. Willis, M. Am. Soc. M. E., but since his resignation in the spring of 1900 Mr. J. P. Pope, superintendent of the company, has been in charge of this part of the work. Messrs. Sargent & Lundy, of Chicago, were consulting engineers on the steam plant. Messrs. Winston & Company, of Chicago, were the contractors on the dam, canal and power house foundations.

The company has already contracted with the Richmond Locomotive Works, the Wm. R. Trigg Company, the Richmond Traction Company and the Richmond Electric Company to supply them with power. In addition, a large number of smaller consumers have made contracts for lights and power. The total load is now about 4,500 horse-power.

The Interdependence of Sanitary Works.

Extracts from remarks by J. James R. Croes, Pres. Am. Soc. C. E., at a recent sanitary conference at Albany.

There is a very important point in connection with the sanitary condition of towns and villages to which I wish to call your attention. It is the necessity for the contemporaneous perfecting of works for furnishing an increased supply of water and the works for the removal of so much of the water as is not absorbed or evaporated during its use. It has become polluted and defiled and unfit for use. To prevent its doing further injury to health it must be removed from proximity to dwellings, and it should be transformed by the removal of its deleterious compounds.

Wherever a supply of good and wholesome water is provided, the sewage or waste water must be taken care of at the same time. The necessity for a rigid enforcement of this rule increases every year and every day.

Twenty-one years ago, when I began the collection of the statistics of American Water-Works for "Engineering News," a work which has since been expanded into the valuable and comprehensive "Manual of Water-Works," there were less than fifty towns and villages in New York State which had a public water supply, and not half of these possessed any means of disposing of the waste water. To-day there are over five hundred public water supplies in the State, but it is believed that only a small proportion of the towns and villages supplied have any system of sewers. Where there is no sewerage system the public health is endangered, and it is the duty of all health officers to see that this evil is rectified as quickly as possible. It is not enough, moreover, that the wastes are removed. They must be purified as well, to prevent their doing further injury to other communities.

In this connection it is worth considering that an excessive and useless consumption of water imposes a double burden on the taxpayers, who have to defray the cost of not only furnishing the water in the first place, but also of disposing of the unused surplus. It is very well to say that "water should be free as air," but the doctrine is carried too far when a comparatively small proportion of the users of water are permitted to waste great quantities of it, which involves the expenditure of a very considerable sum for its final purification and disposal.

The majority of consumers do not, I am satisfied, waste water extravagantly, but there are always some who do waste it, and that not always wilfully or knowingly. I had occasion last year to look into this matter to some extent, while engaged on an investigation of the amount and causes of the waste of water in New York City for the Merchants' Association. I put meters on twenty-five residences of the better class and found that in eighteen of them water was being used with discretion, and that 350 gallons per house was the average consumption. The other seven houses used from 750 to 4,500 gallons each per day, and yet the occupants declared that they were very economical in their use of water. When, at my request, they had their plumbing examined, unsuspected leaks, generally in the ball cocks of water closets, were discovered, and the result was that in four houses which had been using 8,921 gallons per day the consumption was reduced to 2,207 gallons per day and nobody perceived the difference. Now if that 6,714 gallons a day which ran away into the sewers had had to be passed through purifying works, the cost of purification, which must be shared by all the twenty-five houses, would have been increased about 75 per cent. for each householder over what it would have been if those four houses had not wasted water unnecessarily.

It appears, therefore, to be essential to the public welfare, from both the sanitary and the financial point of view, that water waste should be prevented and sewage disposal carefully looked after.

Experiments on French Metal Bridges.

In 1897 to 1899 the Orleans Railway Company, in France, made a great number of experiments on its metal bridges in order to determine the actual behavior of a number of them which were condemned by the common methods of calculating their strength, but behaved quite well in actual service. M. Lanna, chief inspector of permanent way of the railway, reported the results of the investigations to the International Congress for Testing Materials of last year; the following is an abstract of his paper. The apparatus of M. Rabut, described in the "Annales des Ponts et Chaussees" of October, 1896, was used for all measurements of deformations. In general these experiments have proved that the structures investigated are stronger than they appear to be if calculated by the common methods.

Short spans.—If the rails are of the double-headed pattern the concentrated loads are distributed by the rail-chairs. A notable reduction of the greatest bending moment has been obtained by placing the chairs about one foot to each side of the center of the span for all spans up to 18 feet. For spans exceeding the latter length it is advantageous to put a chair at the center of the span.

To decrease the effect of impact the joints of the rails on short bridges have been suppressed. M. Rabut estimates that the introduction of continuous rails is equivalent to a reduction of the effect of the live load from more than a quarter at average speeds to more than a third at high speeds. The results of these experiments prove his conclusions.

Experience has shown that short-span girders are partially fixed at the abutments if the following conditions are fulfilled: (1) No rail joint on the span. (2) Longitudinal wooden tie of one piece in good condition and extending beyond the full length of the beam. (3) Long bearing base on the abutments; this important fact has been revealed by the stresses at the supports, the beam showing compression on the lower side. This affords a considerable reduction of the calculated stresses. Thus bridges of the above type on the line Tours-Mans have been found to be stressed to half of the calculated amounts.

Another cause of the reduction of the stresses from the calculated amounts is found in the relief afforded to the main trusses by the stringers when they are rigidly connected to them. On the line from Lexos to Toulouse, on a bridge of 16.5 feet span of the box section type, a stress of 5,000 pounds per square inch has been found in the lower flange of one of the stringers, while the lower flange of the nearest box girder showed a stress of 6,140 pounds per square inch for the same condition of loading.

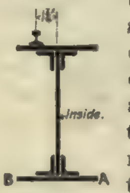
It was frequently found that points of a section located at the same distance and side of the neutral axis showed very considerable differences in stresses. This is sometimes due to faulty construction, which does not make the axis of the rail lie in the central plane of the web of the girder. A slight eccentricity of ⅜ to ¼ inch is sufficient to produce the above-mentioned result. M. Rabut has found that unequal bearings under the two flange angles of a girder produce a similar result. In the girders of the box type it has been found that the middle piece between the girders deflects and tends to draw in the latter by bringing their top flanges closer together. This results in an increased stress on the outside edge and a decreased stress on the inside edge of the top flange.

Longer spans.—Main Pony Trusses.—When the track is placed on the lower part of the trusses, there being no overhead bracing, it was always found that at the center of the truss the maximum bending moment produced different intensities of stress in both sides of the upper flange. The apparatus attached to the outside edge of the upper flange always registered a greater stress than the apparatus attached to the inside edge. This is easily explained. Under the action of the load the floorbeams deflect and cause a rotation of the trusses around the lower end inward, which tends to draw together the top flanges of the two trusses. If all the floorbeams were equally loaded the upper flange would uniformly move inward, and only the end vertical angles, which rest on the bearing plate and cannot well move, would oppose this motion. The upper flanges thus have a tendency to form a curve, which begins at the ends where the flanges are almost immovable, and increases toward the middle. It was found that the difference in intensity of stress in both edges is, generally, very considerable in old structures. The ratio of the two intensities may go down as low as 0.62. This proves well the value of very rigid end posts or angles in opposing such deformation in pony trusses. It has also been found that with the floor at the bottom flange of the truss the lower flange is stressed less than the upper flange. General Inspector Dupuy has explained this fact by assigning to the longitudinal stringers part of the stresses ordinarily assigned to the lower flanges of the main girder. From all this it appears that in pony trusses of a span not exceeding 125 feet, the greatest stress in the main trusses will be found in the outside edge of the upper flange near the center of the span.

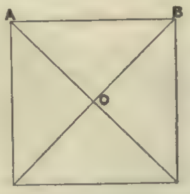
Through Trusses.—In through and deck trusses the upper chords of the main trusses do not deflect inward under a passing load, but in through trusses the lower chords receive less stress than the upper chords, as in the preceding case, for the floor system really constitutes an extension of the lower chord and carries some share of the stress. In the viaduct at Sully on the Loire, consisting of seven through spans of 197 feet each, the stress in the lower chord members under a load producing the greatest bending moment was found to be 8,065 pounds per square inch, while in the top chords it was found at the same section and under same load to be 9,900 pounds per square inch. This shows that in this case the floor system carried about 18 per cent. of the total live load.

Floor Beams and Stringers.—All the experiments demonstrated that the floorbeams were never held fixedly at their ends. Each time the measuring apparatus was applied to the ends of the lower flange of the floorbeam it registered an extension. Under the action of loads, the floorbeams are subjected to a torsion which is due to the deflection of the most loaded stringers. The above leads to the conclusion that floorbeams should always be figured as simple supported beams and their span be taken as the distance center to center of trusses.

Stringers are fixed at their ends only when the loads are symmetrical in the adjacent spans, as the floorbeams are then not subjected to torsion. But the rivets are then subjected to high stresses and they should be calculated with these stresses in mind. On the other hand, the elongation of the truss members is transmitted by the floorbeams to the stringers. The loose rivets which are frequently met in the connections of stringers to floorbeams, are due to this fact. If the rail is not set exactly central with the central plane of the stringers, considerable differences in the stresses in the two edges of a flange will be found, especially if the stringers offer little resistance to torsion. On the Creuse viaduct there was found, for an eccentricity of 1¾ inches, a tension of 13,500 pounds per square inch at A, and one of 4,270 pounds at B. M. Rabut remarks that this result testifies to the existence of horizontal moments in the lower flange of the stringer in a direction from B to A, which decrease the stresses in B and increase those in A. The eccentric axis of the rail has produced a torsion from left to right. These results show that the location of the rails on metal bridges should be a work of precision. For bridges containing curvature, where the eccentricity of the rail is unavoidable, the stringers should be rigidly braced. These inconveniences are avoided by the use of cross-ties.



Riveted Web Members.—The experiments have shown that the stresses due to the deformations of the web members are very complicated. First there is the tendency to elongate or to compress the bars; then bending moments are produced, due to the forces not coinciding in line of action with the neutral line of the members. Usually the bars AO and OB are connected at O. As the compressed bar bends a great deal more than the bar in tension, stresses are induced which tend to increase the bending of the tensile member, and to decrease the bending of the compressed member. Finally the bars of a triangle change their lengths. The bar OA elongates, the bar OB shortens, and since AB also shortens, the members OA and OB bend. The greatest stresses are found near the connections. The bending moments which are produced by the deformations of the bars may cause stresses in some fibers greatly in excess of the supposed average stress. Symmetrical members will reduce these stresses.



Wind Bracing.—Experiments made on the Puy-l-Eveque bridge and the Sully bridge have shown that the horizontal wind-bracing system takes a part of the main truss chord stresses, and that the greatest deformations of these members take place under the action of accidental overloadings. It will be advisable to calculate the wind-bracing system and its riveted connections with this effect in view. If the connections of the wind-bracing members often fail, this is doubtless due to the neglect of the above in designing the riveted connections.

The Effect of Cylinder Cooling on the power developed in high-speed internal combustion engines was investigated at some length by Prof. Hele Shaw at the University College of Liverpool. Experiments were performed on a 6-horsepower engine, with electric igniter, comparing the brake horse-power with the temperature rise in the cooling medium circulated through the cylinder jacket. A series of five trials was made, four with water and the fifth with glycerine, this to obtain a higher temperature than possible with water. With the following temperatures of entering cooling liquid, expressed in degrees Fahr., 66.2, 64.4, 64.4, 212 and 253.4, and the following corresponding temperatures of discharge from the cooling chamber, 77, 131, 212, 212 and 253.4, the brake horse-power was for the five cases in order, 4.77, 4.47, 3.97, 4.07 and 3.94, showing a falling off in delivered power from 4.77 to 3.94, or 17 per cent. A report of the tests was presented in a paper before the recent International Engineering Congress at Glasgow.

The Management of Septic Tanks and Bacterial Contact Beds.

Extracts from a paper read before the Royal Institute of Public Health by Gilbert J. Fowler, superintendent and chemist of the sewage disposal works at Manchester, England.

In speaking of bacterial methods, land treatment either by irrigation or downward intermittent filtration is, of course, included. In the majority of cases, however, especially in the large northern towns, suitable land is not to be had in sufficient quantity, and some method by which larger volumes of sewage can be dealt with per given area becomes a necessity. Even the strongest advocates of chemical precipitation do not claim that this method completely deals with the organic matter in solution. Some form of contact bed or continuous filter must therefore follow chemical treatment. It may now be said to be universally admitted that sewage can be purified practically and efficiently by bacteria beds, following chemical treatment.

There is, however, more question with regard to the possibility of purely bacterial methods, not involving the use of chemicals. Many originally doubtful matters may now, however, be taken as being beyond dispute. It has now been definitely proved: (1), That a thoroughly well purified effluent can be obtained day after day for years, without exception, by purely bacterial methods. (2), That trade refuse, with but few exceptions, exercises little or no influence on the purity of the effluent. (3), That a large proportion of the sludge can be dissolved or converted into gas.

The following observations are the result of experience with experimental plant and with septic tanks and bacteria beds on a working scale, and are put forward in the hope that they may be found of some use to others engaged in purification of sewage, and that they may provoke some criticisms of value to the author. It is not proposed here to deal exhaustively with the relative merits of septic treatment as against direct treatment of raw or settled sewage on bacteria beds, nor with the respective claims of contact beds and continuous filters. It may simply be remarked that in Manchester much higher nitrification can be obtained by the treatment of sewage in the septic tank, followed by contact beds, than by any of the other methods. In other places higher nitrification may be obtained by continuous filters than by contact beds.

The management of septic tanks.—The objects of careful management of septic tanks will be: (1), To dissolve or gasify as much sludge as possible. (2), To obtain a tank effluent in which the matters in solution are easily nitrified. (3), To produce a tank effluent with little suspended matter. (4), To avoid creating a nuisance.

Destruction of Sludge in Septic Tank.—It must always be remembered that no bacteria have yet been discovered which will consume mineral matter. In all cases, therefore, where road detritus is mixed with the sewage, ample catch-pit accommodation should be provided. Having provided grit chambers, it is necessary that they should be cleared out at frequent intervals, or they cease to be catch-pits. If the catch-pits are too small, all the grit will not be arrested; if too large, sludge, which might otherwise have been bacterialized, will be taken away with the grit. Besides grit, it is, in my view, well to screen out bits of wood, rags, etc., as such cellulose material is only very slowly attacked in the septic tank.

Having removed insoluble substances from the sewage, it will be possible to obtain a higher percentage destruction in the septic tank. It will be found, on starting a new septic tank (as in the case of a bacteria bed), that the action begins slowly, and gradually arrives at a maximum. It is important, therefore, that the ultimate flow should not be passed through the tank at first, lest sludge should rapidly accumulate before septic action is established. When one septic tank is fully at work, another may easily be started by pumping into it enough sludge from the first to just cover the bottom.

Production of Easily Nitrified Effluent from Septic Tank.—It must be emphasized, in dealing with this point, that by no means the least important function of the septic tank is to so change and break down the soluble constituents of the sewage that these are readily nitrified when put upon bacteria beds. Even if but little reduction in sludge took place, this action alone would justify the use of septic tanks. Much research is needed before the reactions which take place are thoroughly understood. The following bodies, which are probably products of the hydrolysis of albuminoids, have been detected, viz., amines, acetic and butyric acids, and mercaptans.

If the flow through the septic tank is suddenly increased during a time when the sewage is at full strength, fresh sewage may find its way on to the beds, and will fail to be purified; for it has been definitely established that beds which have become accustomed to septic sewage will not at once purify fresh sewage, and vice versa. Apparently unaccountable changes in the efficiency of bacteria beds may sometimes be traced to this cause. An increased flow of sewage, diluted by rain, may be safely put through, as in this case the proportion of organic matter per gallon will be less.

It is also quite possible, I believe, to work a septic tank too slowly, and produce a putrid effluent which is actually poisonous to the nitrifying organisms. Possibly some complaints of the nuisance arising from septic tanks may be due to this cause. The exact rate of flow to be adopted will depend on local conditions.

Reduction of Suspended Matter in Septic Tank Effluent.—The ultimate product of septic action upon sludge, besides the soluble substances above mentioned, and the gases methane, carbonic acid, hydrogen and nitrogen, is a very finely-divided suspended matter, partly of the nature of humus, partly mineral, e. g., finely-divided clay, or sulphide of iron (if salts are present in the sewage). This tends to pass away with the effluent and on to the bacteria beds. To avoid this result an attempt has been made in Manchester to remove the fine suspended matter by a special pipe communicating with the grit chamber. By such a device it is hoped that the two insoluble products, the grit on the one hand and the humus on the other, may be taken away together from time to time, without disturbing the action of the tank. The experiment has not been tried long enough to definitely decide as to its success, but so far there seems no reason why this arrangement should not effect the object in view.

Avoidance of Nuisance.—A good deal of apprehension has been expressed as to the possibility of nuisance arising from septic tanks, and it is certainly a matter for serious consideration. The residual sludge and grit, if removed as suggested, can be pressed and used for manure, or burnt. The silt alone is quite innocuous, and if tipped is rapidly converted into a dry, sandy heap. Covering the tank is not a real prevention of the nuisance, unless the gas evolved is collected and burnt. In Manchester, Leeds, Accrington and other places, however, there is singularly little odor, either from the open tank or from the sludge.

Management of contact beds.—The management of contact beds should be directed toward: (1), The production of a pure effluent. (2), The maintenance of capacity. (3), The minimum expenditure of labor.

Production of a Pure Effluent.—One of the chief factors in producing a good contact bed effluent or filtrate is the absence of great variation in the composition of the septic tank effluent. It will be more completely achieved if manufacturers can be induced to send down their refuse in a steady stream, and not in intermittent flushes. In most cases there is little difficulty in obtaining their co-operation to this end. It is often to their advantage that their trade refuse should be under careful supervision, as unsuspected sources of waste are often discovered by this means.

The thorough drainage of a bacteria bed is of the first importance in securing a good effluent. If the water cannot get out, the air cannot get in, and the lower parts of the bed rapidly become putrid and the nitrates decrease, perhaps are quite absent. It must be emphasized that when the nitrates decrease, and simultaneously there will always, as a rule, be an increase of nitrites, the bed must be rested.

With experience, a modification of the three minutes oxygen absorption test may be adopted as an index to the efficiency of the bed, which may be put in the hands of a workman to carry out. For a given sewage there is generally a pretty constant relation between the three minutes oxygen absorption test and the other determinations, ammonias, nitrates, etc. If an acid solution of permanganate of known strength is made up in the laboratory and given to the filter foreman, with a measuring glass, by mixing known quantities of the contact-bed effluent and the permanganate solution he can readily ascertain the character of the effluent by the rapidity with which the permanganate is discolorized.

Maintenance of Capacity.—It is quite possible for the effluent from the bed to continue excellent in composition although the bed may be falling off very much in capacity. Careful note must therefore always be made of the time of filling under identical conditions, if more accurate methods of measurement are not available; and if it begins to rapidly decrease, the bed must be rested.

The chief causes of less capacity are the following: (a), Settling together of the material. (b), Growth of organisms. (c), Impaired drainage. (d), Solid matter entering the bed. (e), Breaking down of material.

(a) Settling together of Material.—This must always occur, and largely accounts for the initial rapid decrease in capacity after the bed has been at work for a short time. It may, indeed, often be necessary to put an additional quantity of material upon the bed to maintain the surface at its original level.

(b) Growth of Organisms.—This is at once the cause of increased efficiency in the bed and of loss of capacity. On examining the material of a contact bed in active condition, every piece of it, clinker, coke, whatever it may be, will be found coated over with a slimy growth. If this is removed it is found to be a stiff jelly which, after a little drying, can be cut with a knife. Before examining under the microscope, it should be treated with dilute acid to remove as much as possible of any hydrated oxide of iron present. It is then seen to consist largely of masses of bacteria and zoogloea. If placed in a tube containing air, and connected with a manometer, the jelly will rapidly absorb all the oxygen with production of carbon dioxide. This action will sometimes produce a vacuum equal to several inches of mercury. This experiment shows that there is little need to force air into a bed. As a matter of fact there is always a large amount of oxygen to be found at the bottom of a bed in good condition, owing to the interchange of gases which naturally takes place. The behavior of the bacterial jelly appears to afford the clue to the successful working of bacteria beds. By working them at high speed, i. e., filling them frequently in the day without long periods of rest, the effluent may remain good, but the bacterial growth so rapidly increases that the bed becames too spongy and will not allow the water to drain away. Here, too, is the explanation of the fact that, within limits, decrease of capacity is accompanied by increase of efficiency. This decrease of capacity may, however, become so great as to more than outweigh the advantage of increased efficiency. A long period, say one or two weeks' rest, must then be given to the bed. The superfluous bacterial growths will, during this time, be rapidly consumed, and the capacity of the bed will greatly increase. Increase of capacity due to this cause is not a merely temporary phenomenon, produced by the drying of the bed. One of the Manchester experimental beds, for instance, sank in capacity during the winter of 1899-1900 to such a low point as 1,480 gallons (the capacity at the beginning of the experiment being 4,200 gallons). At the present time, after fifteen months have elapsed, during which the bed has been in regular use, its capacity under similar conditions of measurement is 2,000 gallons, and it has not yet reached its full summer capacity. This result has been brought about simply by judicious periods of rest. It has been found in the course of experiment that these should not exceed a fortnight at most, as the bed then tends to dry up, and the activity of the organisms diminishes.

These results cause me to think that the policy of pushing the working of the bed to its utmost extent and frequently washing the material, as recommended by Dr. Dunbar, of Hamburg, is not really satisfactory. By washing the material the bacterial jelly is removed, and will have to be reformed before the bed is completely efficient. The time spent in washing, if given to resting the bed, would probably produce a rise in capacity almost equal to that possessed by the bed after the initial period of slow working required for regaining efficiency.

(c) Impaired Drainage.—This matter has already been dealt with in speaking of the causes which tend to deteriorate the effluent. It cannot be too strongly emphasized that every care should be taken in designing the bed to make the drainage as efficient as possible. There should be no opportunity given for the finer particles of the material to work down and block the interstices of drain pipes, etc. The half-acre beds which are being constructed in the Manchester scheme are provided with radial channels, all converging to the exit penstock. The channels will be covered with perforated tiles or cement blocks, and over these will be placed at least a foot of large lumps of clinker.

(d) Solid Matter entering Bed.—The decrease of capacity owing to solid inorganic matter entering the bed is not necessarily great, inasmuch as this material, especially if of a sandy nature, has itself a water-holding capacity. Its character will depend on the locality, i. e., whether the district is gravelly or clayey, etc. In any case the dry capacity of the bed will not be greatly affected. The danger is that the interstices of the bed may be filled up with clayey mud, which in the wet state will hold up the water and so decrease the wet or working capacity. This loss of capacity will not be affected by resting, and therefore all such solid matter should be retained, as far as possible, on the surface of the bed, and removed from time to time. It will be found to constitute excellent soil, as it will contain nitrates and phosphates from the sewage, and cabbages and other vegetables will grow upon it.

(e) Breaking down of Material.—A more serious cause of loss of capacity than any of the foregoing is the disintegration of the material of the bed. This should be avoided at all costs by using only hard refractory material. When clinkers are used, as will probably be most commonly the case, such only as are hard and well fused should be put into the bed. All shale and ashes must be rejected. As a matter of fact, the ordinary weathering which an old cinder tip undergoes will generally have resulted in the disintegration of all but the harder portions. On screening, therefore, the fines will retain most of the softer material.

To summarize the foregoing: for the successful working of bacteria beds the following method of procedure will be calculated to give the best results:

The bed must be worked very slowly at first, in order to allow it to settle down and the bacterial growths to form. In this way there will be less danger of suspended matter finding its way into the body of the bed while the material is still loose and open.

The burden should not be increased till analysis reveals the presence of surplus oxygen, either dissolved, or in the form of nitrates, in the effluent.

Analyses of the air in the bed may usefully be made from time to time during resting periods.

Also the variations in the capacity should be carefully recorded. If the capacity is found to be rapidly decreasing a period of rest should be allowed.

Long periods of rest should be avoided during winter, as, when deprived of the heat of the sewage, the activity of the organisms decreases. If necessary, the burden of the bed should then be decreased by reducing the number of fillings per day, rather than by giving a long rest at one time.

The suspended matter may be retained on the surface by covering the latter with a layer of finer material not more than 3 inches in depth. This should not be raked into the bed, but when the amount of suspended matter retained becomes excessive, it should be scraped off. This suspended matter may be tipped and made use of for agricultural purposes.

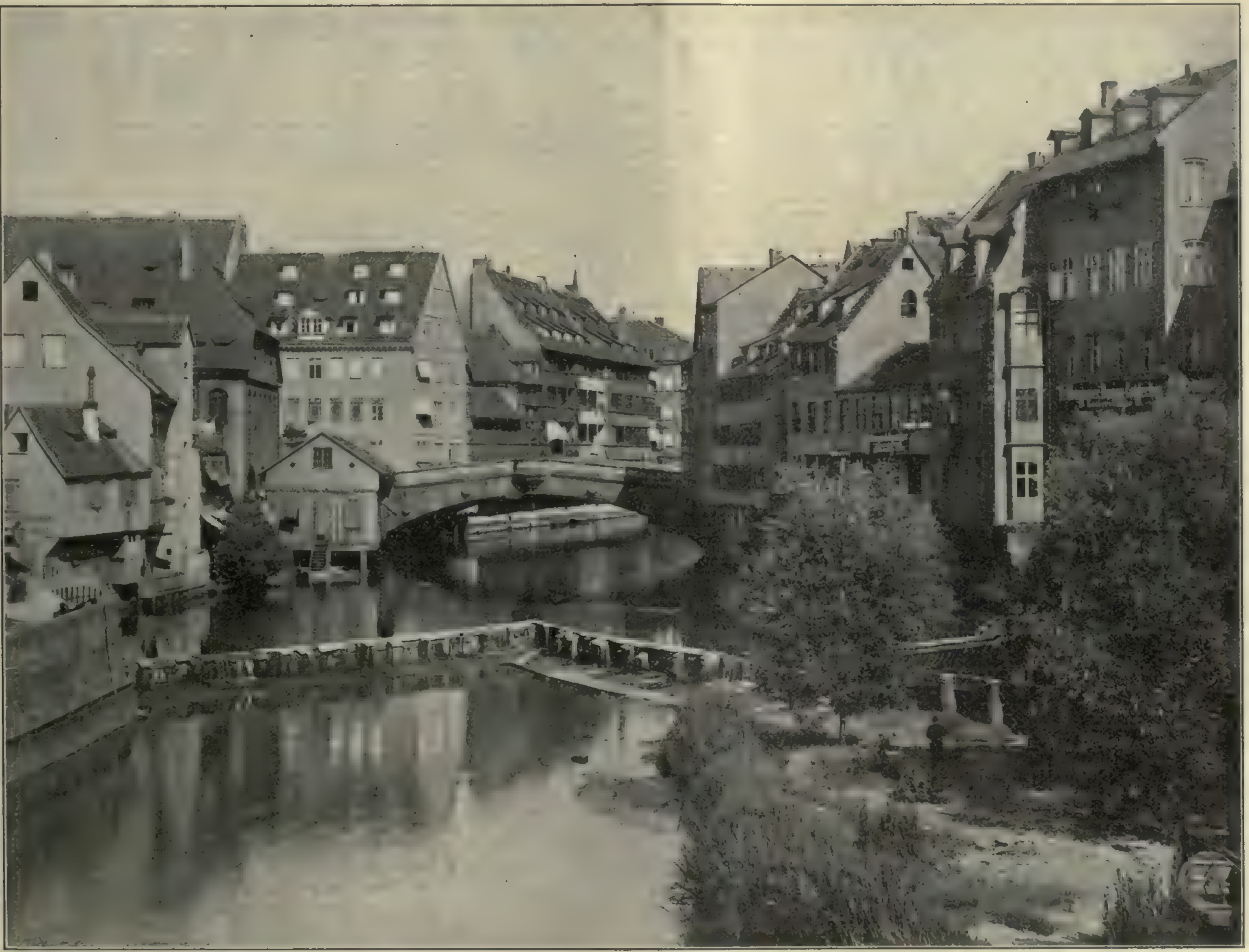
By placing the inlet and outlet penstocks as close together as possible, the suspended matters will tend to concentrate at this point, and their removal will be facilitated.

After many years it may, in spite of all precaution, be necessary to wash a portion, at any rate, of the material. It should not be difficult to devise a machine by which this may be easily and cheaply done, purified effluent water from a neighboring bed being used for the purpose. The mud so washed out will readily dry and may be also used for raising vegetables.

The Minimum Expenditure of Labor.—Unfortunately, data for the actual cost of maintenance of bacteria beds are still limited. Experience with experimental beds at Manchester and at Oldham, where several acres of beds have been at work for upward of three years, shows that it should be by no means excessive.

Facilities should always be provided in designing beds for the economical removal of material from the surface.

The evidence all points to the conclusion that, with careful management, founded on chemical and bacteriological knowledge, the sewage even of large manufacturing towns may be efficiently



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLI, NUREMBERG, FLEISCH BRIDGE.

A beautiful single span of comparatively small rise, but vigorous. The balcony treatment above the center of the arch is particularly happy. It was built in 1598 and is generally reported to have been modeled after the Rialto bridge in Venice which was completed in 1591.

and economically purified by bacterial methods. Thus we may look forward to a time when the unsightly cinder heaps of our manufacturing districts will be removed to find useful application in purifying the vast volume of their waste liquids. As a consequence, large open spaces will once more be set free, which may be utilized for the good of the community. Further, by careful removal of the surface of the beds from time to time the nitrates and phosphates may be largely recovered from the sewage and in a perfectly inoffensive form be returned for the service of agriculture.

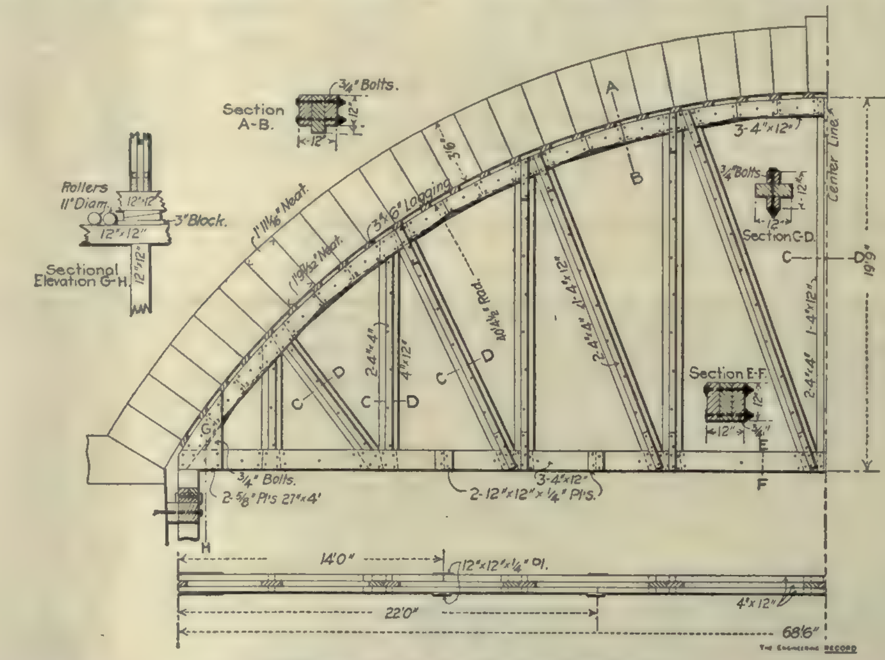
The Rockville Stone Arch Railway Bridge.

The four-track bridge of the Pennsylvania Railroad, across the Susquehanna River at Rockville, five miles above Harrisburg, is among the longest stone arch railway bridges in the world, and has a total length of about 3,820 feet, a minimum width of 52 feet over all, and a height of 51 feet from the low water level to coping. It has 48 70-foot segmental arch spans, which are built with cut-stone voussoirs, ashlar pier faces and spandrel walls, and concrete hearting and spandrel filling. It contains about 100,000 cubic yards of masonry of all sorts. The increase in volume of traffic and weight and dimensions of rolling stock and the improvements of the roadbed made it necessary to build this bridge to replace a double-track through-truss iron bridge of 23 120-foot spans, which was built in 1874 at nearly the same site.

The new bridge is mainly of interest on account of its magnitude and the methods and plant by which so much important work has been rapidly executed. The axis of the main part of the bridge is a straight line, making a small angle with the axis of the river, and intersecting the axis of the old bridge about 200 feet east of the east shore line, beyond which point the old structure diverges upstream from the new one about 450 feet in the width of the river. The spans are supported on 47 piers and two abutments, all founded on solid rock only about 5 feet in maximum depth below the low-water level. The bridge is divided into six sections of eight spans each, and at the ends of the sections the river piers are made extra heavy, with a transverse thickness of 19 feet at the springing line, so as to provide independent stability for the arches on both sides and arrest there the possible progressive collapse of successive arches if one should be destroyed and the intermediate piers should fail under the unbalanced thrusts.

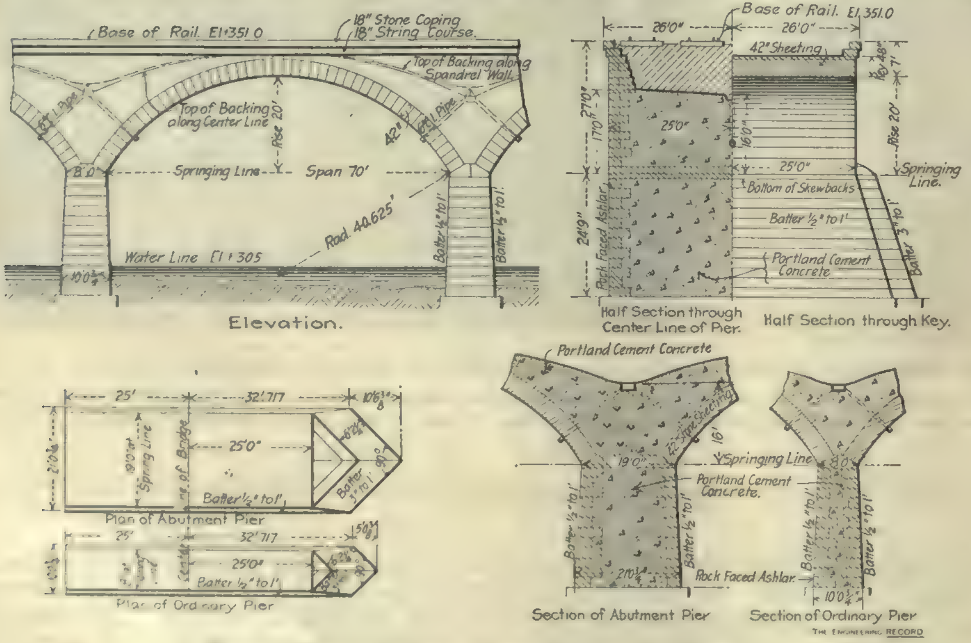
The north, or upstream face, of the bridge is a straight line from the east end to the forty-fourth pier, and the south face is parallel to it from the west end to the fourth pier. Beyond these respective piers the north face curves upstream at the west end, and the south face curves downstream at the east end, so as to increase the width of the bridge to about 100 feet at the abutments, a modification effected simply by curving the masonry of the divergent face, and cutting the ring stones to the required angles without changing the regular bond and coursing of the voussoirs. This feature is adopted to avoid a larger skew in the bridge axis and relieve the curves on which the tracks enter and leave the bridge, and at the east end allows two extra tracks to diverge from the main lines before they leave the bridge. The tracks are on a level grade across the whole length of the bridge, and are 7 feet above the intrados at the crown and 27 feet above the springing line. The springing line is at about the level of the great flood of 1889, and is 19 feet above ordinary spring water level, and about 23 feet above the average level of the rock bottom. At the east end of the bridge the tracks deflect downstream from the center of pier 4 on a 6-degree curve, and at the west end they deflect upstream from the center of pier 44 on a 5-degree curve.

The details and dimensions of the piers and spans are as shown in the accompanying elevation and sections. The intrados is a segmental curve of 40.625 feet radius, 70 feet clear span and 20 feet rise. The extrados is parallel to it with a radius 42 inches longer, thus giving a uniform depth to all the voussoirs except the key-stone, which is 48 inches deep. The 46



CENTERING EMPLOYED FOR THE ARCHES.

GENERAL VIEW OF THE ROCKVILLE MASONRY BRIDGE ON THE PENNSYLVANIA RAILROAD.



GENERAL DETAILS OF THE MASONRY ARCHES AND PIERS.

voussoirs are 1 foot 9 7/32 inches thick on the intrados and 1 foot 11 1/16 inches thick on the extrados; the keystone is about 3 inches thicker, and all radial joints are ¼ inch thick, giving total lengths of 84 feet 4 5/16 inches and 91 feet 7 7/16 inches to the intrados and extrados respectively. The skewbacks are about 4 feet wide, 9 inches high at the lower end edge, 2½ feet high at the upper edge and project 1 foot beyond the extrados. On the intermediate piers the skewbacks for the adjacent arches are in contact, and together form a coping course completely covering the top of the pier. The longitudinal spandrel walls and pier faces are of rock-faced ashlar sandstone from local quarries, laid in 2-foot courses. The centers of the piers and the spandrels up to 16 feet above springing line, are filled with Portland cement and limestone concrete which has a waterproofed upper surface dished to sumps over the pier centers, whence the drainage is discharged by cast-iron pipes carried through the soffits of the arches. On the concrete there is a cinder fill to subgrade, above which there is standard broken stone ballast. There is about 35,000 yards of concrete and an equal amount of cut stone arch-sheeting in the bridge, the remaining 30,000 yards being ashlar face masonry.

At the site the water is shallow and has a slow current over a comparatively smooth, regular rock bottom. Work was commenced on the foundations in April, 1900, and the contractors were fortunate in having a very dry season, so that the pier footings were built in water usually 3 feet or less in depth and were completed at the rate of six a week, the first being finished on May 20 and the last on July 31. Timber cofferdams were built on shore, floated to position, sunk and puddled with clay. They were emptied by steam pumps and the leakage was removed by steam syphons. The unsound surface rock was removed and the footings leveled up with concrete. Pumps and derricks were installed on flatboats, and materials were delivered on a service trestle alongside the bridge. All work was carried on simultaneously by two contractors who pursued similar methods, installing corresponding plants at opposite ends of the bridge.

Each arch was built in longitudinal halves, the first being completed to the axis of the bridge, after which the centering was moved transversely out from under it into place for the second half, which was built and bonded into the first, after which the spandrel walls and filling were completed at leisure. The centers were segmental trusses, made of solid squared timber with horizontal bottom chords, vertical posts and single inclined members, with panels from 6 to 8 feet long, as shown in the accompanying elevation. The top and bottom chords were each made of three 4 x 12-inch pieces, and the vertical and diagonal members were each made with one 4 x 12-inch center piece and two side pieces, so that the former could pack between the side pieces of the chords, to which it was securely bolted, while the ends of the side pieces were scabbed over the sides of the chords. At the ends of the trusses the top and bottom chords were connected by pairs of triangular ⅝-inch steel side plates 4 feet high. The trusses were set about 4 feet apart and were connected together in groups of seven, enough for the half arches, by 3 x 6-inch lagging strips about 21 inches apart on centers, which corresponded to the horizontal joints of the sheeting and supported the voussoirs at the edges only. The trusses were seated at each end on a single 12 x 12-inch transverse sill 50 feet long. Under each truss the sill had bearing on a parallel 50-foot cap with two white oak wedges and a 3-inch block. The cap formed the top of a two-story trestle bent with its bottom sill seated on the offset of the concrete footing close to the pier. The bent had thirteen 12 x 12-inch vertical posts and a middle horizontal timber, the posts being spaced so as to be in the planes of the trusses.

After one-half of the arch span was completed the wedges were slacked off and the sills lowered to bearing on 6-inch rollers, on which the trusses were moved transversely to the other side of the bridge in position to support the second half of the arch. When the span was completed the arch-center trusses were shifted to the next span by floating 15-ton boom-derricks on 30 x 50-feet scows which had been used for building the pier masonry. In each set of centers, besides the seven trusses under the sheeting, there was an eighth truss near the axis of the bridge to carry one rail of the traveler track, and each contractor had 84 trusses, so that work could be maintained on laying the sheeting of several arches at once. At each end of the bridge the masonry and materials were handled by three stiff-leg boom derricks traveling on a 20-foot gauge track having one rail supported just beyond the axis of the bridge and the other rail near the edge, both being carried between the piers by trestle-bents supported on the false-work trusses or on the finished arches. There was one material track at the outer edge of the bridge and none on the center line.

Each arch contains 2,350 feet of sheeting, which was laid in about five days. The mortar was mixed by hand on the bridge as used; concrete was mixed in a Cockburn square-drum power machine on each shore and, with the stone, was delivered by cars drawn by narrow-guage locomotives. The stone was quarried by the contractors, cut and stored in large quantities in yards at the ends of the bridge, where it was handled by ordinary steam derricks. About 300 men were employed at the bridge site by the Drake & Stratton Company and by Mr. H. S. Kerbaugh, both of Philadelphia, to whom the contracts for the east and west halves of the bridge, respectively, were awarded.

The plans were prepared in the engineering department of the Pennsylvania Railroad, Mr. Wm. H. Brown, chief engineer, by Mr. H. S. Righter. The construction was in charge of Mr. Righter and Mr. George Nauman, assistant engineers.

A Rolling Lift Bridge of the Scherzer Type was recently erected at Cleveland on the Big Four road without stopping railway traffic or the navigation of the river the structure spans. It was erected in an upright position on the piers which were to serve as permanent supports, the trains running through the new bridge during the construction. When it was finished, the old bridge was removed, the new one closed for service, and within 15 minutes five passenger trains had crossed on it.

The Cost of a Superheated Steam Plant was referred to as follows by Mr. R. Lenke in a paper on superheated steam, read before the International Engineering Congress at Glasgow: Steam engines with superheated steam, he said, use on an average 30 to 40 per cent. less steam than engines of the same type using saturated steam. Consequently boilers could be made 30 per cent. smaller, and the difference in price would nearly cover the cost of the superheater. For the same steam consumption the superheated steam engine was cheaper, as it could be worked with a lower boiler pressure; instead of a compound engine with saturated steam, a single-cylinder engine with superheated steam could be used. He called attention to the fact that superheated steam can travel at 30 to 40 per cent. higher speed through steam ports than saturated steam, which consequently means smaller steam pipes throughout.

Ethics of the Engineering Profession.

By Victor C. Alderson, Dean of Armour Institute of Technology. Reprinted from the Armour Institute of Technology Yearbook, 1901-2.

The work of the professional man, be he doctor, lawyer, clergyman or engineer, always bears some direct relation to well-defined fundamental principles. These principles may result from the experience of humanity, they may come from a priori reasoning, or they may rest upon combinations of these two. But no profession can be regarded as stable until it has such a body of well-established principles as will guide a member of the profession in determining the actual value of his work, will teach him that his calling is honorable to himself and valuable to the community, and will determine what line of action may elevate the profession and instill into him the lesson that he must do nothing to bring reproach upon his chosen profession. In a word, they give him ideals to struggle for, and to struggle for an ideal is the only method of gaining true and lasting satisfaction. Pure professional success, as distinguished from mere money getting, depends upon acting in harmony with these principles.

A trade may be distinguished from a profession in that it does not recognize the importance of these basal principles. Not that the man at the bench, the machine, or the loom does not need guiding principles in his work, but that they assume a distinctly subordinate place. The professional man must be a broader man, must have a wider grasp of relations, must have the ability to solve new complications, must be the leader and the thinker as well as the doer. The machinist may run his machine, but the mechanical engineer understands machinery. The electrician may close the circuit, but the electrical engineer understands polyphase machinery. The engine man may open the throttle, but the railway engineer understands railroading. The engineer, whatever his specialty may be, must base his practice upon the well-established laws of nature. If he belongs to the group of the successful rather than the unsuccessful engineers, he must have plain, practical sense, a scientific education, tact, business ability and a strong personality.

The principles which underlie the legal profession, no matter what the lawyer may regard as professional ethics in a particular case, are statutes and the common law—that is, crystallized human experience. These laws form the principles upon which he aims to decide between right and wrong, between justice and injustice, and his work, except in certain criminal cases where the facts of guilt alone are to be proved, consists largely in properly fitting each new case under some one of the numerous general cases. The two parties to a suit merely urge the application of different principles, and the ultimate reason for legal wrangles is that the fundamental principles, according to which judgment is formed, are of purely human origin; consequently, they are in a state of change, of evolution. For this reason the determination of right and wrong is difficult; the question is always debatable; the legal profession has no solid foundation on which to rest its basal principles. The witty retort of the lawyer makes my meaning clear. "That is not the law," said the judge, in answer to a claim set up by a lawyer. "It was, sir, until your Honor spoke," replied the lawyer.

At first thought the clergyman seems to have an advantage over the lawyer. To him, "Thus saith the Lord," in Scripture is as potent as the laws of the Lord in nature. However, he will admit that the element of faith must enter every religious creed, and that without faith his creed would not be religious. Rev. James Freeman Clarke would never have found the materials for his "Ten Great Religions" were this not true. But the quality and quantity of faith varies with peoples to such an extent that many religious sects, violently opposed to each other, have resulted. It is true, however, that their common ground is ethical or moral; that is, their unifying principle is based on human standards and, therefore, is debatable. Consequently, the profession does not have that unfailing criterion which we are seeking.

The medical profession has a more favorable position. The physician seeks to aid nature. He can do but little more, and he is ever trying to find out just how nature will work in the particular case under consideration. He deals with organic nature, and, while he may endeavor to be strictly scientific, the complications are so great that he cannot predict the result with certainty. So many variable elements affect his diagnosis that he has no exact criterion for judgment. He is very largely a mere observer of nature's workings. Like the lawyer and the minister, his standards of right and wrong are based, though in a less degree, upon shifting human experience and observation. In all these cases there seems to be lacking an incontrovertible, unfailing criterion by which the professional man's work can be judged.

In the case of the engineer the circumstances are quite different. The relation between the engineer on the one hand, and the laws of nature on the other, is unique, and differs from the relation that exists between any other professional man and nature. Unlike the geologist, who is limited in his observations to those favorable localities which nature has been kind enough to unfold for his inspection, or the biologist, who must stand merely as an observer of nature's acts, the engineer pins nature down and forces her to answer his question. It may be only a yes or a no, but it is an answer, and since he can vary his questions—that is, the conditions of his experiment—he can ultimately get the information he desires. He deals with the immutable, the unchanging laws of inorganic nature. He, alone of all professional men, has an unvarying criterion by which he may decide the right and the wrong, the correct and the false. He gets accurate data by which he may build his bridge, construct his dynamo, or lay out his railroad. Departure from these data means failure. Other professional men are subject to varying human laws and human notions, and so get along without ever having before them an absolute standard; but the engineer is forced to be in harmony with natural laws; his work must be absolutely truthful; his logic must be without flaw. Sophistry and ignorance are not for him. He must know, and know accurately; he must reason, and reason logically. If he does not know the stresses in his bridge, the endurance of his material, or the details of his dynamo, he cannot rank as an engineer. Nature, calm and dispassionate, is always on guard over him. No other man in the world, I believe, unless it is the chemist or physicist, is subject to such rigid and unceasing discipline; no man's errors are so glaringly brought to light as his. The lawyer can fall back on the plea that the judge was biased, or the jury packed; the doctor may, perchance, bury his mistakes; but the mistakes of the engineer may bury him. We accept his success as natural, because it is in harmony with nature's laws; his errors are glaring, because they are out of harmony with nature. All the world sees his failure. A mere tyro can recognize a poor roadbed, defective machinery or a dangerous bridge. The engineer has, then, for his ethics the most dignified and exalted standard; he has an absolute and unvarying criterion for truth and error; he has over him a judge who will decide with unerrring swiftness that his work is a failure if he violates the law. We have found, then, the ultimate lines of distinction between the engineering profession and other professions.

Recognizing, therefore, that the success of the engineer's work rests upon harmony with nature's laws, and that she is merciless in showing his weakness, that this is the most accurate standard of which we know, we can draw some deductions from these principles and see what effect such a standard has upon the profession as a whole, and upon the mind and character of the individuals. Who is the final arbiter of professional eminence? In the case of the lawyer, the doctor and the minister, reputation is made and success determined by the public at large —by clients who know, as a rule, little of real professional worth. Since the ultimate standards of judgment rest on human models, quackery is possible and all too common. In the case of medicine and law, legislation defines who shall practice, but the requirements are far too low. Legislation, however, recognizes no such profession as engineering, consequently the burden of maintaining professional standing rests solely upon the profession itself. Presumably, then, quackery should be more common; but the facts show that it is less common in engineering than elsewhere, for this reason —the final judgment of the success of the lawyer, the doctor or the minister rests with his clients, while in the case of the engineer judgment is rendered by his peers. In no other profession is this judgment so pronounced, in no other profession is quackery so quickly discovered and held up to criticism. As a result, the engineering profession is the best educated for its work of any of the professions. True, there may not be so many stars of the first magnitude in the engineering firmament, but more emit a strong, steady light, and very few show a false light. From the nature of his work the engineer does not have an opportunity to pose before the public; he cannot be the idol of the forum. His success or failure is determined by the judgment of a most competent board of critics—his professional associates.

The distinction which an engineer most covets, and which gives him unquestioned professional standing, is membership in the national engineering societies. This is obtained only after successful professional practice, and is granted by engineers themselves. No other profession demands so high a qualification for membership. In England, membership in the engineering societies takes the place of the engineering degree. In the matter of a professional degree, the engineering profession takes a lofty position. The mere fact that a man has acquired the degree of C. E., M. E., or E. E., counts for little with engineers; less than the M. D. with doctors or the LL. B. with lawyers. If obtained from a high-grade institution, it gives a presumption in favor of the holder, but in no case does it carry much weight. The engineering profession is chary of its favors and degrees; it holds that three qualifications are essential to an engineer—natural aptitude, proper technical training and successful experience. No young man, however great his ability or how thorough his training, is an engineer until he has had experience. High as these standards are, they are no higher than we should expect from a profession which has such fundamental tenets.

Every field of activity in the whole realm of nature may yield something of value to the engineer. His interests are world-wide. As man has climbed slowly up the rugged pathway we call civilization, he has needed more and more the services of the engineer. What was yesterday a theory becomes a demonstration to-day, and to-morrow we expect the engineer to apply it for our comfort or convenience. As agencies for civilization, engineering works have been given far too little prominence. True it is that Greece has left us a priceless heritage of art and Rome a code of laws; but in the wake of the Roman armies went the engineer, building bridges, roads and aqueducts, making civilization more advanced. To-day, thanks to our railway experts, the world is smaller than ever before, and is steadily growing smaller; for distance is no longer computed in miles, but in length of time in transit. Once New York and Liverpool were three months apart, now less than a week. With the aid of bridges like the St. Louis, the Brooklyn and the Forth; tunnels like the Mersey, the Sarnia and the St. Gothard; canals like the Manchester and the Suez; trains like the Limited and the Empire State Express, the engineer has done noble work for advancing civilization by making intercommunication easier and removing that ever-recurring obstacle —ignorance of other peoples. The influx of people to the large centers of population has brought forward new problems, not only of travel, but of pure water supply, disposal of sewage, public health, all of which the engineer is called upon to solve. Industrial history may be dry reading, because it does not fire the ardor with thrilling deeds on the field of battle. Some enthusiasm may be kindled over the success of Robert Fulton with his steam engine and Edison with his phonograph, but little or none over the success of John A. Roebling in building the Brooklyn Bridge, or the struggle of our civil engineers to make our present railway travel fast and safe. But to the engineering profession as a whole we must grant the credit for being the greatest practical civilizing agent we have.

From the principles underlying the profession only one conclusion can be drawn as to what are the professional ethics of the engineer. Whether the relation is with the employer, the client or the public, the ideals of the profession are high and well maintained. Men in other callings get wide experience, great learning and national reputations. Their opinions are sought after, and they frequently get into the dangerous condition of thinking that their opinions are of weight merely because they are their own opinions. The engineer, however, is daily and hourly trained by nature to know that his opinions are worthless unless they are carefully deduced from authentic data. Naturally, then, we get sounder and more mature judgment from engineers than from any other class of men; we find less conceit in them, and more straight thinking from accurate data to logical results. Like other professional men, the engineer has his clients, whose interests are his own. Honor and duty, therefore, are essential to his success, and become so much a part of his professional equipment that he does not talk about them. The reputable engineer takes for granted that he must love truth and truth only; that he must have a direct purpose; that he must be devoted to his work, and that he must be guided only by the loftiest standards of conduct. All this comes from the exacting requirements which nature puts upon him. Consider the responsibility attached to the engineering profession. In matters religious a man selects his own church, his own minister; in time of sickness he chooses the physician who shall attend him; should he be sued, he selects a lawyer to defend him; but if he rides on a railroad train, does he select the superintendent of motive power, by means of whose professional skill his journey is made in safety? Are the future users of the new East River Bridge, between New York and Brooklyn, consulted in the selection of the civil engineers who are to construct the bridge? The trust which the public has in the engineering profession places upon it a heavy obligation—greater than upon any other profession. For this reason the engineer does not rely upon superficial observations. It is a peculiar trait of human nature that the wish is father to the thought. If, then, observations prove to be as we wish them, we are not apt to be critical; but if they give undesired results, we examine them again with great care. The true engineer is as cautious with favorable as unfavorable data. If he is called upon to make a report, he should make it with the utmost frankness, even though it may displease a client. A proper regard for his own professional standing and the dignity of the profession at large demands that the engineer should hide nothing from his client; doubts as well as favorable facts alike should be submitted. Honesty and truth, then, follow as a natural consequence of his ideals. He need not make special effort to be truthful, for his work follows so closely upon the truths of nature that departure means failure. Every hour and every minute he is trained to truth and honesty. They form an ingredient of his daily tasks, and, unconsciously to him, influence his character. The unchangeable laws under which he works, and which he must rigorously apply, exert a constantly elevating influence upon him. His work is to control, or resist, or to guide the forces of nature. If his data are correct and his reasoning is sound, his finished work stands as permanent evidence of the fact; but if his data are incorrect or his reasoning is faulty, the merciless laws of nature will discover and lay bare to every observer his own incompetence. These very qualities of mind and character which caused him to choose the engineering profession, and which make his work a pleasure, combine to bring his entire work into harmony with the laws of the universe. If his mind and character are not thus attuned, if he is not guided by strict adherence to facts and logical deductions from them, and his ethics are not in harmony with right doing and clear thinking, then he is to that extent not skilled in the application of the forces of nature to the uses of man, and is not an engineer.

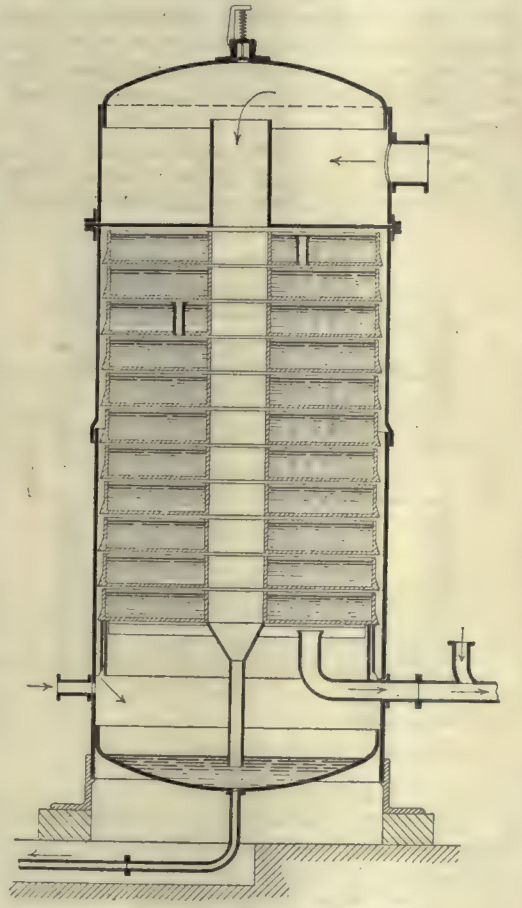
Extravagance is a fault of which no true engineer is guilty. One of the greatest claims the engineering profession has upon the respect of the public is that it works constantly and persistently to increase efficiency, to reduce cost, to convert what is harmful or useless into sources of wealth, and to avoid waste. Numerous are the examples which might be cited to maintain this assertion, but they are needless.

One other consideration which results from fundamental principles should be noticed, even though it is purely intellectual. The psychologist recognizes the faculty of constructive imagination, which is not merely the reproduction of images previously obtained, but the rearrangement of these in new forms, adapted to new purposes. This is the intellectual work of the engineer when he designs a new engine. His drawings are but the language by which he communicates his ideas to the workman; they embody the object in every detail which he has mentally formed by his power of constructive imagination. The man who does not possess this intellectual faculty can never be a successful engineer.

In conclusion, I am willing to grant, that in the minds of many laymen, engineering is not regarded as a profession, but as a refined trade or a business; yet I am confident, that if the advocate of engineering as a profession is given a fair hearing, he can easily prove his case. I have claimed that the effect of the engineer's work upon civilization has been very great—greater than most persons realize; but the claim must be made upon the reason rather than upon the feelings, and consequently is more slowly granted; but calm, dispassionate historians will place the credit where it justly belongs. The effect upon the mind and character of the individual engineer, due to the principles which underlie the profession, cannot be easily estimated; but I am confident that if the lives of our prominent engineers could be unfolded to the public gaze, they would show in abundance those qualities of honor, honesty, integrity and manliness which naturally follow from intimate association with nature's inexorable laws.

A Regenerative Accumulator for Exhaust Steam.

The accompanying drawing shows a vertical section through an apparatus intended to convert an intermittent supply of exhaust steam brought to it into a steady outflow of low-pressure steam taken from it. In other words, it is intended to supply low-pressure steam turbines, or other motors requiring a steady supply of steam, with exhaust steam from engines having an intermittent action, such as reversible engines of rolling mills or hoisting engines. Assuming that a winding engine uses about 100 pounds of steam per brake horse-power per hour, it is asserted that by the use of the apparatus in connection with a steam turbine coupled with a dynamo, two horse-power in electric energy are added for every horse-power in the winding engine. The apparatus was described in a paper presented to the International Engineering Congress at Glasgow by Mr. A. Rateau, of Paris, who calls it a regenerative accumulator.


A Regenerative Accumulator.

The difficulty which the accumulator solves is the following: The turbine requires to be supplied with a continuous flow of steam, whereas the engine working intermittently delivers it at more or less regular intervals of one or two minutes. A reservoir is therefore required between the two engines. An ordinary reservoir would have excessive dimensions, while with this apparatus this excessive size is avoided, and the erection cost is, it is said, relatively small. It serves the purpose of a reservoir. The solid and liquid materials which it contains form a storage in which the steam gathers and condenses when arriving in excess, and subsequently re-evaporates during the period when the main engine slackens or stops.

The variations in temperature necessitated by the condensation and re-evaporation of steam correspond to the small fluctuations of pressure in the accumulator. The pressure rises while the apparatus is filling, and falls while it is being emptied. The amplitude of these temperature and pressure oscillations is stated to be 5,4 to 9 degrees Fahrenheit, and 1.4 pounds to 2.1 pounds per square inch. This variation, it is said, can be limited to any desired range by designing the apparatus sufficiently large, in accordance with the periods of running and standing of the main engine.

The apparatus consists, as may be seen from the illustration, of cast-iron annular basins placed one above the other, inside a cylindrical vessel of sheet iron. The steam, which enters the vessel by the pipe near the top, reaches the basins by the central channel. The portion which is not condensed, as well as that which is re-evaporated, descends along the lateral partitions of the vessel, and reaches the pipe leading to the low-pressure machine. The water carried away by the steam separates out in the upper chamber, and falls, first through holes in the top plate, thence from basin to basin by the passage in the overflow to the bottom of the vessel, whence it is discharged by the small pipe and an automatic steam trap. The basins are always thus covered with water. The apparatus is completed with a safety valve and an automatic steam valve, for assisting the turbine by steam direct from the boilers.

Parallel Operation of Engine-Driven Alternators.

A paper read before the American Institute of Electrical Engineers by Mr. W. L. R. Emmet.

There has been, and is, much diversity of opinion and practice among engineers in relation to the operating of alternators in parallel from steam engines. This paper explains a method of overcoming the difficulties of such operation which has been in successful use for three years in many important installations.

The problem to which it relates is one of the greatest importance, and the solution described is, or is believed to be, complete and universal. It is for every reason desirable to the whole fraternity of electrical engineers that differences of opinion and of method in such a matter be removed or reconciled. I hope, therefore, that this paper, with the discussions which may follow it, will serve either to establish generally the use of the methods proposed, or to bring about the general acceptance of other or improved means for accomplishing the same result.

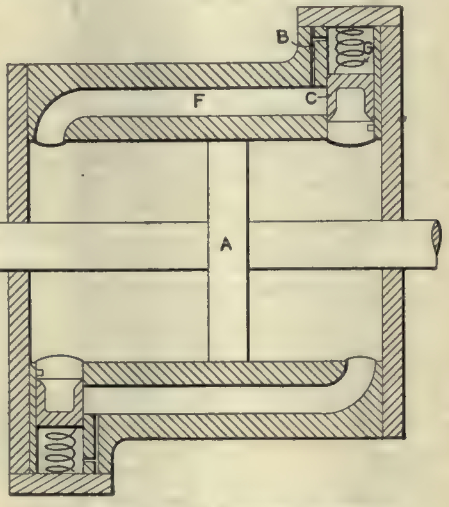
The problem of operating engine-driven alternators in parallel arose in Europe before it attracted attention in this country. Our early alternating experience was, for well-understood reasons, confined to small generators operated on separate circuits. The use of direct-coupled engine-driven alternators did not begin in this country until about 1893, and the cases of parallel operation were quite infrequent until three or four years later. During the years of '95, '96 and '97 I was concerned in the installation of a number of machines of this type, which were operated in parallel, but, for various reasons, none of the troubles characteristic to parallel operation of alternators occurred in these cases, so that up to the year 1898 I had not encountered the problem here discussed, and had done nothing toward its solution. In Europe the problem had arisen much earlier, and serious troubles had been encountered, which were described in the different electrical journals. These accounts of trouble, combined with our knowledge of phenomena of hunting in synchronous apparatus, led me to be apprehensive about the parallel operation of alternators under certain conditions, before the difficulty was actually encountered.

The first case of trouble which I encountered was in the fall of 1898, when two 800-kilowatt, 60-cycle alternators, operated at 100 revolutions per minute from McIntosh & Seymour engines, were put into operation in Cleveland. These machines, when thrown into parallel, immediately began to surge so violently as to render service impossible. About the same time we started two 1,000-kilowatt, 60-cycle machines of the same type in Philadelphia and four 1,500-kilowatt, 60-cycle machines at 120 revolutions per minute in Boston. In both cases the same trouble appeared that had occurred in Cleveland, except that it was worse in both of the latter cases, particularly in the case of Boston, where parallel operation was at first impossible under any condition of load.

I happened to be responsible for the engineering of these three plants, and found myself confronted with a very serious problem. I carefully considered the available European information which bore upon the subject, and found that two remedies for this trouble had been there applied. One of these remedies was described in an article by Mr. Gisbert Kapp, which came to my attention. This article explained that the period of oscillation in relative motion of parallel alternators was governed by two quantities, namely, the electrical synchronizing force and the weights of moving systems. Mr. Kapp explained that these quantities could be estimated and compared, and an arrangement could be adopted by which the natural period of oscillation between machines would not conform to the strokes of engine, or would be of such a frequency that trouble was unlikely to result. The other method of cure I found described by M. LeBlanc, who advocated the use of deadeners in the form of windings or attachments to the field structure, in which currents would be generated by the shiftings of flux, and which would so serve to consume energy and interpose an electrical friction, which must tend to kill the oscillations.

A careful consideration of both these remedies indicated to my mind that neither of them afforded an adequate solution of the difficulty with which we were confronted. Special design of dynamos to obtain certain synchronizing effects with certain loads was almost out of the question, since commercial dynamos should be adapted to operation under all conditions, so that the investment in them may not be lost when change of condition is brought about through growth or other circumstances. M. LeBlanc's method was also objectionable, since it introduced devices which must occupy valuable space and complicate the design of machines, and which must, under operating conditions, introduce more or less serious losses. It was furthermore reasoned that a simple deadener could not be complete in its effectiveness, since the deadening effect must increase in proportion to the oscillation, and must be very small where the angle of oscillation is slight. It therefore seemed that this disappearing quantity would probably limit the extent of oscillations, but could hardly be expected to entirely prevent them under all conditions. Our subsequent experience showed that both of these methods were sound in theory and practicable within certain limits, but also developed the fact that they could not be depended upon as a basis of commercial work under various conditions.

At the same time that these theories were being considered I started a set of investigations with a view to ascertaining the exact conditions which existed in engine and dynamo while these troubles were occurring. In conducting these investigations I reasoned that there must be a powerful actuating force employed in keeping these oscillations alive, since the waste of energy incident to their maintenance must necessarily be large, even where no pole-piece attachments or other form of deadeners are used. Theory clearly indicated that the oscillation was a pendulum action, whose period was governed by the weight and by the synchronizing power. I reasoned that this pendulum continued to swing in spite of a heavy friction, and I conducted my investigation with a view to ascertaining the actuating force. I presumed that this actuating force must come from the steam in the engine cylinders, and I had careful sets of indicator cards make, showing the impulses under successive strokes and in the different cylinders. The comparison of these indicator cards immediately showed that there was a large irregularity in the delivery of steam to engines, and that the differences of area in different cards or in cards which should be the same under fixed load were very great. It was further observed that these variations arose from periodic motions of the governor, and that they conformed in period with the swing of the machines, and with the fluctuations of electro-motive force and current.



Dash Pot for Steam Engine Governor.

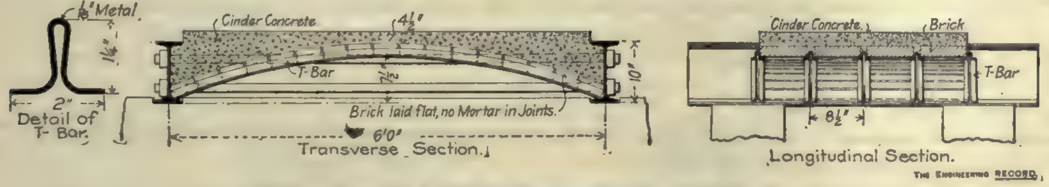
These facts, which were communicated to me by letter from Cleveland, led me to believe that the cure for the trouble must be sought in a prevention of a rapid periodic motion in the engine governors. I explained this in letters to the engine builders, suggesting to them that retarding dash-pots be used on their governors, which would prevent these sudden motions. The builders of the Cleveland engines in return replied that their governors were fitted with dash-pots, and that they were of the best anti-hunting type then known to the art. By such correspondence I soon discovered that the matter was entirely beyond the practical experience of the engine builders, and that we could hardly expect them to afford us a solution of the problem. I then went myself to Philadelphia, where the conditions for experiment were favorable, first communicating my theory in writing to the purchaser and to the engine builder as a matter of record. The governors of engines in Philadelphia were so arranged that dash-pots could be very readily attached to them which would limit the speed of their motion to any desired degree. Our first experiment was to block the governors positively and run with fixed load. Under this condition no sign of oscillation appeared. We then operated the engines under various conditions of load and excitation, with and without dash-pots having various degrees of stiffness. These investigations showed that the tendency to oscillation gradually disappeared as the freedom of the governor was limited by the dash-pot. Under certain conditions a small dash-pot effect would kill the oscillation altogether, while under other conditions a stiffer dash-pot would be found necessary. In every case, however, the dash-pot effected improvement, and the cure seemed to be simply a matter of degree. In this particular case it was found that satisfactory parallel operation under all conditions of service could be obtained with dash-pots which were not so stiff as to materially interfere with the quick action of the engines, and such a cure was adopted, so that the investigations were not carried further in this plant.

From my experience in Philadelphia, however, I reasoned that other cases would arise where such a cure could not be applied, since the dash-pots necessary to afford stability of parallel operation would be too stiff to admit of the proper quick governing of the engines. These anticipations were very soon realized in the operation of the machines above mentioned at Boston. In these machines the oscillating tendency was so strong that they could not keep in step at half load with dash-pots so stiff as to admit dangerous variations of speed with sudden load fluctuations. From this experience it was seen that we must find some means of deadening the motions of the governor occasioned by the oscillations, and at the same time we must leave the governor free to move where actual changes of load came upon the machine. A means of accomplishing this result was devised in Cleveland by the combined efforts of Mr. H. W. Buck, my assistant, and Mr. Harte Cook of the McIntosh & Seymour Company. The device (on which letters patent are pending) is indicated in the accompanying cut, which shows only one of many forms devised for accomplishing practically the same result. The main piston rod shown in this sketch is connected to the governor weights in such a manner as to be moved directly by them. The space on both sides of the piston and all the port spaces are filled with a heavy grease. By-passes, F, are provided, through which this grease can flow from one side of the piston to the other. Each of these by-passes is actuated by a small piston valve, C, backed by a spring, G, and provided with a small by-pass, B. The practical effect of this device is that the springs tend always to keep the gates of the main by-passes closed, and that the piston is thus virtually locked until the pressure at one end of it has forced the by-pass valve back. The first motion of the main piston is thus limited by the size of the small by-pass, B; whereas its later motion, after the valve has been forced back, is limited only by the size of the main by-pass, F. It will be readily seen that this dash-pot can be so adjusted that it will act as a temporary lock on the governor mechanism, and that it will release entirely after the tendency to govern has continued for a certain length of time.

Such dash-pots were first applied to the engines above mentioned, operated in the plant of the Boston Electric Light Company, and it was found that they afforded a positive and complete cure of the oscillating troubles which had been experienced there. By their use, with proper adjustment, the engines can be operated under all conditions of load, and with any number in parallel, without the slightest indication of the oscillating trouble which was at first so difficult to prevent. In this case the tendency to oscillation was much more positive than in any other which has come to my notice, and the perfect success of the remedy has led me to believe that the method is universally applicable, and that all similar troubles can be cured by its intelligent application.

In order that this form of dash-pot may properly accomplish its functions in the most difficult cases it must be made strong enough mechanically and hydrostatically to bear for a time the entire force imposed by the governor weights in their effort to assume a new position, and the period of such opposition must be such that the dash-pot will not unlock within the time of a single period of oscillation when the machines are operating in parallel. It is also necessary that the dash-pot be kept full of grease, so that there will be no lost motion through air spaces. If the dash-pot falls short in any of these particulars, the remedy which it affords will be only partial, and in difficult cases it may prove inadequate. It is only in certain difficult cases that we need use such complete preventives as were found necessary in Boston.

While discussing this subject, it may be profitable to briefly touch upon a few other facts which have developed in the course of my experience in the parallel operation of alternators. It is popularly supposed that it is necessary to use very heavy fly wheels in order that alternators may be successfully operated in parallel; it being the custom of some engineers to consider a guarantee of small angular variation as the equivalent to a guarantee for parallel operation. My experience has rather indicated that generators with light fly wheels are most easy to operate in parallel. The frequency of natural oscillations in such machines is high, and the conditions of engine operation are generally unfavorable to their development. Large fly wheels are desirable on direct-coupled alternators, because a steady frequency is a valuable feature in any system. The requirements of parallel operation, however, are rather unfavorable than otherwise to the use of heavy fly wheels.



Arrangement of a 6-Foot Segmental Arch for Testing.

The peculiar periodic action of an engine's governor which I have before described, is not confined entirely to the parallel operation of alternators, but also may occur and cause trouble where a single alternator is operating a load of synchronous apparatus. We may even have alternators which will operate together in parallel, but which will, through periodic action of the governors, give trouble with certain loads of synchronous apparatus. It is thus desirable in all cases to prevent this periodic action of the governors, and by this prevention many troublesome difficulties may be lessened or overcome.

The behavior of all parts of the system while this oscillating trouble occurred in parallel operation was very beautifully illustrated during our experiments at Philadelphia. The shafts of engines were in line, and the relative positions of poles could, at all times, be seen; the poles of one machine appearing to stand still when the machines were in perfect synchronism. The movements of the governor mechanism could also be seen by oscillations of a lever arm which was in the line of vision. Ammeters and voltmeters were also placed in the same line. It was possible at a glance to see the degree of angular displacement of the poles, the degree of motion of the governor, and the fluctuations of the current and voltage. An observation of these conditions showed very clearly the exact character of this phenomenon. It was found that under some conditions the oscillation was an extremely sensitive matter, and had very little power of sustaining itself. A slight change in the field strength of one of the machines would sometimes break it up so that it entirely disappeared, after which the machines might remain steady for some time and then gradually begin to swing again. Under other conditions it was more persistent. Everything indicated, however, that it could not exist for any appreciable period without the actuating force afforded by the irregularity of steam impulses.

Weight Tests of Rapp Floor Arches.

Late in the summer of this year the Board of Buildings of New York, of which Mr. James G. Wallace is president, conducted a series of weight tests of the Rapp system of flooring, of which the official results are given in the accompanying table. There were four of these arches in all, representing three different types of construction. The largest had a span of 12 feet, and the brick forming the filling between the special T bars extending from one end girder to the other, were laid on edge; this is termed the A type of arch. There were also two arches of 10 and 6 feet span, respectively, of the B type, in which the brick were laid flat. These three arches were all segmental, while the fourth, of D type, was flat. The T bars in the D type were laid on the bottom flanges of the end I-beams and carried a filling of brick, laid flat and covered with concrete up to the desired level for the floor.

The general arrangement of the test arches is shown in the accompanying sketch of the construction of the 6-foot type B span. The bars were held the right distance apart during the brick-laying by means of separator strips of light sheet metal, bent to fit over the upright webs of the tees. Mortar joints were used only in the 12-foot arch. In every case the concrete was mixed in the proportion of one part of Portland cement, two parts of sand and five of steam ashes.

The table gives the various pressures in pounds per square foot, with the deflections caused by them, and the final permanent set. The pressures were produced by loading the arches with pigs of iron.

Loads in Pounds per Square Foot and Deflections in Decimals of an Inch of Four Rapp Arches.

Load.	B type, 6-ft.	D type, 6-ft.	B type, 10-ft.	A type 12-ft.
150	.....	0.01	.....	.....
300	0.01	.....	0.055	0.03
600	0.015	0.015	0.095	0.06
750	0.015	0.02	0.105	0.10
900	0.015	0.06	0.14	0.14
1,200	0.04	0.135	0.21	0.175
1,500	0.055	0.205	0.305	0.23
3,000	0.165	.....	0.675	0.5
Full load lasted.	4 days.	3 days.	4 days.	4 days.
3,000	0.18	.....	0.73	0.525
1,500	0.175	0.225	0.65	0.21
1,200	0.16	0.22	0.595	0.195
900	0.155	0.215	0.555	0.15
750	0.15	0.205	0.52	0.125
600	0.143	0.19	0.5	0.115
300	0.115	.....	0.445	0.015
150	.....	0.11	.....	.....
No load ...	0.025	0.075	0.205	0.01
Permanent set	0.02	0.055	0.175	0.005

So far as could be seen the arches sustained no injury as the result of the loading. Mr. W. A. Ewing, engineer in charge of the tests for the Board, recommends allowing these types of arches to be used with loads up to the following amounts:

Span	6 feet	6 feet	10 feet	12 feet
Construction..	Segmental	Flat	Segmental	Segmental
Type	B	D	B	A
Max working load (lbs. per sq. ft.).......	300	150	300	300

Heating in a Large Group of Car Shops, Baltimore.

A fan system of heating for 8.7 acres of open-type buildings aggregating 12,822,700 cubic feet of space has been installed in what are known as the Carroll Park buildings of the United Railways & Electric Company, of Baltimore. The circulation of the air is effected by four fan-heater units, each employing fans with 13-foot blast wheels and heaters presenting in the aggregate 18,000 square feet of heating surface, the whole designed to secure a change of air every 25 minutes and maintain temperatures of 60 to 70 degrees Fahrenheit under all conditions of outside temperature. The circulation of steam is effected with the Holly system of gravity return, presenting a very interesting example of this method of water return; and 750 horse-power in water-tube boilers were installed for the heating plant. The duct system follows the usual construction of apparatus for this method of shop warming, consisting of overhead circular main ducts feeding short circular branches, reducing the mains in size as the branches are taken from them; the largest duct is 84 inches in diameter. Something over 60 tons of galvanized sheet iron were required for the manufacture of the ducts.

The United Railways & Electric Company, as stated in last week's issue, was formed by the consolidation of several street railway and lighting companies in Baltimore, and besides the erection of the shops which are the subject of the present article, contemplates bringing the production of all power under one roof, the boiler plant for this purpose being described in the issue mentioned. The buildings occupy two whole blocks, extending from Bush Street to Elk Street, and from Columbia Avenue to Carroll Street. They are divided into two groups, separated from each other by Gunpowder Street; each group consists of practically four buildings under the one roof. Each building is 92 feet wide and 479 feet long, with the exception of a mill and cabinet shop, which has the same width but is about 344 feet long. In the bed of Gunpowder Street, a transfer table has been erected for transferring cars from one shop to another.

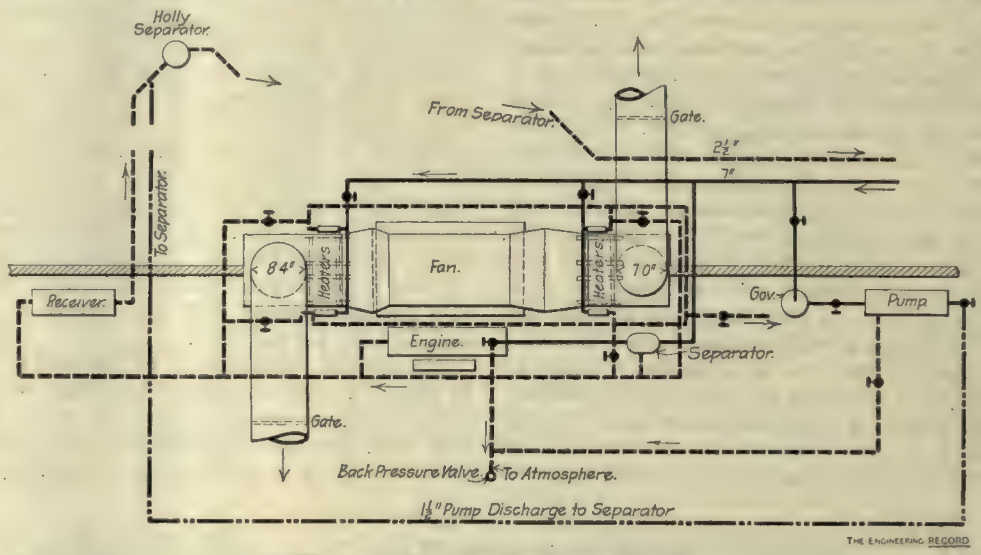
A plan of the shops is shown in an accompanying drawing. The main axes extend northeast and southwest. One group of buildings consists of a car barn, two paint shops and a varnishing room and store room, the varnishing room having the most northerly position of the whole plant. The other group, as shown, consists of a machine shop on one side and a mill and cabinet shop on the other side, and in between a motor-erecting shop and a car-erecting shop, these two practically open to each other throughout their length. Each building has the monitor type of roof, with the ridge about 60 feet above the general floor level and the bottom of the roof truss 24 feet above the floor. Where required there are pits 5 feet deep, from which the lower parts and trucks of the cars are reached.

The boiler plant is located in one corner of the machine shop building, and consists of water-tube boilers aggregating 750 horse-power in capacity and set in two units, as indicated. Steam is generated at a pressure of 80 pounds per square inch and is distributed at that pressure to the four fan-heater units which there are. The boilers feed into a header which supplies two steam mains, one for each group of buildings. That for the apparatus in the group in which the boilers are located starts 9 inches in diameter and crosses the buildings underneath the roof trusses, but over the trolleys, and feeds two 6-inch pipes which drop from the main and run below the floor near the wall of the pit toward the center of each pair of buildings. Each of the 6-inch pipes feeds the fan-heater unit, and besides these a 1½-inch high-pressure steam main is taken from the header to hot-water heaters for toilet fixtures in the far points of the erecting shops. The other steam main, which starts 10 inches in diameter, likewise crosses overhead and feeds two steam mains, each of which passes through a brick trench under the transfer table in Gunpowder Street. These mains are 7 inches in diameter, and at the end of their run through the trenches rise upward and are carried overhead of their respective fan units.

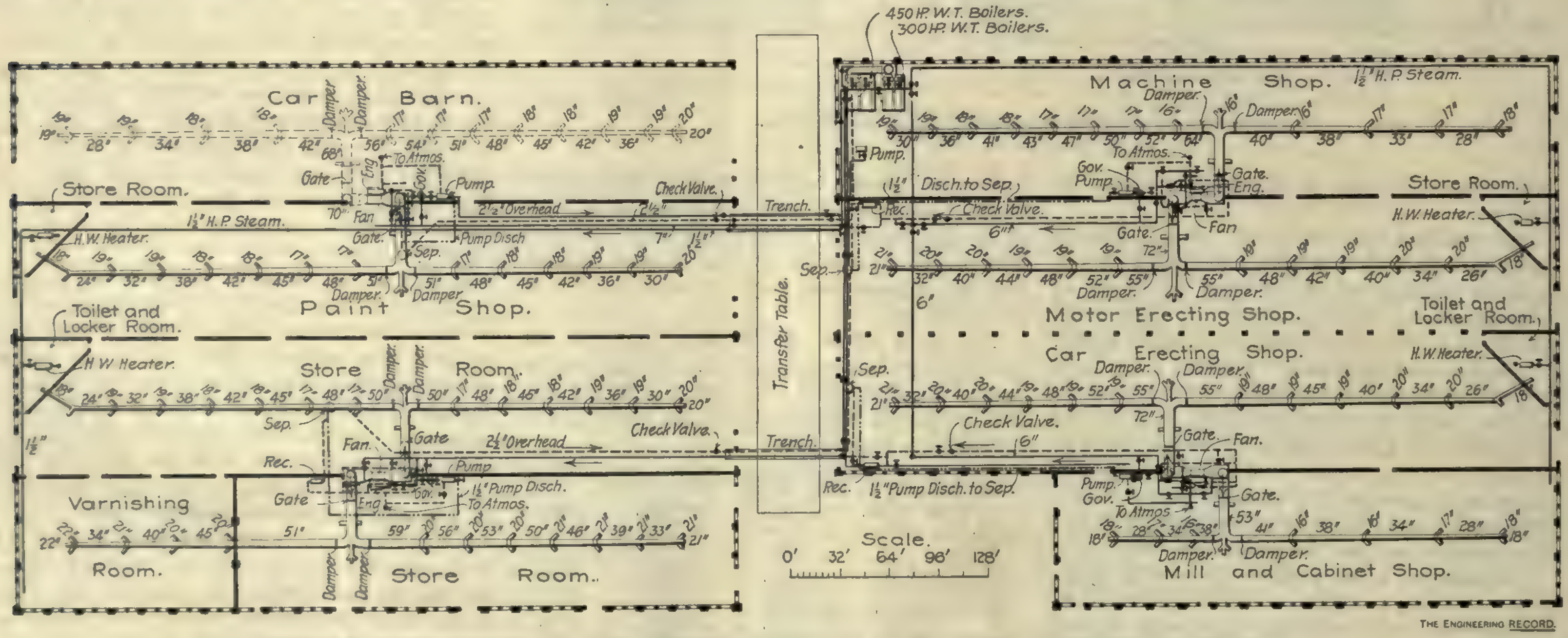
The steam main to each fan-heater unit supplies a steam engine by which the fan is directly driven, a header for each group of heater coils connected to the unit and a pump used to return water to the boilers. The heaters are, of course, divided into a number of sections, each independently supplied from the header with a valve on each connection. A separate header has also been provided to utilize exhaust steam from the fan engine, the exhaust pipe from this passing to an exhaust header for each heater, this header likewise supplying independent branches to the various sections of the heater. The exhaust steam is also allowed exit to the atmosphere through a pipe fitted with a back-pressure valve.

The blower in each unit is a three-quarter housing steel-plate fan with a double discharge, and was designed by the American Blower Company, of Detroit. The blast wheel in every unit is 13 feet in diameter and is arranged to be driven at a speed of 125 revolutions per minute from a 14 x 18-inch steam engine, the blower having a capacity at this speed of about 116,825 cubic feet of air per minute. A set of heating coils is located close to the blower in the discharge pipe from each outlet; each outlet is then connected by ducts to a single shop, two outlets from each of the four blowers thus providing for the eight buildings. Altogether there are 18,000 square feet of heating surface in the heaters, formed of 1-inch pipe in cast-iron bases, divided in proportion to the demands of the location of the apparatus. The whole unit rests on foundations of brick and cement, with I-beams for supporting the coils.

It is interesting to note that the units located in the buildings toward the north and west are supplied with 7-inch high-pressure steam pipes, while 6-inch mains suffice for the others. The water from the sections of the heater supplied with the high-pressure steam is drained, as indicated in an enlarged plan of the fan-heater unit, into a Holly receiver, one of these being provided for each unit, and the water being returned to the boilers by means of the Holly gravity system. The water from the coils receiving the exhaust steam is carried to a pump and governor by which it is automatically returned to the boiler plant. Any of the heater sections can be connected to either source of steam and the return mains from the return headers are valved in all cases close to the headers. The steam supply to each engine is provided with a separator, and the exhaust connection from each engine is fitted with an oil eliminator, the latter to prevent as much as possible any oil or grease getting into the boilers.



PLAN OF ONE OF THE FAN-HEATER UNITS.



CARROLL PARK PLANT OF THE UNITED RAILWAYS & ELECTRIC COMPANY, BALTIMORE.

Beyond each group of heating coils is located a hot-air chamber and the main heating duct for each shop is taken from the top of this. The fan unit is located at the partition between each pair of shops, and the duct from one hot-air chamber passes in the one direction for one of the buildings and that from the other chamber passes in the other direction for the other shop. The ducts are carried through the roof trusses, supported with tee-iron ring bands, which extend entirely around the ducts and are carried from the top by brackets and truss rods, making a neat and substantial hanger. The car barn is not at present warmed from the apparatus, but provision has been made to do so at any time, as indicated in dotted line.

The location and distribution of outlets from the ducts are shown in the plan of the plant. In general the larger openings are more distant from the fan, so that the volume of air may be more or less equably distributed, a larger area compensating for the reduced pressure at the extreme points. The area of outlets from the fans are also designed to suit the conditions of location, the combined area of the two outlets of the fan supplying the paint shop and store room being 65.2 square feet, while that of the outlets of the fan unit in the car barn is 55 square feet. On the basis of the capacity of the fans, taking into account that the air is expanded on warming, and of the total area of all outlets, the velocity of the air on issuing into the buildings varies from 1,050 to about 1,350 feet per minute. Roughly, the area of the outlets of the hot-air chambers is one-half that of the total area of shop outlets, so that the velocity in the main ducts on this basis ranges from 2,000 to 2,800 feet per minute. The latter figures are based on the system warming the cabinet shop, assuming the fan driven at the stated speed and discharging the accredited volume of air through the duct system there constructed.

Including the system for the car barn, there are, all told, 236 outlets, 59 of which are 19 inches in diameter, 56 18 inches in diameter, 42 20 inches in diameter and 38 17 inches in diameter; for the larger part these are spaced 25 to 30 feet apart. It has been arranged in both the erecting shop and in the mill and cabinet shop to create a positive circulation of air under the platforms, so that in winter time, when the cars enter the shop with considerable ice on the motors, they can be readily thawed out and quickly dried.

The work described was designed by Messrs. Crook, Horner & Company, of Baltimore, and erected by them in three months. The buildings were built from the plans of Messrs. Baldwin & Pennington, of Baltimore, under their supervision and that of Messrs. D. B. Banks and Joseph Wilkens, engineers of the United Railways & Electric Company.

LETTERS TO THE EDITOR.

Long-Column Formulas.

Sir: In your issue of the 18th May last, I find that you have a leading article on "Formulas for the Resistance of Long Columns." As it makes some reference to my own paper [Transactions Am. Soc. C. E., vol. xlv, p. 334.] on the subject of columns, perhaps you will allow me to make one or two remarks as to the impression which may have been given to your readers by your article.

In the first place, if I were a mathematician, I should be highly flattered by the opinion expressed as to the analytic value of my paper, but I am simply an engineer who is especially anxious to have a clear, common sense notion of the truth of things without being confined to the narrow paths of rigid mathematics of highly refined nature, and I fear that the character you have given my paper in a mathematical sense may prevent young engineers from reading it. The paper was written with the earnest desire that the mathematics should be of the simplest order, involving only simple algebra, and, as a matter of fact, any engineering student with a fair knowledge of common algebra can both read and understand it.

I heartily agree with your opinion that we must refer to the results of experiment, and that experimental evidence is of far greater importance than any purely analytic result, and if you will refer to my paper again you will find that by far the greater part of it consists of practical remarks and of a collection of a very large number of experimental results, all plotted on diagrams, just as you suggest, so that whether we make use of a formula or not we can see the actual results of experiment, and so that we can draw either a free-hand or a mathematical curve of safe loads at a respectful distance from the lower values of ultimate strength there shown. I believe this collection of results of tests is the most complete yet made.

I have a very keen remembrance of the amount of time and energy which I spent as a student endeavoring, often vainly, to understand highly analytic articles on the resistance of materials and structures, and I also remember the desire I had that I should read what was correct and most free from approximations of which the precise effects were not fully apparent. If any of your student readers have the same experience, and if they should doubt that results of sufficient analytic accuracy are possible by such simple means, let me assure them that the theoretical results given in my paper, while not involving any high mathematics, yet involve no errors of any practical importance whatever in an engineering sense.

The theoretical part of my paper I regard merely as an attempt at a simple exposition of the principles involved in the resistance of columns, and which ought not to be lost sight of in their practical design.

The convenience of the straight line formula is indubitable, but its empiricism is so absolute that we can never use it outside of the narrowest limits.

Empiric formulas, generally, are of great use to the engineer, but I hope the day is far distant when engineers will be satisfied with such substitutes for an intelligent rational understanding of the principles which explain the causes of failure and assist us in properly providing sufficient resistance in an economical manner.

Yours truly, J. M. Moncrieff,
Newcastle-upon-Tyne, Aug. 31.

The Apprenticeship System of the American Bridge Company.

Sir: I take pleasure in giving you information as to our apprenticeship system. The American Bridge Company employ apprentices who are graduates from grammar schools, manual training or high schools, preference being given a young man with a manual training or a high school education. The apprentice signs an agreement to serve four years, after he has had three months' trial. These three months are counted as part of the apprenticeship, if the young man is retained in the employ of the company, receiving the following rate of wages per week for his services: First year, $3.50 per week; second, $4.50; third, $5.50; fourth, $6.50. In addition to the above wages, a bonus of 50 cents for every week's service is paid to each apprentice at the expiration of the agreement, no bonus, however, being allowed to any apprentice who breaks his agreement, or who is discharged for cause.

For boys with high school, manual training or equally good school training, an allowance can be made in the agreement shortening the time of apprenticeship, if the engineer in charge thinks this proper after the three months' trial. As a special reward for extremely efficient service, the term of service of the last year may be reduced, but never by more than six months, at the discretion of the engineer.

About eight months out of every year a class is formed, and tutors are selected from the graduate engineers for the purpose of teaching the apprentice studies which a good draughtsman should know, such as algebra, logarithms, geometry, trigonometry, mechanics of materials, and the figuring of the stresses in simple structures if there is time. An examination is given the apprentice at the close of each school term, and an average obtained for the studies taken, a final examination being given at the close of the apprentice agreement, this examination being for the purpose of deciding the ability of the apprentice, by the average obtained.

The apprentice usually starts in the designing department, and extends quantities for estimates which are being made, and also traces the stress sheets for the structures designed. After six months are spent in this way he is transferred to the drawing room.

The object of employing young men as apprentices is to teach them to become efficient draughtsmen. In exceptional cases, they are given the opportunity of entering the designing department, for the purpose of becoming familiar with the designing and estimating of steel structures, but this is an exception rather than the rule.

Graduate engineers from colleges of good standing are employed by the American Bridge Company at the close of their college year as students for a period of six months, receiving for their services $12 per week. The student is placed in the drafting room for two or three years to become thoroughly familiar with shop practice and proper methods used, so as to give satisfactory results when he is designing important structures. The first two or three months in the drafting room are spent in tracing detailed work, after which time the student is given work to detail, gradually getting the more intricate work, to thoroughly acquaint him with all classes of building and bridge details. After a good experience is obtained in detailed work the student is transferred to the designing department, for the purpose of becoming familiar with the figuring of stresses in structures of all kinds.

Some persons have made the claim that the employing of apprentices lessens the chances for advancement of the college graduate engineers. This is an error, as from actual knowledge the student advances twice as rapidly as heretofore, for the reason that originally the student spent about six years in the drawing room before he was given the opportunity of applying his knowledge in the designing department, on account of there being no one to take his place as draughtsman except a former student. Now the student is advanced as rapidly as possible to become familiar with all classes of detailing, the apprentice acting as a tracer for the student until he becomes familiar with detailing, the apprentice taking the place of the student after he has been transferred to the designing department.

Yours truly, M. N. Shoemaker.
Pencoyd, Oct. 4.

Trade Publications.

The publishers of the pamphlets mentioned below will be glad to have The Engineering Record mentioned in applications from its readers for copies.

The Hayward Co., 97 Cedar St., New York, has issued a handsomely printed album of views of digging machinery, with brief explanatory notes and a general introduction on orange-peel and clam-shell buckets. The views illustrate land and floating dredges and plants for handling coal, limestone and similar materials, and cover such a wide range of subjects that most contractors will find the book of value.

Charles Winn & Co., Granville St., Birmingham, England, have published several large folders describing their automatic water gauges for boilers and their gauge glass protectors. The automatic valves shut off the gauge in case the glass breaks, while leaving the passages into the boiler free for cleaning at other times.

A 72-page well-illustrated book on belt conveyors has just been issued by the Robins Conveying Belt Co., 21 Park Row, New York. The construction of the belts, idle pulleys, grease cups and trippers for discharging the load on the belts is first explained, and then the elaborate description of installations is begun. The plants range over so many fields, power stations, mines, metallurgical and industrial establishments, large excavating contracts on land and water, gas works and many others, that the book has a wide field of utility.

The Plymouth wedge hole cutter is a special bit employed, with an Ingersoll-Sergeant drill designed for the purpose, to cut wedge-holes or sheers in quarrying operations. Wedges corresponding to the bits are then placed in the holes, which they fit so that their power is exerted well down below the surface of the stone, making it easier to sledge them than the usual wedges. A well-illustrated description of the tools, their use, and the experience with them during two years' tests in several quarries has been published by the Ingersoll-Sergeant Drill Co., 26 Cortlandt St., New York.

The Westinghouse Electric & Mfg. Co. has recently added two pamphlets to its valuable "Circulars." No. 1053 relates to the Westinghouse 69 railway motor for city and suburban service, which is described with the same thoroughness as earlier types in previous circulars, that is to say, the pamphlet is a concise monograph on railway motors. Circular No. 1054 describes the surface-contact electro-magnetic traction system, now in regular use in several places for both passenger and freight purposes.

The Lincoln power station of the Boston Elevated Ry. has been described in some detail in this journal, yet its readers particularly interested in power-house design will find in "Pamphlet No. 0111" just issued by the C. W. Hunt Co., Allen St., West New Brighton, N. Y., considerably more data on the elaborate coal-handling system installed there.

The General Electric Co., Schenectady, N. Y., has reprinted the paper on arc lighting at the beginning of the twentieth century, read before the National Electric Light Association last May by H. W. Hillman. It is a paper that everyone interested in electric lighting, but unable to follow its progress closely, should take time to read.

The Mason Regulator Co., 158 Summer St., Boston, has issued a 40-page revised catalogue of its steam specialties. These include regulating valves for steam, air and water, damper and elevator regulators, pump governors, reducing valves and allied products, and the Mason steam pump. The details of the construction and operation of the appliances are explained with unusual fulness.

The expanded metal system of concrete-steel construction is explained in an unusually handsome publication of the New York Expanded Metal Co., 256 Broadway, New York, and its associated companies. The book describes concrete-steel foundations, piers, sewers, bridges, subways, reservoirs, flumes, tunnels, conduits, vaults, storage bins, docks, floors, roofs and other structures, and should be owned by all users of concrete.

Personal and Obituary Notes.

Mr. Mark W. Roe has left the Foster Engineering Co., Newark, to become chief engineer of the Stirling Co., Barberton, O.

Major John Biddle, Corps of Engineers, U. S. A., has been formally installed as engineer commissioner of the District of Columbia.

Mr. W. E. Maloney, formerly assistant superintendent of the Worcester Consolidated Railroad, has been appointed superintendent of the Manchester, N. H., Street Railway.

Stephen Greene, the last partner in the firm of Lockwood, Greene & Co., mill architects, Boston, died at Newton on Wednesday. His reputation among mill owners was very high, and his firm designed many of the most important textile factories and establishments of that class recently built in the country. He had a business interest in several Southern mills and factory insurance companies, and was a trustee of several public institutions in Massachusetts.

James P. Kennedy, who died in Youngstown, Ohio, on Monday, was a notable example of a man who achieved much success in the iron industry while still young, although without any technical school training. He was born in 1861, and the death of his father from camp fever a few years later left his mother with resources which restricted the children's schooling to such subjects as the local institutions taught. After a few years in sewing machine and newspaper work, the son James entered the office of the Andrews Bros. Co., where he stayed six years as book-keeper, and then went to the Youngstown Bridge Co. This change was made in 1889. In the dozen years since that date he brought the plant and its business into considerable prominence, and only recently played a leading part in the organization of the American Bridge Co., of which he remained a director until his death.

The following candidates for admission to the different grades of membership in the American Society of Civil Engineers were announced elected November 6: Members—L. F. Bellinger, civil engineer, U. S. N., Brooklyn; E. B. Budge, Chilian State Railways, Valparaiso, Chile; N. B. K. Hoffman, Dept. of Sewers, Borough of Bronx, New York City; Alexander Maitland, Jr., American Bridge Co., Butte, Mont.; J. W. Seaver, Wellman-Seaver Engineering Co., Cleveland, O.; F. O. Sinclair, Burlington & Hinesburgh Railway Co., Burlington, Vt.; H. M. Sperry, Union Switch & Signal Co., New York City; J. H. Wallace, Temple Court Bldg., New York City; Charles Worthington, Pittsburg, Pa. Associate members—Alvin Gravelle, Wisconsin Bridge & Iron Co., Milwaukee, Wis.; W. A. Heindle, J. G. White & Co., Ltd., London, Eng.; R. E. Hunter, The Cuba Co., Santa Clara, Cuba; W. T. Lyle, engineer to James Seine, Newark, N. J.; F. D. Rhodes, J. B. & J. M. Cornell, New York City; T. M. Ripley, Ohio River Bridge & Ferry Co., Marietta, O.; Albert Rosenthal, Westchester Lighting Co., Mt. Vernon, N. Y.; W. McG. Wallace, Bureau of Construction & Repair, Navy Dept., Washington, D. C. Associate—C. E. Dewey, Watertown, N. Y. Juniors—L. S. Benton, New York City; E. D. Harshbarger, Pittsburg; A. E. Riedel, New York City; T. C. Strawn, Pittsburg.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

ONTRACTORS BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

LaGrange, Ill.—LaGrange Water, Light & Power Co. has been incorporated with a capital of $126,000 to operate water, light, heat and power plants. Incorporators: Allen G. Mills, J. H. Walter, Jr., and others.

Fayette, Miss.—Engr. in Charge C. H. Jenks, of St. Louis, Mo., writes all bids opened Oct. 28, for furnishing material and constructing a complete system of water-works have been rejected, and new bids will be received Dec. 2. Geo. V. D. Shober, Town Clk.

Pittsfield, Mass.—The contract for constructing the Ashley Lake dam is stated to have been awarded to Thos. Kearney, of Little Falls, N. Y., for $20,064. For bids received see The Engineering Record of Oct. 12.

Malta, Mont.—It is proposed to build a $50,000 dam across Milk River, 10 to 20 miles above Malta; also an irrigation ditch to Malta and Hinsdale. Wm. Wooldridge, of Hinsdale, Mont., Engr.

Springfield, Mo.—Local press reports state that a stand pipe 100 ft. high and 35 ft. in diameter, with a capacity of 720,000 gallons of water, will be built by the water company this winter.

St. Louis, Mo.—Local press reports state that extensions of the city water mains aggregating nearly 60 miles in length, will be made by the Water Department.

Ithaca, N. Y.—The Ithaca Light & Water Co. has been incorporated, with $400,000 capital. The directors are G. S. Sheppard, T. W. Summers and W. T. Morris, of Penn Yan.

Pagosa Springs, Colo.—The Town Board is considering propositions for the construction of water-works and electric lights.

Bloomville, O.—The citizens are said to be considering the advisability of laying a system of water pipe to secure fire protection.

Campbell, Cal.—The question of securing an adequate water supply is being considered by the Board of Trade.

Syracuse, N. Y.—Upon the recommendation of Superintendent Moffitt and the Water Department, the Board of Contract and Supply has authorized the extension of the water main system in numerous streets.

Guthrie, Okla. Ter.—The contract for the completion of 3 city wells at Island Park has been awarded to J. O. Severns, of Guthrie, for $11,500. The wells will be 40 ft. deep and 20 ft. in diameter, with 18-in. walls on stone foundations.

Yardley, Pa.—The Yardley Borough Water & Power Co. has been organized, with a capital of $10,000. Board of Directors: Chas. T. Eastburnn, E. E. Insinger, T. Sidney Cadwallader and others. It is stated that works are to be built at once.

Ogden, Utah.—Weber County farmers propose to construct a dam 120 ft. high to store 600,000,000 cu. ft. of water for irrigation purposes.

Salt Lake City, Utah.—The Board of Jordan River Canal Presidents, Angus M. Cannon, Pres. of the Board and also of the South Jordan Canal Co., has under consideration the proposition to construct a canal from the head of Weber River to Provo River, for the purpose of storing in Utah Lake the surplus water of Utah River.

Beverly, N. J.—The Delaware River Water Co. has been incorporated, with a capital of $200,000. Principal office, Beverly. Incorporators: Theo. Zurbrugg, Wm. M. Paul, Howard Parry and others.

Jamestown, N. Y.—Local press reports state that within a short time the city will either purchase the plant of the Jamestown Water Supply Co. or construct a complete new system.

Barre, Vt.—The City Council is considering the question of purchasing the Perry & Scribner spring water system, which is owned by W. A. Perry and C. M. Scribner, and offered to the city for $25,000.

Lawton, Okla. Ter.—The Lawton Water-Works Co., of Lawton, has been granted a charter for a term of 20 years, with a capital stock of $16,000. The directors are: W. F. Pierce, El Reno; M. A. Duff, Enid; H. G. Trosper, Oklahoma City, and others.

Oakland, Cal.—The residents of Linda Vista Terrace have formed the Linda Vista Water Association, with a view to installing a water plant, at a probable cost of $15,000, to supply this locality with water. John C. Hill, Moss and Oakland Aves., is said to be interested.

Mantua, O.—It is stated that bids are wanted Nov. 15 for furnishing material and constructing water-works, consisting of 17,000 ft. of pipe, 4½ tons of castings, 22 hydrants, a 500,000-gal. pump, etc. L. E. Chapin, Engr., Canton; R. M. Wheeler, Mayor.

Elgin, Ill.—R. R. Parkin, Supt. of the water-works, writes that it is proposed to sink a shaft 10 or 15 ft. in diameter, tunnel to wells and install plant to raise water from bottom of shaft. Estimated cost, $60,000. Bids will be wanted after Jan. 1, 1902.

Dover, N. J.—It is stated that bids are wanted Nov. 18 for $60,000 water bonds. H. S. Peters, Mayor.

Washington, D. C.—The Superintendent of the Water Dept. has recommended for award the bid of Allis-Chalmers Co., of Chicago, Ill., at $18,500, for building a complete water end for the pumping engine at the U St. station.

Westerly, R. I.—The contract for furnishing 1,300 tons of pipe to be used in the proposed extension to Watch Hill, has been awarded to the U. S. Cast Iron Pipe & Fdy. Co., of Philadelphia, Pa., at $22.80 per ton, subject to the making of a contract between the town and the proposed Watch Hill Fire district.

Harrisburg, Pa.—Bids are wanted Nov. 12 for laying a water main in 15th and North Sts. E. Mather, Pres. Bd. Commrs., Water & Lighting Dept.

Bement, Ill.—It is stated that bids are wanted by the Bement Electric Light & Power Co. until Dec. 1 for sinking an 8-in. tubular well. W. J. Day, Engr.

Atlanta, Ga.—The City Engineer is preparing profiles and estimates for the water-works reservoir, which is to have a capacity of 270,000,000 gallons.

Corydon, Ky.—Bonds to the amount of $15,000 are stated to have been voted for water-works.

Caldwell, Idaho.—It is stated that bids will be received in the early part of December for the construction of water-works, for which bonds to the amount of $20,000 were recently issued. W. J. Roberts, Engr., Pullman, Wash.

Wilmington, O.—Corporation Clk. Baker writes that bids are wanted Dec. 10 for water and light plants to be constructed on the franchise plan; bids are also wanted for the sale of the old light plant.

Los Angeles, Cal.—Local press reports state that bids will be received by the City Clerk until Nov. 18 for $2,000,000 water-works bonds. Bids will be received for a portion or for the entire issue.

Paulsboro, N. J.—The question of water-works is under consideration; applications for franchises have been made by a citizens' company and by outside capitalists, but a municipal system is advocated by some of the residents.

Colchester, Ill.—Press reports state that the C., B. & Q. R. R. Co. (F. C. Rice, Supt. Ill. Lines, Galesburg, Ill.) has determined upon building a system of water-works in Colchester for watering its engines running between Galesburg and Quincy.

Caldwell, Idaho.—Press reports state that the Pioneer Irrigation District has voted to issue $200,000 bonds for irrigating purposes.

Salinas, Cal.—Articles of incorporation have been filed by the Monterey County Water Co. The object is to acquire, rent, lease and sell land, construct and conduct flumes and waterways, and erect an electric lighting and power plant in this county if so disposed. Capital stock is $5,000,000. The principal place of business is San Francisco. Directors: J. D. Spreckels, W. H. Hannan, Thomas Brown and others, of San Francisco.

Cambridge, Ia.—This town is stated to have voted to establish a system of water-works.

Hendricks, Minn.—Village Recorder R. M. Burlingame writes that on Oct. 28 it was voted to issue $9,000 bonds for water-works.

Collins, Ia.—The Council is said to be considering the matter of constructing a water system.

Buffalo, N. Y.—Press reports state that the Depew & Lake Erie Water Co. is preparing to lay mains through South Park Ave. from the Terminal Ry. tracks in Hamburg to the Buffalo city line, and across the Ridge Road, easterly to the tracks of the B., R. & P. Ry., and westerly to the tracks of the Lake Shore Ry.; also on Southside Parkway, in the town of West Seneca; also a main line into the village of Gardenville and another line from Woodlawn Beach to the power-house of the Hamburg Ry. Co.

Millville, N. J.—The City Council has granted a franchise to the People's Water Co., headed by Col. Geo. Pfeiffer, of Camden, N. J.

Greensboro, N. C.—City Clk. John S. Michaux writes that it is proposed to make improvements to the water-works plant, estimated to cost $35,000, but that plans and surveys have not been completed. J. M. Bandy, Engr. in Charge. W. T. Lugeaut, Chmn. Water Com.

Cheyenne, Wyo.—Local press reports state that plans are being considered for the increase of the water supply by the construction of two reservoirs, at an estimated cost of $80,000.

El Paso, Tex.—The City Council has passed the ordinance granting to Arthur H. Squier, of Pittsburg, Pa., a 35-year franchise to construct a water-works system for El Paso. J. A. Escajeda, City Clk.

Florence, S. C.—The contract for furnishing plans and specifications for a water-works system is stated to have been let to Hite-Smith & Minshall, of Norfolk, Va.

Lemoore, Cal.—Bids are wanted Dec. 2 for the purchase of $22,000 water-works and electric light bonds. W. F. Holser, City Clk.

Kansas City, Mo.—George H. Benzenberg, Stephen A. Mitchell and John Donnelly, composing the commission which is examining the water system, have submitted a report to the Board of Public Works recommending the extension of the second 30-in. flow pipe from Kaw Point to a point near 12th and Genesee Sts., which improvement they consider the first essential towards an adequate water supply for Kansas City. Estimated cost, $31,000.

Beaverton, Mich.—The proposition to issue bonds for the construction of water-works carried at the recent election.

Columbus, O.—Local press reports state that the Board of Public Works has under consideration the question of purchasing about 10,000 water meters at a probable cost of $100,000.

Kissimmee, Fla.—The Council has appointed a committee to secure estimates for a water-works system.

Savannah, Ga.—The contract for the installation of an air lift plant at the water-works is stated to have been awarded to the Pneumatic Engineering Co. of New York, for $21,130.

Southington, Conn.—At the recent election a vote was taken in favor of municipal ownership of the water-works.

New York, N. Y.—The following bids were opened Nov. 7 by the Dept. of Water Supply for furnishing, delivering and laying water mains from stand-pipe at new high service pumping station to Jerome Ave., in Jerome and Mosholu Aves., in 233d St. and in Kingsbridge Road:

Items and Quantities.	W. E. Welch.	Jno. J. McQuade.	F. Thilemann, Jr.	Cunningham & Kearns.	Norton & Dalton.	Chas. W. Collins.	F. V. Smith Contg. Co.	Jno. Cornwell, Jr.	J. S. Rogers.
Straight pipe, 4,200 tons	$25.50	$25.00	$24.00	$25.00	$23.00	$24.00	$24.50	$20.00	$23.75
Special castings, 60 tons	50.00	50.00	60.00	52 00	52.00	53.50	60.00	60.00	51.00
Rock excavation, 4,500 cu. yds	.40	1.50	2.50	2.00	3.00	.50	2.50	.01	.30
Earth excavation, 32,500 cu. yds	.40	.40	.40	.35	.30	.50	.40	.01	.30
Filling, 30,000 cu. yds	.40	.30	.25	.15	.30	.50	.10	.01	.30
Pipe laying:									
48-in., 100 lin. ft	1.50	1.10	1.30	1.40	2.00	1.50	2.00	2.60	2.00
36-in., 12,700 lin. ft	70	1.00	.95	1.00	.80	.90	.90	2.60	.90
20-in. (2,750 ft. relay), 16,500 lin. ft	.50	.60	.60	.50	.50	.50	.60	1.60	.60
12-in., 1,000 lin. ft	.25	.40	.40	.35	.25	.40	.40	.30	.30
6-in., 1,200 lin. ft	.15	.30	.25	.30	.18	.35	.20	.15	.30
*Stop cocks, etc	8,730.00	7.065	10,216	9,183	7,764	8,493	10,205	9,400	8,955
Blow-offs, to set, 10	15.00	30.00	20.00	15.00	20.00	10.00	10.00	15.00	15.00
†Boxing for pipe	660.00	90.00	1,075	640.00	520.00	360.00	800.00	1,000	695.00
Macadam pavement relay, 14,500 sq. yds	.01	.20	.75	.70	.50	.01	.50	.01	.50
Curb, reset, 500 lin. ft	.01	.20	.05	.10	.10	.10	.10	.01	.10
Brick masonry, 180 cu. yds	10.00	12.00	12.50	9.00	10.00	9.00	10.00	15.00	12.00
Concrete masonry, 10 cu. yds	10.00	3.00	5.00	5.00	5.00	7.00	4.00	8.00	2.00

*Includes 1 48-in., 4 36-in., 8 20-in., 16 12-in., and 27 6-in. stop cocks and 23 hydrants.

†Includes 70 ft. of boxing for 36-in. pipe and 20 ft. boxing for 20-in. pipe.

SEWERAGE AND SEWAGE DISPOSAL.

Providence, R. I.—Bids are wanted Nov. 18 for constructing a sewer in tunnel in Section 27, Moshassuck Division, as advertised in The Engineering Record.

New London, Conn.—The Board of Sewer Commissioners has voted to construct sewers in Rogers, Bradley and Cutler Sts., and in Connecticut Ave.

Ashland, O.—Mayor Wm. G. Heltman writes that at the election held Oct. 28 it was voted to issue $60,000 bonds for the construction of a sewerage system and a sewage disposal plant.

Lake Forest, Ill.—The contract for constructing a brick sewage tank 80 ft. square and 40 ft. high has been awarded to Alvord & Shields, of Chicago, for $8,000.

Newberry, S. C.—City Secy. W. S. Langford writes that C. C. Beddoes, of Newberry, has been selected to prepare plans and specifications and supervise the construction of a sewer system, for which bonds to the amount of $25,000 have been sold.

St. Louis, Mo.—Sewer Commissioner Herrmann has stated that as a result of the passage of charter amendments his department will construct 75½ miles of sewers, at an estimated cost of $2,200,000.

Canon City, Colo.—City Engr. L. C. Hall writes that all bids opened Oct. 21 for the construction of a system of sewers were rejected, and new bids will be received Nov. 11. There will be 13.4 miles of 6 to 24-in. pipe sewers, average depth 9.3 ft. Ed. Minor, City Clk.

Moline, Ill.—Local press reports state that General Manager Potter, of the D., R. I. & N. W., has definitely decided that his road must build the remainder of the city sewer in the tailrace, and ¼ mile of 7-ft. sectional tile sewer will be laid at an approximate cost of $30,000.

Middletown, Conn.—It is stated that bids are wanted Nov. 19 for $53,000 sewer bonds. Jas. P. Store, City Treas.

Birmingham, Ala.—Local press reports state that the survey of the routes for the Jefferson County sanitary sewerage system is about completed and contracts will probably be let soon.

Jacksonville, Ill.—It is stated that bids are wanted by the Board of Local Improvements until Nov. 11 for constructing pipe sewers in 2 streets.

San Francisco, Cal.—The Board of Supervisors has passed a bill ordering the extension of Sunset main sewer, approving and adopting plans and specifications, and authorizing the expenditure of $40,000 for said work.

Indiana, Pa.—Boro. Solicitor D. B. Taylor writes that at the recent election it was voted to construct 2 main sewers and a disposal plant, at a probable cost of $25,000.

Canonsburg, Pa.—Town Clk. W. J. Gowern writes that it was voted on Nov. 5 to issue $40,000 bonds for a sewerage system.

Ft. Dodge, Ia.—Bids will be received by the City Council until Nov. 11 for constructing a 12-in. pipe storm water sewer along First Ave., North. D. [illegible] Weller, City Clk.

Chicago, Ill.—The Board of Local Improvements has ordered plans prepared and an ordinance drawn for the 59th St. sewer system. Estimated cost of work, $665,000. Local press reports state that 14 miles of pipe will be required to complete the system, which will lead to the mouth of the Calumet River, where the pipe will be 10 ft. in diameter.

St. Joseph, Mo.—The contract for constructing over 300 ft. of Blacksnake sewer extension has been let to Patrick Morley for $19.85 a lin. ft. The sewer is to be built as far as the $6,000 appropriated for the work will permit.

Manistee, Mich.—City Engr. E. W. Muenscher writes that in the spring the city will commence the construction of a trunk sewer on the north side of the city. Work to be done by day labor.

Canton, O.—Bids are wanted at the office of the City Clerk, until Nov. 23, for 8 and 12-in. sewer pipe, average cut 12 ft. Estimated cost, $2,800. Philip H. Weber, City Engr.

Gueydan, La.—The Gueydan drainage district has been authorized by the vote of a recent election to issue $50,000 bonds, and it is stated that an engineer is to be engaged at once to make surveys.

Pomona, Cal.—City Clk. Arza Crabb writes that the contract for constructing sewers in District No. 1 has been awarded to Mr. Hostetter, of Los Angeles, for $14,000. Contracts will be awarded in a few weeks for the construction of 2d District sewers. W. H. Sanders, Engr.

Pasadena, Cal.—City Engr. T. D. Allin writes that bids will be wanted about Dec. 1 for the construction of sewers in the southwestern part of the city, in all 3.12 miles of 8, 10 and 12-in. salt-glazed vitrified pipe. Estimated cost, $14,000.

Duluth, Minn.—Bids are wanted Nov. 11 for constructing sanitary sewers in 3 streets. R. Murchison, Clk. Bd. Pub. Wks.

Binghamton, N. Y.—Bids are wanted Nov. 29 for constructing a sewer in Irving Ave. I. C. Hull, City Clk.

Glenville, O.—Bids are wanted Nov. 29 (change of date) for constructing a storm water sewer, with catch-basins, manholes and other appurtenances, in a portion of Eddy Road; also for constructing a sanitary sewer with flush-tanks, manholes and other appurtenances in a portion of Park St. Ira C. Farley, Village Clk.

Swissvale, Pa.—Bids are wanted Nov. 11 for constructing 2,571 ft. of sewers in several streets. C. B. Judd, Boro. Engr., Park Bldg., Pittsburg.

Pittsburg, Pa.—Bids are wanted Nov. 15 for constructing 9, 15, 18, 20, 24 and 30-in. pipe sewers and 2, 3 and 4-ft. brick sewers in portions of several streets. Edw. M. Bigelow, Dir. Dept. of Pub. Wks.

Salina, Kan.—Local press reports state that the City Council will receive bids for 3,261 ft. of 18, 21 and 24-in. sewer.

Sharon, Pa.—The proposition to issue $40,000 bonds to complete the sewer system is stated to have carried at the recent election.

South Bethlehem, Pa.—The Boro. Secy., Thos. Ganey, writes that on Nov. 5 it was voted to issue $100,000 sewerage bonds.

Georgetown, Ky.—A vote will be taken on the proposition to construct a sewer system, at a cost of $25,000.

West Hoboken, N. J.—The contract for building Kerrigan Ave. sewer has been awarded to Thos. O'Neill, of Jersey City, for $22,563.

Long Island City (L. I.), N. Y.—The following bids were opened Oct. 23 by Jas. Kane, Commr. of Sewers, New York City, for the construction of a sewer in Broadway, Boro. of Queens, and a disposal plant in connection with same: Bidders—A, W. E. Welch, 665 Lexington Ave., N. Y., $183,700; B, T. G. Carlin, 26 Court St., Brooklyn, $203,185; C, Norton & Kirk, 215 W. 125th St., N. Y., $244,030; D, DeWitt C. Bouker, Jr., 21 State St., N. Y., $187,350; E, Charles Hart, 118 Prospect Park W., Brooklyn, $181,850 (recommended for award):

Items and Quantities.	A	B	C	D	E
7′ x 5′ 1⅜″, 1,550 ft	$16.50	$13.65	$18.09	$14.00	$13.50
7′ x 4′ 6″, 1,220 ft	11.00	12.19	14.73	11.00	11.50
6′ x 4′ 2¾″, 1,080 ft	10.75	11.60	14.55	11.00	11.50
5′ x 3′ 4″, 450 ft	10.00	10.61	11.33	8.00	9.00
4-ft. circular, 1,500 ft.	7.30	7.68	10.17	8.00	8.00
3-ft. circular, 1,650 ft.	5.80	6.05	8.23	5.00	6.00
18-in. pipe, 1,500 ft	2.70	2.65	4.64	3.00	2.75
15-in. pipe, 1,500 ft	3.00	4.75	4.74	2.00	3.00
12-in. pipe, 1,000 ft	1.75	1.20	3.04	2.00	1.70
10-in. pipe, 750 ft	1.50	1.15	2.95	1.00	1.40
Manholes, 65	50.00	36.75	50.00	50.00	70.00
Lumber, 40 M. ft	30.00	25.00	25.00	30.00	25.00
Rock, 100 cu. yds	4.00	2.50	4.00	2.00	.....
Piles, 2,000 ft	.30	.20	.20	.20	.10
Concrete, 200 cu. yds.	6.00	5.75	5.00	6.00	7.00
Sewage disp. plant	90,000	110,000	123,000	100,000	90,000

BRIDGES.

Des Moines, Ia.—Bids are wanted Dec. 14 for the construction of a Melan arch bridge across Des Moines River at North 6th Ave., as advertised in The Engineering Record.

Des Moines, Ia.—Bids are wanted Dec. 14 for the construction of a steel highway bridge across Des Moines River at East 6th St., as advertised in The Engineering Record.

Brockton, Mass.—The construction of a bridge at Ames St., at a probable cost of $16,000, is contemplated.

Reading, Pa.—The City Engineer has been directed to make an estimate of the cost of constructing approaches to Front St. bridge, and report to the Council.

Wilmington, Del.—It is stated that the Bridge Committee of the Levy Court will recommend the construction of a bridge at Roseville.

Wilkesbarre, Pa.—A petition is being circulated, and will be presented to the County Commissioners, asking for the construction of an iron bridge at Vine St., which will replace present structure.

Lockland, O.—It is stated that the construction of a $10,000 bridge at Benson St., Lockland, is contemplated.

Keyser, W. Va.—The construction of a bridge across Potomac River, connecting Keyser with Westernport, Md., is being considered.

Weiser, Idaho.—Business men are said to be contributing largely toward the construction of a steel bridge across Snake River, at Weiser.

North Tonawanda, N. Y.—It is stated that the New York Central & Hudson River R. R. Co. will soon construct a steel bridge across Erie Canal and Tonawanda Creek, to replace present structure. F. L. Brooks, Supervisor of Bridges, New York City.

Findlay, O.—Plans are being prepared, according to reports, by the Lake Erie & Western R. R. Co., T. H. Perry, Ch. Engr., Indianapolis, Ind., for a steel bridge to be constructed across Blanchard River, at Findlay.

Pittsfield, Mass.—Press reports state that the American Bridge Co. has received the contract for 20 bridges on the Berkshire Street Ry., at a total cost of $25,000.

Corning, N. Y.—An appropriation of $5,000 has been made for the construction of an iron bridge across Canisteo River, at Corning.

Denver, Colo.—According to press reports the City Council has voted to construct a bridge across Platt River, at Bayard St.

Savannah, Ga.—The Seaboard Air Line is said to have under consideration the construction of a bridge across Savannah River, at Savannah. W. W. Gwathmey, Ch. Engr., Portsmouth, Va.

Washington, D. C.—It is stated that bids are being received by the officials of the Pennsylvania R. R. Co., for masonry work on bridge across Potomac River, near Washington. W. A. Pratt, Engr. of Bridges, Philadelphia.

Scranton, Pa.—The Dayton Construction Co. has received the contract for constructing 50 bridges on the Lackawanna & Wyoming Electric R. R., from Scranton to Wilkesbarre.

Kansas City, Mo.—Press reports state that E. F. Swinney and Stuart R. Knott, receivers for the Union Terminal and Suburban Belt R. Rs., have authorized the expenditure of $200,000 for 5 steel bridges. The largest will cross the mouth of Kaw River, and cost about $100,000.

Buffalo, N. Y.—The Board of Aldermen has approved awarding the contract for constructing the counter weights on Michigan St. bridge, to Kellogg Iron Wks., at $5,900.

Bangor, Me.—Bangor and Brewster are considering the construction of a joint bridge to replace the present toll-bridge. Nothing definite has as yet been done.

Franklin, Tex.—Co. Clk. W. W. Wilson writes that Robertson County contemplates rebuilding the Port Sullivan bridge, but not in the very near future.

New Castle, Pa.—This city is about to build a steel viaduct over the railway entrance in the southern part of the city.

Urbana, Ill.—The contract for a 130-ft. highway bridge, with about 185 yards of stone masonry, will be let at the Court House on Nov. 12. Address Ira O. Baker, Engr., Champaign, Ill., for plans and specifications.

Saginaw, Mich.—Bids are wanted Dec. 12 (not Dec. 17, as previously stated) for constructing a bridge at Genesee Ave. Hiram E. Terry, City Engr.

Cincinnati, O.—Bids are wanted Nov. 30 for constructing the superstructure of a plate girder bridge at Marshall Ave. Geo. F. Holmes, Clk. Bd. Pub. Service.

Maxtown, O.—It is stated that bids are wanted Nov. 25 for constructing a steel bridge across Big Walnut Creek, in Genoa Township. Frank Warren, Co. Aud., Delaware.

Livingston, Mont.—County Clk. Chas. Angus writes that the contract for building a 2-span steel bridge across Yellowstone River has been awarded to O. E. Peppard, of Missoula, Mont., for $9,495.

Lansing, Mich.—The Common Council on Nov. 4 instructed City Engr. H. A. Collar to prepare plans and specifications for a bridge to cross Grand River at Washington Ave.

Ft. Worth, Tex.—The Midland Bridge Co., of Kansas City, Mo., has received the contract for two bridges over Colorado River on county line of Lampasas and San Saba counties, Tex., at $20,000 for both bridges; plans submitted by bidders. Other bidders were American Bridge Co., $17,500 to $22,000; C. O. Horton, $19,975; L. S. Leversidge & Co., $20,500; Alsbury & Son, $20,000; S. A. Oliver & Co., and Geo. E. King Bridge Co., bids unknown.

Walhalla, S. C.—Bids are wanted Nov. 14 for constructing a steel bridge. F. A. H. Schroeder, Commr.

Jasper, Ga.—It is stated that bids are wanted Nov. 16 for constructing a 100-ft., 3-span bridge across Talona Creek. C. J. Cornelison, Ordinary.

Lafayette, Ind.—It is stated that bids are wanted Nov. 12 for repairing 2 bridges. Geo. A. Jamison, Co. Aud.

Cleveland, O.—The Secretary of the Board of Control writes that the contract for rebuilding the bridge at Canal St. has been awarded to the King Bridge Co., of Cleveland.

De Kalb, Ill.—The Jacobs Bridge & Iron Co., Amboy, Ill., is stated to have secured the contract for constructing a plate girder bridge at College Ave., for $5,000.

Port Huron, Mich.—There is talk of constructing a jack knife bridge at Military St., to replace present swing bridge.

Milwaukee, Wis.—Local press reports state that the bids received Nov. 1 for constructing a bascule bridge at Broadway were as follows: American Bridge Co., $124,000, and the Wisconsin Bridge & Iron Co., $125,375.

Boston, Mass.—Bids will be opened by Supt. of Streets Wheeler, on Nov. 20, for the steel superstructure of the Bennington St. bridge, East Boston; it will be a through plate-girder bridge, about 81 ft. long on the center line, and 36 ft. between centers, and will be built on a skew; the floor will be of plank with wooden stringers. Bids will also be received at the same time for the superstructure of Brooks St. bridge, Brighton; it will be a deck-plate bridge 44½ ft. long and 33 ft. wide, and will have a buckle-plate floor; the concrete and asphalt flooring is not included.

PAVING AND ROADMAKING.

Washington, D. C.—Bids are wanted Nov. 23 for grading Massachusetts Ave., as advertised in The Engineering Record.

Detroit, Mich.—The contract for paving Haigh Ave., from Woodward Ave. to Brush St., has been awarded to the Barber Asphalt Paving Co., for $10,428.

Pittsburg, Pa.—The Common Council has passed ordinances for grading, paving and curbing La Place St., Lake St. and Plymouth Way.

Brooklyn, N. Y.—Bids are wanted Nov. 15 for repairing and resurfacing with asphalt such walks in Prospect Park as may be designated. Geo. C. Clausen, Commr. of Parks, N. Y. City.

Hutton, Ill.—Bids are wanted by the Highway Commissioners of Hutton Township until Nov. 11 for constructing a gravel road in Hutton Township, on Charleston and Diona road. Thos. E. McMorris, Town Clk.

Topeka, Kan.—City Engr. Jas. F. McCabe writes that about 30,000 sq. yds. of 2-course brick pavement is to be laid on sand. Estimated cost, $38,000, exclusive of grading and curbing.

East Chicago, Ind.—It is stated that bids are wanted Nov. 19 for improving 15,000 ft. of streets. H. E. Jones, City Clk.

Jacksonville, Ill.—It is stated that bids are wanted by the Board of Local Improvements until Nov. 11 for brick paving on 2 streets.

Flushing (L. I.), N. Y.—A petition is being circulated requesting Deputy Highway Commissioner Wissel to have Broadway asphalted from Main St. to the Bridge St. railroad crossing.

Milwaukee, Wis.—Mayor Rose, in a recent message to the Councils, recommends the issue of $160,000 bonds for street improvements.

Washington, D. C.—The District Commissioners have ordered that Highland Ave., Cleveland Park, from Newark St. to Connecticut Ave., be macadamized and gutters be laid thereon, at an estimated cost of $6,990.

Denver, Colo.—The Board of Public Works on Nov. 4 adopted plans and specifications for the construction of 20 miles of sandstone sidewalk, to be laid in what is known as Sidewalk District No. 9; the walk to be 5 ft. wide and 2½ ins. thick. Estimated cost, 85 cts. per lin. ft.

Columbus, O.—Local press reports state that the following are the lowest bids opened recently for paving Buckingham St.: A. G. Pugh, on Wassell block, $10,678, on Trinidad asphalt $14,666; Cleveland Trinidad Asphalt Paving Co., on Trinidad asphalt, $13,778; Barber Asphalt Paving Co., on pitch lake asphalt, $13,874.

Huntington (L. I.), N. Y.—The Town Board has appropriated $7,000 for general highway expenses and $4,000 for permanent improvements during the year.

Toledo, O.—Bids are wanted Nov. 18 for block pavement on a portion of River Place; also until Dec. 2 for repaving a portion of Superior St. by paving with Trinidad Pitch Lake asphalt or Trinidad asphalt. John E. Connell, City Clk.

Palestine, Tex.—Local press reports state that John W. Maxcy is preparing estimates for paving, which is soon to be done by the city. Probable expenditure, $40,000.

Winston, N. C.—J. L. Ludlow, 434 Summit St., Winston, has about completed plans and specifications for macadam streets, and wishes to correspond with contractors for macadam work who are in position to furnish their own rock crushers and steam roller. Appropriation, $25,000.

Norfolk, Va.—An election will be held Nov. 14 in Atlantic City Ward to vote on public improvements, to cost $485,000. Proposed improvements are the paving of the streets with asphalt, and the extension of the water and sewer systems.

Allentown, Pa.—An ordinance has passed third reading in the City Councils, providing $3,300 for the purchase of a steam road roller.

Norfolk, Va.—The Petersburg Granite Co. is reported to have secured the contract for furnishing material for the paving of Nicholas St. at the following prices: Curbing, 40 cts. per ft.; corners, $5 per set, and Belgian blocks, $3.65 per ton.

Louisville, Ky.—Thomas P. Craig, Sec'y Bd. of Pub. Wks., writes that the lowest two bids received Oct. 29 for paving several streets, in all 10,986 sq. yds., with vitrified block, were from Geo. W. Gosnell, Louisville, at $1.22, $1.23 and $1.24 per sq. yd., and from L. R. Figg, Louisville, at $1.19 per sq. yd.

Denver, Colo.—Local press reports state that the following bids were received for grading and curbing the South Broadway grading district: Hugh Murphy Construction Co., $45,695.75; John M. O'Rourke Construction Co., $55,383; D. J. Tiersworthy, $47,968.30, and Thomas J. Tully, $47,124.50. The contract was awarded to the Hugh Murphy Construction Co., its bid in detail being as follows: Grading, 16 cts. per cu. yd.; lumber, $27 per 1,000 ft.; curbing, sandstone, 6 x 18, $1.05 per ft.; 5 x 18, $1 per ft.; curved granite, 6 x 18 and 5 x 18, both $2 per ft.

Baltimore, Md.—The following amounts have been included in the annual ordinance of estimates for street paving in 1902, which was recently passed by the City Council and approved by the Mayor: With asphalt block—Fulton Ave., $19,000; North Ave., $70,241; Warren Ave., $20,300; McCullough St., $4,000; another portion of North Ave., $2,424, and another portion of Fulton Ave., $3,400. With Belgian block—Hanover St., $19,429, and Canton Ave., $4,200. With sheet asphalt—St. Paul St., $14,606, and Baltimore St., $3,900. Total, $16,150. This is in addition to various ordinances which are passed from time to time and provide for street paving by assessing cost thereof on abutting property.

POWER PLANTS, GAS AND ELECTRICITY.

Ripon, Wis.—The Ripon Light & Water Co. is stated to have received the contract for lighting the city for 10 years at $70 per light per year for each arc light.

La Grange, Ill.—See "Water."

Media, Pa.—David Halstead is stated to have secured the contract for erecting poles and stringing wires for the municipal electric light plant for $6,600.

Middletown, N. Y.—The contract for electric work, rewiring and fixtures for the main building at Middletown State Hospital has been awarded to the Commercial Construction Co., 1 Madison Ave., New York City.

Wadesboro, N. C.—The Bluitt Falls Electrical Power Co. has been organized, with Fred. J. Coxe, of Wadesboro, as Pres. and Treas., Robt. L. Steele, of Rockingham. Sec'y, and Sam'l T. Stowe, of Mecklenburg County, Gen. Supt. Principal office in Wadesboro. Richard Morton, of Baltimore, has been employed as consulting and construction engineer, and parties wishing to furnish machinery, etc., should address him. About 6,000 H.-P. can be developed at Bluitt Falls at the driest seasons of the year, and this power is to be transmitted to Wadesboro, Rockingham, and Hamilton for the purpose of lighting; also for operating mills and electric railways, etc.

Wilmington, Del.—The United Ry. & Light Co., of Wilmington, is reported incorporated to furnish light, heat and power for electric railways; capital, $1,000,000.

Alameda, Cal.—It is reported that about $7,000 will be expended on improving the municipal electric light plant.

Baltimore, Md.—See "Electric Railways."

Marshfield, Vt.—The Molly Falls Electric Light & Power Co., of Marshfield, is stated to have been incorporated, with a capital of $10,000, to manufacture and furnish electric light and power in Marshfield, Plainfield, Cabot and other towns: Incorporators: M. E. Beckley, J. A. Mears, and others, all of Marshfield.

Pagosa Springs, Colo.—See "Water."

Genoa, Ill.—A franchise is reported to have been granted to Fred H. Alden to construct a lighting plant.

Onalaska, Wis.—It is reported that Col. F. E. Nichols contemplates putting in an electric light plant and a feed mill.

Winnipeg, Man.—The Manitoba Water-Power Electric Co., recently organized, is reported to have secured the lease of a water power on Winnipeg River, 60 miles from Winnipeg, and it is proposed to put in an electric plant capable of producing 10,000 H.-P.

Yardley, Pa.—See "Water."

Herrin, Ill.—The Herrin Light & Power Co., of Herrin, is reported incorporated, with a capital of $20,000, to operate light, heat, power and cold storage plants. Incorporators: B. Bollinger and C. E. Ingraham.

Little Falls, Minn.—See "Electric Railways."

Los Angeles, Cal.—The Ontario Power Co. has been incorporated, with a capital of $500,000, to acquire and operate street car systems and to produce electric light, power and heat. Directors: R. M. Weed, J. N. Moore and others, all of Los Angeles.

Ithaca, N. Y.—See "Water."

Youngstown, O.—The City Council is stated to have granted Chas. D. Hauk, of Washington, D. C., a franchise to erect a plant here for the manufacture of fuel and lighting gas and the use of the streets in which to lay mains.

Brazil, Ind.—City Clk. J. W. Williams writes that the contract for lighting the city has been awarded to P. DeC. Ball, of St. Louis, Mo., at $62.40 per arc light per year for 10 years. A press report states that he will construct an electric light plant here at once.

Baltimore, Md.—Bids are wanted by the Board of Awards until Nov. 14 for furnishing 10,000 ft. of single conductor arc light cable. Thos. G. Hayes, Pres.; Chas. E. Phelps, Jr., Ch. Engr., Electrical Commn.

Philadelphia, Pa.—Bids are wanted by the Commissioners of Fairmont Park until Nov. 21 for naphtha and electric lights in Fairmont and Hunting Parks. Jesse T. Vodges, Ch. Engr. & Supt.

Wilmington, O.—See "Water."

Whittier, Cal.—It is stated that the Council will receive bids Dec. 2 for the purchase of electric light and power franchises.

Butler, N. J.—The Butler Gas Co. has been incorporated, with a capital of $20,000, to construct and operate gas works in Butler. Chas. E. S. Thorn, of Newark, is one of the incorporators.

Casey, Ill.—It is stated that bids are wanted Nov. 11 for furnishing and installing a complete electric light and power plant. Chas. F. Johnson, Mayor; A. M. Patitz, Consulting Engr., Milwaukee, Wis.

Skaneateles, N. Y.—The citizens on Nov. 1 are stated to have voted to issue $10,000 bonds, to add to the equipment of the municipal electric light plant.

Alameda, Cal.—It is stated that bids are wanted by the Village Trustees until Nov. 18 for a 150-H.-P. automatic non-condensing engine, and alternating generator of 90 to 120 kw.

Lancaster, Pa.—Bids will be received by the Lamp Committee until Nov. 26 for furnishing material and lighting the streets and public places. E. E. Humphreville, Chmn.

East Liverpool, O.—L. W. Healy, Pres. of the United Power Co., writes that the company expects to increase the capacity of its power plant, but has not yet decided upon the capacity or the kind of machinery to be used.

Boonton, N. J.—W. W. Riddle, Engr. of the Boonton Gas & Improvement Co., writes that bids will be opened within 60 days for the construction of a gas plant, estimated to cost $50,000 to $60,000. Plans and specifications are wanted for a plant capable of supplying a 60,000 cu. ft. tank, coal or water gas.

Lemoore, Cal.—See "Water."

Columbia, S. C.—Bids are wanted by the Commission for lighting the State House and other Public Buildings until Nov. 20, for the electric wiring of the State House, hospital and other public buildings. J. Q. Marshall, Chmn.

Norwood, O.—Bids are wanted Dec. 2 for $20,000 bonds for the purpose of enlarging the electric light plant. W. E. Wichgar, Village Clk.

Salinas, Cal.—See "Water."

Louisville, Ky.—Joseph McWilliams is stated to have secured a franchise to furnish steam heat and electric light in that portion of the city between 3d and 5th and Chestnut and Green Sts. He will install a plant at once.

El Paso, Tex.—See "Electric Railways."

Dowagiac, Mich.—It is reported that D. E. Connine, the Electric Light Commissioner, has prepared estimates for the proposed electric light extension. It will necessitate the use of 4 miles of new wire, 41 poles, etc.

New Haven, Conn.—The contract for the electrical work in the High School is stated to have been awarded to W. W. Gale & Co., of New Haven, for $4,146.

Cuyahoga Falls, O.—City Clk. C. A. Weidner writes that at the recent election it was voted to issue bonds for electric light improvements.

Caldwell, O.—Bids are wanted Nov. 12 for $5,000 bonds to be used to purchase additional machinery for the electric light plant. Cyrus McGlashan, City Clk.

Burlington, Ia.—City Engr. Emmet Steece writes that the following bids were opened Nov. 1 for lighting the streets for a period of 5 years from Sept. 1, 1902: *a*, 400 Welsbach lights, dusk to midnight; *b*, same, Phila. moonlight schedule; *c*, same, all night and every night; *d*, 2,000 c. p. open arc lights, Phila. moonlight schedule; *e*, incandescent lights, 16 c. p.; *f*, incandescent lights, 32 c. p.; the prices are per light per year: Welsbach Lighting Co. of America, Philadelphia, Pa., *a* $23.31, *b* $24.80; Gen. Electric Co., Chicago, Ill., *d* $70, *e* $17, *f* $11; Gen. Construction Co. of Detroit, Detroit, Mich., *d* $71.50, *e* $19, *f* $12; Burlington Electric Light & Power Co., Burlington, *b* $17, *c* $20, *d* $71, *e* $18, *f* $12.

ELECTRIC RAILWAYS.

Battle Creek, Mich.—The Battle Creek & Marshall Traction Co. is reported incorporated, with a capital of $200,000.

Zanesville, O.—The preliminary survey of the Columbus, Newark, Zanesville & Wheeling Electric Ry. is stated to have been completed, and it is expected that work on the construction will begin early next year.

Ossining, N. Y.—A syndicate of Cleveland men is stated to have purchased the Ossining Electric R. R. and will extend the line to Pleasantville, Croton, White Plains and Tarrytown.

Little Falls, Minn.—The Council is reported to have granted the Westinghouse Mfg. Co. a franchise to construct and operate electric car lines. They are reported to have bought the interests of the Little Falls Water Power Co. and will probably develop and utilize the water power in supplying the city and surrounding villages with electric power.

New York, N. Y.—The Subway & Suburban Construction Co., of N. Y. City, was incorporated Nov. 1, with a capital of $300,000, to construct railways and to do work incidental thereto. Directors: Frank V. Ainslie, Brooklyn, Emile Dreyfus and Wm. F. McCombs, Jr., of New York City, and others.

Yeadon, Pa.—The Council is stated to have granted franchises to the Delaware County Rapid Transit Co. and to the Philadelphia, Morton & Swarthmore Ry. Co. W. H. Janney, Gen. Mgr., Folsum, Pa.

Frostburg, Md.—John W. Burchinal, of Moundsville, W. Va., John Macfarlane, of Lonaconing, Md., and others are stated to have filed a certificate of incorporation for the Westernport & Lonaconing Electric R. R., which proposes to construct a line between Frostburg and Lonaconing.

Ft. Wayne, Ind.—A press report states that engineers have commenced surveying for the proposed line to be constructed from Ft. Wayne to Cincinnati, O., by the Ft. Wayne, Dayton & Cincinnati Traction Co. Dr. Sam'l F. George, Pres., Dayton, O.; Chas. W. Gebhart, Sec'y, Dayton.

Baltimore, Md.—The Maryland, Sparrows Point & North Point Electric Ry. Co., of Baltimore County, has been incorporated with a capital of $250,000 by Robt. S. Carswell, Alvin N. Bastable and others to construct and operate a railway from the eastern limits of the city of Baltimore to Sparrows Point and North Point; also for generating and supplying electricity and also for conducting a water transportation business.

Kingston, N. Y.—The Kingston Consolidated R. R. Co. is reported to have purchased a site 100 x 100 ft. adjoining the power house in Ponckhockie and it is proposed to enlarge the power house and install additional machinery. F. Gaffney, Ch. Engr., Kingston.

New Orleans, La.—A correspondent writes that a 50-year extension of the street railway franchise has been sold to the Orleans R. R. Co. Additions and extensions will be made to the lines and service. Robt. Scott, Ch. Engr.

Lexington, Ky.—Chas. J. Bronston and Dr. David Bennett, of Lexington, are reported interested in the construction of an electric railway between Lexington and Richmond.

Rutland, Vt.—The Rutland St. Ry. Co. is stated to have increased its capital from $150,000 to $1,500,000. H. W. Burgett, Mgr., Brookline, Mass.

Carbondale, Ill.—The Carbondale & Murphysboro Electric Ry. Co. has been incorporated, with a capital of $50,000. Directors: Thos. M. Logan, Murphysboro; E. F. Harper and Wm. S. Forman, of East St. Louis, and others.

Hagaman, N. Y.—The Amsterdam St. R. R. Co. is stated to have filed with the Secretary of State a certificate of extension of route to the village of Hagaman. J. Ledlie Hess, Pres., Fonda.

Redlion, Pa.—The Redlion & Windsorville St. Ry. Co. is reported to have been formed to construct an electric railway in Redlion and Windsorville.

Savona, N. Y.—Johnstone, McGahar & Co. have petitioned the Village Trustees for a franchise for a street railway.

Elmira, N. Y.—The Elmira & Waverly Ry. Co. has been incorporated, with a capital of $200,000, to construct an electric railway between Elmira and Waverly, a distance of 18 miles. Directors: J. M. Diven, Wallace W. Seeley and others, of Elmira, and Jas. L. Rhymer, of Philadelphia, Pa.

Fond du Lac, Wis.—The Wisconsin Rapid Transit Co. is stated to have petitioned the Council for a franchise.

Canastota, N. Y.—The Canastota & Morrisville Electric Ry. Co. is stated to have secured authority to construct a line from Canastota to Morrisville.

Camanche, Ia.—The Iowa and Illinois Ry. Co. is stated to have petitioned the City Council for a franchise.

Allentown, Pa.—A charter has been granted to the Lehigh & Carbon Traction Co., of Allentown, to construct a line 15 miles long between Allentown and Walnutport; capital, $90,000. Incorporators: Geo. F. Coffin, Easton; Hugh E. Crilley, Allentown, and others.

Millbury, Mass.—The Worcester & Providence St. Ry. Co. is stated to have petitioned the Selectmen for a franchise.

Berwick, Me.—The Berwick St. Ry. Co. is stated to have been formed to construct a railway from Berwick to Lebanon, about 8 miles in length. Wallace E. Lowell, of Newton, Mass., is reported interested.

Haverhill, Mass.—The Council is stated to have granted a franchise to the Haverhill, Plaistow & Newton St. R. R. Co.

West Chester, Pa.—A charter is stated to have been granted to the Keeley Trolley Co., of West Chester, to operate a trolley line from Phoenixville through Spring City to Birdsboro.

Goshen, Ind.—J. F. Rothwell, of St. Louis, Mo., is stated to have received a franchise over Elkhart County roads for the construction of a line between Goshen and Ft. Wayne, by the way of Syracuse, Lake Wawasee and Churubusco.

Coshocton, O.—The Council is stated to have granted a franchise to the Newark, Zanesville & Coshocton Traction Co.

Lawton, Okla. Ter.—A charter is stated to have been granted to the Oklahoma & Indian Territory Electric Ry. Co., with a capital of $1,500,000. Principal place of business at Norman, Okla. Ter. The estimated length of the line is 175 miles, with South McAlester, Ind. Ter. and Lawton, as the termini. Incorporators: J. W. Helvie, of Norman; Jas. D. Maguire, of Lawton, and C. B. Campbell, of Minco, I. T.

Lonaconing, Md.—The County Commissioners on Nov. 4 are stated to have granted a franchise to the Westernport & Lonaconing Ry. Co. to construct an electric railway over the county roads from Lonaconing to Westernport.

El Paso, Tex.—A press report states that C. R. Bucheit, T. N. Barnsdall and E. W. Davis, of Pittsburg, Pa., have purchased all the traction and electric lighting interests of El Paso, Tex., and Jaurez, Mex., and are forming the El Paso Electric Co., with a capital of $1,250,000, under a New Jersey charter, to operate the property. It is also reported that a single power house of 20,000 H.-P. will be constructed.

Manchester, Mo.—The St. Louis & Manchester Ry. Co. is stated to have been formed, with a capital of $250,000, to construct an electric railway to Manchester. D. C. Taylor, Pres., Manchester.

Los Angeles, Cal.—A press report states that the Los Angeles & Redondo R. R. is to be converted into an electric line. The line is to be extended from the depot on Jefferson St. a few hundred feet across to Grand Ave. and joined to the city system. The line is to be made first-class as to roadbed, rails and equipment, and it is estimated that about $500,000 will be expended on the improvements. L. J. Perry, Supt., Redondo, Cal.

Long Beach, Cal.—The Council is stated to have granted Col. Duke, of the Seaside Water Co., a franchise for an electric railway.

San Bernardino, Cal.—The Supervisors are stated to have granted the San Bernardino Valley Traction Co. a franchise for an electric railway between this city and Redlands.

Saranac, Mich.—The Council is stated to have granted a franchise to E. L. Alvord and I. F. Tucker, representing the Saginaw & Grand Rapids Electric St. Ry. Co.

Richmond, Va.—The Committee on Streets has voted to recommend to Council the adoption of ordinance granting a franchise to the Citizens' Rapid Transit Co.

West Brookfield, Mass.—The Hampshire & Worcester St. Ry. Co. is stated to have petitioned the Selectmen for a franchise to construct a line from West Brookfield to Ware.

Germantown, Ill.—Chas. M. McCabe and H. G. Schlosser are stated to have received a franchise to construct an electric railway through the town.

Deshler, O.—The Council has granted a franchise to the Toledo & Lima Traction Co.

Bloomsburg, Pa.—The Columbia & Montour Electric R. R. Co. is stated to have secured a right of way from Rupert to Catawissa from the Pennsylvania Canal Co., along the abandoned towpath of the canal. W. S. Moyer, of Bloomsburg, is one of the directors.

Tribeshill, N. Y.—Bids will be received by the Fonda, Johnstown & Gloversville R. R. Co., at Gloversville, until Nov. 25, for furnishing material and erecting a power house near Tribeshill. J. Ledlie Hess, Pres.; C. H. Ledlie, Consulting Engr., Rialto Bldg., St. Louis, Mo.

Celina, O.—Bids are wanted Nov. 26 for the construction and operation of Street Railway Route No. 2. Chas. R. Bohrer, Village Clk.

RAILROADS

New Florence, Mo.—The Mineola, New Florence & Middletown R. R. Co., of New Florence, has been incorporated, with a capital of $300,000, to construct a railroad from Mineola to Middletown, a distance of 30 miles. Incorporators: Howard Ellis, H. F. Scanland and others.

Florence, Ala.—The Florence Iron, Phosphate & R. R. Co. is reported incorporated, with a capital of $100,000, to construct a railroad in Kentucky, Tennessee and Alabama. Iincorporators: W. J. O'Hearn, Jos. Kothmen and others.

Boise, Idaho.—The Boise Basin R. R. Co. has been incorporated, with a capital of $500,000, to construct a railroad about 20 miles in length. Incorporators: N. M. Ruick, E. H. Beggs, and others.

Dallas, Tex.—The Dallas & New Mexican R. R. Co. is stated to have petitioned the City Council for the right to build over certain streets of the city.

Tullahoma, Tenn.—W. H. Hanson is reported to have completed surveys for a railway to be constructed between this place and Lynchburg.

Santa Maria, Cal.—Markall McDonald is reported interested in the construction of a railroad from Santa Maria to Bakersfield.

Lunenburg, Va.—The citizens of Lunenburg County are stated to have voted to subscribe $100,000 to the Mt. Rogers & Eastern R. R. The road will be constructed through Lunenburg County, from Independence to near Norfolk, Va.

North Attleboro, Mass.—The R. R. Commissioners are reported to have issued an order approving the issue of capital stock by the Old Colony R. R. Co. (E. C. Foster, Gen. Mgr., Boston), amounting to about $150,000, the proceeds to be used for the construction of an extension of its line in the town of North Attleboro and from there to a point near Adamsdale on the line of the Rhode Island & Massachusetts R. R.

Chicago, Ill.—The Track Elevation Committee on Oct. 31 recommended for passage an ordinance for the elevation of tracks on the Grand Trunk Ry. (J. Hobson, Ch. Engr., Montreal, Que.), and the Chicago Junction Ry. (J. B. Cox, Ch. Engr., Chicago), between Wallace St. and California Ave., and on the Panhandle Route (E. A. Dawson, Mgr.. Chicago) and the Chicago Terminal Transfer R. R. (F. E. Paradis, Ch. Engr., Chicago) between 39th and 55th Sts. The elevation provided for is about 5 miles, and the total trackage 30 miles; 34 subways are to be constructed; cost of the work to be about $800,000.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Philadelphia, Pa.—J. H. Jordan, 2118 Oxford St., is stated to have received the contract for erecting the new fire station on Parrish St., for $27,738.

Kalamazoo, Mich.—It is reported that the State Agricultural Board has ordered plans and specifications for a $50,000 laboratory.

Lake City, Fla.—H. W. Otis, of Jacksonville, is stated to have secured the contract to erect the Columbia County court house for $33,377.

York, Pa.—The County Commissioners are stated to have rejected bids received Oct. 22d for additions and repairs to the York County jail, as all were in excess of the amount appropriated, which is $100,000.

Reedsburg, Wis.—Chas. Fitzgerald, Mack Bldg., Milwaukee, is stated to have completed plans for the Sauk County Poor House, to be erected here, at a cost of $15,000.

Sewickley, Pa.—It is stated that a $25,000 hospital will be erected here. W. L. Clause, Chmn. Com.

Los Gatos, Cal.—Andrew Carnegie is stated to have given this city $10,000 for a library.

Atlanta, Ga.—W. F. Denny, Prudential Bldg., is stated to have completed plans for the Westminster Presbyterian Church, to be erected on Forest Ave. and the Boulevard, to cost $25,000.

Butte, Mont.—Bids are wanted Nov. 12 for erecting a city hall and fire station. J. D. Matheson, City Clk.

New York, N. Y.—Bids are wanted Nov. 21 for the excavation and removal of rock from the site of the New York Public Library, Astor, Lenox and Tilden Foundations. Geo. C. Clausen, Commr. of Parks.

Crockett, Cal.—It is stated that bids are wanted Dec. 2 for erecting a jail at Crockett. J. E. Rodgers, Co. Clk., Martinez.

Streator, Ill.—Cullen Bros., of Janesville, Wis., are stated to have secured the contract to erect the Carnegie Library, for about $35,000.

Gatesville, Tex.—Bids are wanted Nov. 15 for erecting a brick and stone church at Gatesville. Geo. G. Orr, Archt., 308 North Texas Bldg., Dallas.

Manchester, N. H.—The Christian Science Society will erect a church. Chickering & O'Connell, 1037 Elm St., Archts.

By the will of the late Emeline R. Balch, the city has been left $250,000 to found a hospital, which will be known as the "Balch Hospital."

Denver, Colo.—The Carter Museum Association is stated to have adopted the plans of F. J. Sterner for a museum building, to cost about $65,000.

Greenville, Pa.—The citizens are stated to have voted on Nov. 5 to erect a $20,000 city hall.

Turtlecreek, Pa.—Bids are wanted Nov. 14 for erecting a municipal building. Chas. R. Church, Chmn. Property Com.

Toronto, Ont.—Bids will be received by the Board of Control until Nov. 20 for erecting office buildings and caretaker's residence on Wellington St., in connection with the cattle market. O. A. Howland (Mayor), Chmn.

Canandaigua, N. Y.—Andrew Carnegie is stated to have offered this city $10,000 for a public library.

Milwaukee, Wis.—It is stated that the Holy Assumption R. C. Congregation will erect an edifice to cost about $50,000 on 63d and Elm Sts.

Norfolk, Va.—Carpenter, Bruse & Ferguson are stated to have prepared plans for a $50,000 church for the Second Presbyterian Society. Rev. Ernest Thaker, Pastor.

Brooklyn, N. Y.—A permit has been issued for a 3-story brick extension to the Home for Aged Men, at Classon Ave. and Park Pl., to cost $45,000. Architects, Lord & Hewlett, 16 E. 23d St., N. Y. City.

Natchitoches, La.—The plans of F. B. Hull, of Jackson, Miss., are stated to have been accepted for a $30,000 jail.

Emporia, Kan.—Bids are wanted Nov. 11 for erecting a $16,000 M. E. church. W. C. Madison, Chmn. Bldg. Com.

Munhall, Pa.—A press report states that the new borough of Munhall is to have a town hall, to cost about $20,000. Plans are now being prepared in the office of the Carnegie Steel Co.

Boston, Mass.—The following bids for erecting (including heating, ventilating and plumbing) a House of Correction at Deer Island, Boston Harbor, were opened Nov. 4 by Alpheus Sanford, Penal Institution Commr.: Bidders all of Boston: Mack & Moore, 166 Devonshire St., $370,900 (awarded); Morrill & Whitton Construction Co., $399,400; F. G. Coburn & Co., $395,000; Jones & Meehan, $410,000; McNeil Bros., $418,000 (if Eastern Expansive Metal Co.'s construction is used, deduct $8,000); Thompson & Starrett Co., $430,160 (if cell construction be modified, deduct $4,000).

New York, N. Y.—Bids are wanted Nov. 18 for material and work required in the repairs and alterations to the hot-water system and the heating system of the building connected to the central steam plant, located on Randall's Island. John W. Keller, Pres., Charity Commrs., Dept. of Pub. Charities.

BUSINESS BUILDINGS.

Walla Walla, Wash.—The Washington Lodge, Independent Order of Odd Fellows, and Columbia Lodge, Knights of Pythias, are reported to have under consideration the erection of a $40,000 building.

Cincinnati, O.—A permit is stated to have been issued to the Moerlein Brewing Co. for a stock house, a 6-story cemented building, to be erected on Pleasant and Henry Sts., to cost $100,000.

San Diego, Cal.—The Masonic Temple Association is reported to have been formed, and will erect a Masonic temple at 5th and ◡ Sts., to cost about $100,000. Directors: R. M. Powers, S. W. Hackett and others.

Menasha, Wis.—Geo. Utz, cashier of the First Nat. Bank, is reported to be interested in a movement to organize a stock company to erect a $35,000 hotel.

Danville, Ill.—Harrison B. Walter, of Danville, is stated to have secured the contract to erect a depot here, for the Wabash R. R., for about $25,000.

Providence, R. I.—See "Miscellaneous."

Buffalo, N. Y.—The packing plant of Jacob Dold & Co. is reported to have been destroyed by fire Nov. 2.

Kansas City, Mo.—S. N. Dwight, of Galena, Kan., is reported interested in the construction of a 7-story office building on 10th St. and Baltimore Ave.

New Castle, Pa.—The Hileman Co. is stated to have been organized here, with a capital of $100,000, to erect a 6-story building. Directors: C. C. Hileman, Greensburg; E. E. Hileman, of Kittaning, and R. L. McNabb, of New Castle.

Columbus, O.—Moling Bros. are reported to have selected the plans of S. Hannaford & Sons, Cleveland, for a 5-story hotel to be erected at High St. and 14th Ave.

Wheeling, W. Va.—The Central Glass Works, which were recently burned, will be rebuilt. The power plant was not burned. A. F. Meder, Sec'y.

San Francisco, Cal.—Hemenway & Miller, Hearst Bldg., are stated to have prepared plans for a 6-story brick and fireproof office building to be erected on Sutter and Trinity Sts. for A. Aronson, to cost about $80,000.

Rock Falls, Ill.—Cobb & Drew intend to build a 2-story brick factory in the spring, for which shafting, pulleys, etc., will be purchased later.

Saltillo, Mexico.—The Bank Coahuila will receive bids for the installation of electric elevator, electric plant and steam heating plant for the bank and hotel building, work to be let as one contract. Address, Alfred Giles, Architect, Saltillo.

Chicago, Ill.—Grace & Hyde, 1408 Wabash Ave., are stated to have secured contracts for erecting a depot for the Chicago, Rock Island & Pacific and the Lake Shore Railroads at Van Buren and La Salle Sts.; cost, about $1,000,000; and an office building and warehouse for the Lake Shore road, to be erected at 449-507 La Salle St.; cost, about $150,000.

Paterson, N. J.—Bids will be received by Thos. Cressey, Archt., 800 Broad St., Newark, until Nov. 13, for erecting a car barn and other buildings for the Jersey City, Hoboken & Paterson St. Ry. Co., to be located on Market, Jersey and Pine Sts., Paterson. David Young, Pres.

Portland, Me.—The wholesale grocery house of the Milliken-Tomlinson Co., at 303 Commercial St., was burned Nov. 5.

Ludington, Mich.—It is stated that Justus S. Stearns has purchased a site on Hamlin Lake, near Ludington, and will erect a 3-story brick summer hotel, to cost about $25,000.

Hammond, Ind.—D. Mahaffy, 84 La Salle St., Chicago, Ill., is stated to have prepared plans for a sanitarium to be built at Hammond for Dr. J. P. Henderson, to cost $20,000.

Buffalo, N. Y.—Green & Wicks, 110 Franklin St., are stated to have completed plans for a 10-story building for the Fidelity Trust Co., to be erected at Main and Swan Sts.

Texarkana, Ark.—It is reported that the Kansas City Southern Ry. Co. will erect a $25,000 passenger and freight depot here. J. A. Edson, Gen. Mgr., Kansas City, Mo.

Atlanta, Ga.—The Lyceum Theater, on Edgewood Ave., was burned Nov. 6th.

Alliance, O.—It is stated that the Lake Erie, Alliance & Wheeling R. R. Co. will erect a $15,000 depot.

Ft. Wayne, Ind.—J. M. E. Riedel, Schmitz Blk., has prepared plans for a $15,000 brick bakery to be built for Mrs. A. Katzenberg, of Fort Wayne, on Montgomery St., east of Calhoun St.

Plans have also been prepared by J. M. E. Riedel for a brick factory to be built for the Packard Co., at a cost of $14,500. Owner, A. Bond.

Chicago, Ill.—A permit is stated to have been granted to the Lake Shore & Michigan Southern R. R. Co. to erect a 2 and 3-story brick freight house, 596 ft. long and 33 to 50 ft. wide, on 449 to 507 La Salle St.; cost $150,000. S. A. Handy, Ch. Engr., Cleveland, O.

The Trustees of Lewis Institute will erect a 6-story building 86 x 165 ft. on West Van Buren and Morgan Sts. for the use of the Geo. M. Hill Publishing Co., to cost about $150,000.

M. J. Morehouse, 226 La Salle St., is stated to have prepared plans for a building as an addition to the plant of the Cole Mfg. Co., stove founders, at 35th St. and Western Ave., to cost $30,000.

E. M. Newman is stated to have prepared plans for a 7-story building 60 x 80 ft. for the Plamondon Estate, to be erected at 105-107 Clinton St., to cost $50,000.

The J. G. Harlow Co., a West Side real estate firm, will improve the S. E. cor. of Washington Boulevard and Peoria St. with a 7-story manufacturing block, 100 ft. sq. Four stories are to be built at present, at a cost of $50,000.

Gustave Voight, 3220 S. Canal St., has prepared plans for rebuilding a factory at 3140-3142 Canal St. for the Freund Bros. Mfg. Co. at a cost of $20,000.

Springfield, O.—Local press reports state that bids will be received by the Pythian Home Board at the office of Yost & Packard, Y. M. C. A. Bldg., Columbus, until Nov. 15, for erecting an administration building at Springfield, to cost about $45,000.

Mobile, Ala.—It is stated that bids will be received about Dec. 1 for erecting a department store for L. Hammel & Co., to cost about $60,000, and to be equipped with electric freight and passenger elevators. Stone Bros., Archts, New Orleans, La.

Walla Walla, Wash.—Henry Osterman is stated to have prepared plans for a $22,000 building for the Walla Walla Club. Levi Ankeny, Chmn. Bldg. Com.

Omaha, Neb.—Local papers state that bids will be received at once for excavating for the foundation of the proposed auditorium. John Latenser, Archt., 414 Karbach Blk.

DWELLINGS.

Chicago, Ill.—Bishop & Co., 189 La Salle St., are stated to have prepared plans for a 3-story brick and stone apartment house, to be built by A. R. Clark & Co., at 244-250 65th Place; cost, $40,000.

John D. Atchison, 90 Washington St., has prepared plans for a 3-story brick and stone apartment house, 100 x 47 ft., which James P. Miles will build, on Washington Boulevard and 45th Ave., at a cost of $30,000.

Council Bluffs, Ia.—Woodward Bros., of Council Bluffs, have prepared plans for a $25,000 residence, to be built for J. T. Wilcox.

Macon, Ga.—Alex. Blair, 673 Cherry St., has prepared plans for a $20,000 residence to be built for Wallace McCaw.

National Home, Wis.—Bids are wanted Nov. 12 for erecting chaplain quarters at this Home. J. E. Armitage, Treas.

Newark, N. J.—Wm. E. Lehman, 224 Market St., is reported to be preparing plans for an 8-story fireproof apartment house 50 x 100 ft., which Leschziner & Co. propose erecting at Lincoln Park, to cost about $100,000.

South Bend, Ind.—C. A. Brehmer, of South Bend, is preparing plans for a flat building having all modern improvements, to be erected for A. Kuntzman, Jr., of So. Bend. Cost, $16,000.

New York, N. Y.—It is stated that Wm. Waldorf Astor will erect a 9-story apartment house on B'way, West End Ave. and 78th St., to cost about $2,500,000.

Reading, Pa.—Muhlenberg Bros., 2d Natl. Bank Bldg., have prepared plans for a 2-story residence to be built for John R. Miller. Cost, $12,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

5 & 7 E 75th St, 2 stone front dwell'gs; c, $200,000 all; o, Wm Hall's Sons; a, Welch, Smith & Provot.

5th Ave & 84th St, 2 stone front dwell'gs and extension; c, $295,000 all; o, B A Williams; a, Van Vleck & Goldsmith.

SCHOOLS.

New Haven, Conn.—A press report states that Yale University will expend about $150,000 in a building to be known as the Lampson Lyceum.

Brooklyn, N. Y.—Bids are wanted Nov. 18 for erecting school No. 141. Richd. H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Ypsilanti, Mich.—E. W. Arnold is reported to have been commissioned to prepare plans for a $50,000 science building for the State Normal School at Ypsilanti.

Scranton, Pa.—Bids are wanted Nov. 11 for erecting school No. 40; separate bids will be received at the same time for installing the ventilating and heating systems. Eugene D. Fellows, Sec'y Bd. of Control.

Omaha, Neb.—The Board of Education has ordered plans from John Latenser, 414 Karbach Blk., for a $25,000 grammar school.

Helena, Mont.—It is stated that bids are wanted Dec. 3 for $250,000 school bonds. Maria M. Dean, Chmn. School Trus.

Bellport (L. I.), N. Y.—I. H. Green, of Sayville, is stated to be preparing plans for a $15,000 school.

Oshkosh, Wis.—Local press reports state that the Board of Public Works will receive plans until Nov. 30 for a high school, to cost about $60,000.

San Francisco, Cal.—Wm. Mooser, Jr., 14 Grant Ave., is stated to have prepared plans for the erection of a school on Douglass and 24th Sts., to cost about $50,000.

South Bend, Ind.—Bids are wanted Nov. 18 for erecting two 8-room schools. Geo. A. Baker, Secy.

South Bethlehem, Pa.—Boro. Secy. Thos. Ganey writes that on Nov. 5 $39,100 school bonds were voted.

STREET CLEANING AND GARBAGE DISPOSAL.

New Haven, Conn.—The Board of Health is urging an appropriation of about $25,000 for the establishment of a garbage crematory plant.

Philadelphia, Pa.—Press reports state that the following bids were opened at the Bureau of Yards & Docks, Navy Dept., Washington, on Oct. 26: For a garbage crematory at the League Island navy yard: Dixon Garbage Crematory Co., Toledo, O., $5,973; North Penn Iron Co., Philadelphia, $7,891; $7,531; $6,203, and $5,943; Benjamin Boulger, New York, $6,800; $6,000, and $5,500; Davis Garbage Furnace Co., Lancaster, Pa, $6,990; Municipal Engineering Co., New York, $7,200.

Brooklyn, N. Y.—One bid only was received Nov. 1, by P. E. Nagle, Commr. of Street Cleaning, New York City, for the final disposition of ashes and street sweepings, that of Wm. Nolan, 503 Henry St., for $103,000 for the year beginning Jan. 1, 1902. The bid is estimated on the amount of ashes and street sweepings disposed of during 1899, a total of 900,000 cu. yds., with a maximum daily output during March of 3,480 cu. yds., and an amount on days of maximum collection of 4,000 cu. yds.; the contractor has to provide dumps at the water front, none being operated by the Dept.

New York, N. Y.—One bid only was received Nov. 1, by P. E. Nagle, Commr. of Street Cleaning, for the final disposition of ashes and street sweepings in the Boroughs of Manhattan and Bronx, that of Booth, Dailey & Ivins, 21 Park Row, for $566,784 for the year beginning Jan. 1, 1902. The bid is estimated on the amount of ashes and street sweepings delivered on barges at the Dept. dumps along the water front by Dept. and authorized private carts during 1899; this amounted all told to 1,220,664 loads, which is equivalent to 1,884,000 cu. yds., or an average daily quantity of 6,020 cu. yds., with an average daily maximum during March of 7,800 cu. yds. and an amount on maximum day of 8,500 cu. yds.

GOVERNMENT WORK.

Ft. Barrancas, Fla.—Bids are wanted Nov. 23 for sinking a well at Ft. MacRee, Fla. Address, W. E. Cole, Q. M.

Ft. Sill, Okla. Ter.—Bids are wanted Nov. 28 for erecting a forage storehouse at Ft. Sill, Okla. Ter. Maj. John W. Pullman, Ch. Q. M., Omaha, Neb.

Ft. Adams, R. I.—Bids are wanted Nov. 14 for erecting a brick building for fire apparatus; also until Nov. 20 for erecting a bake house, including electric conduit and wiring, at Ft. Adams. Address H. C. Schumm, Q. M.

Pawhuska, Okla. Ter.—Bids are wanted Nov. 26 for furnishing building materials at the Osage Agency as follows: Stone, cement, lime, roofing, etc. Address O. A. Mitscher, Indian Agent.

Philadelphia, Pa.—Bids are wanted Nov. 23 for furnishing and installing a steam heating system in a workshop and boiler house at the Navy Yard, League Island, Pa. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Norfolk, Va.—Bids are wanted Nov. 30 for constructing slips for mooring torpedo vessels at the Navy Yard, Norfolk. Estimated cost, $70,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

San Francisco, Cal.—Bids are wanted Dec. 7 for constructing a pile and concrete quay wall at the Navy Yard, Mare Island, Cal. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Warren, Mass.—Bids are wanted Nov. 15 for erecting a brick guard-house at Ft. Warren. Lieut. Edw. Hill, Q. M., Ft. Warren, Boston.

Olongapo, P. I.—The main report of the Naval Board, which has prepared plans for the proposed naval station at Olongapo, shows the project to be extremely expensive.

Washington, D. C.—The contract for erecting the building for the marine corps headquarters at the marine barracks is stated to have been awarded to Herman Probst, of New York City, for $45,804.

Tampa, Fla.—Bids are wanted Dec. 4 for removing wreck of Bark "Ceres," Key West Harbor, Fla. Capt. Herbert Deakyne, Corps Engrs., U. S. A.

Governors Island, N. Y.—The following bids for building rip rap bulkhead at Governors Island were opened Nov. 2 by Maj. W. L. Marshall, Corps Engrs., U. S. A., N. Y. City.: Prices are per ton of rip rap: Remano V. Perini, Wilmington, Del., 74 cts.; O'Brien Bros., N. Y. City, 47 cts.; Brown & Fleming, N. Y. City, 35 cts.; E. S. Belden, Hartford, Conn., 69 cts.; John H. Bouker, N. Y. City, 53 cts.

Narragansett Bay, R. I.—The following bids were received Nov. 2 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of a basin and slips for housing torpedo vessels at the Naval Coal Depot, Narragansett Bay: International Construction Co., New York, $245,000 for work complete according to plans and specifications; $131,000 alternate bid. Appropriation, $140,000.

New York, N. Y.—Bids are wanted Nov. 30 for erecting a 2-story brick and steel building at the Navy Yard, New York. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Washington, D. C.—Bids are wanted by the Bureau of Yards & Docks, Navy Department, until Dec. 21, for completing the construction of 2 coal sheds, 2 steel piers and 24 steel channel beacons at Dry Tortugas, Fla. Mordecai T. Endicott, Ch. of Bureau.

Boston, Mass.—The following bids were opened Nov. 2 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing 2 brick and steel buildings at the Boston Navy Yard, appropriation $121,000: *a*, for shop; *b*, for electric light building; *c*, for both buildings: L. L. Leach & Son, Chicago, *a* $104,500, *b* $41,600, *c* $145,600; Mead, Mason & Co., Boston, *c* $155 000; J. H. Colson & Son, Boston, *a* $112,000, *b* $44,000, *c* $156,000.

New York, N. Y.—The following bids were opened Nov. 7 by the Supervising Architect, Treasury Dept., Washington, D. C., for the general construction of the U. S. Custom House at New York City: Jno. Griffiths & Son, Chicago, $2,295,000; Jno. Peirce, New York, $2,187,000, $2,287,000 and $2,387,000; P. J. Carlin & Co., Brooklyn, $2,227,776 and $2,319,632; Norcross Bros., New York, $2.284,000 and $2,384,000; W. A. & A. E. Wells, Chicago, $1,929,535; Isaac A. Hopper & Son, New York, $3,000,000; Jno. C. Rodgers, New York, $2,092,000 and $2,030,000; D. H. Hayes Co., Chicago, $2,391,000 and $2,297,000.

Fitchburg, Mass.—The following bids were opened Nov. 6 by the Supervising Architect, Treasury Dept., Washington, D. C., for the construction, including heating and electric wiring, of the U. S. Post Office at Fitchburg: Kehr & Felton, New York, $96,435; Ambrose B. Stannard, New York, $107,459; Chas. McCaul Co., Philadelphia, Pa., $97,495; J. W. Bishop & Co., Worcester, Mass., $108,266; Richardson & Burgess, Washington, D. C., $94,700; Carpenter & Williams, Norwich, Conn., $99,543; Mead, Mason & Co., Boston, Mass., $107,973; Mack & Moore, Boston, Mass., $106,600.

Ft. Leavenworth, Kan.—Capt. D. E. McCarthy, Q. M., U. S. A., writes that the following are the lowest bids opened Oct. 26 for the construction of buildings, etc., at Ft. Leavenworth:

For construction—J. W. Wright, Leavenworth, Kan., light artillery stable, $16,700; Ziegler & Dalton, Junction City, Kan., bachelor officers' quarters, $30,976; 6 sets infantry barracks, $185,526; band barracks, $12,626; V. A. Kelly, Leavenworth, artillery barracks, $28,000; artillery gunshed, $6,466; 14 double sets lieutenants' quarters, $144,640; artillery guard-room, shops, etc., $5,000; Coldren & Barnes, Leavenworth, barracks No. 45, $69,713.

For heating—Peoria Heating & Plumbing Co., Peoria, Ill., barracks No. 45, $3,024; bachelor officers' quarters, $2,840; Barr & Creelman, Rochester, N. Y., 14 double sets lieutenants' quarters, $8,426; Harris & Algor, Camden, N. J., band barracks, $1,249; 6 infantry barracks, $16,044; artillery barracks, $3,197.

For plumbing—Peoria Heating & Plumbing Co., barracks No. 45, $10,200; band barracks, $1,490; artillery barracks, $3,500; artillery stable, $700; James Foley, Leavenworth, Kan., 6 infantry barracks, $18,954; artillery guard-room, etc., $389; Tholen Brothers, Leavenworth, Kan., bachelor officers' quarters, $4,219; 14 sets lieutenants' quarters, $11,378.

For electric wiring—E. M. Reed & Co., band barracks, $262; 6 infantry barracks, $3,327; artillery barracks, $458; artillery guard-room, etc., $80; bachelor officers' quarters, $939; 14 double sets lieutenants' quarters, $3,587.

MISCELLANEOUS.

Sioux City, Ia.—Bids are wanted Nov. 12 (not Nov. 5, as previously stated), for excavating a channel to connect Floyd River with Missouri River, and filling a portion of the old channel with material excavated from the new; also for pile and rock protection at point of cutoff and at mouth of new channel. Estimated cost, $17,000. A. Hermann, Chmn. of Health Com.

Mounds View, Minn.—Bids are wanted Nov. 12 for constructing a Marsden Lake Ditch. W. R. Jones, Co. Aud., St. Paul.

Cincinnati, O.—Bids are wanted Nov. 18 for constructing a retaining wall and stone steps at Ellen and Kilgour Sts. Jacob E. Cormany, Chmn. Com. on Bldgs. & Repairs, Bd. Educ.

Stillwater, N. Y.—A bill has been passed by the Legislature providing for the construction, by the State, of a dam at Stillwater by the appropriation of $85,000.

Vinton, La.—The citizens have accepted the proposition of Sam'l Robinson, of the Houston River Canal Co. (capitalization $200,000), to build an irrigation canal from Sabine River eastward.

Boston, Mass.—Bids are wanted by the Harbor and Land Commissioners, Room 131, State House, until Nov. 14, for building timber jetties and dredging at the mouth of the Bass River, in the towns of Dennis and Yarmouth. Woodward Emery, Chmn.

Chicago, Ill.—Bids are wanted by the Board of Trustees of the Sanitary District of Chicago, until Jan. 2, for dredging the main Chicago River and the south branch of Chicago River, and docking that portion of the river front contiguous to the portions dredged, together with other work collateral thereto. A. R. Porter, Clk.

Buffalo, N. Y.—R. G. Parsons, Sec'y Bd. of Pub. Wks., writes that the following bids for dredging Buffalo River and the City Ship Canal, including removal of rock, were opened Oct. 31: *a*, Buffalo River; *b*, City Ship Canal: Jas. B. Donnelly, Buffalo, *a* $67,200, *b* $43,980; Buffalo Dredging Co., Buffalo, *a* $59,340 (awarded), *b* $40,375 (awarded); Hingston & Woods, Buffalo, *a* $61,000, *b* $41,000.

Providence, R. I.—Local press reports state that the Providence Dock & Warehouse Co., Geo. H. Webb, organizing manager and Treas., proposes to construct a plant which will include a sea wall 344 by 6 ft., a covered pier 600 by 150 ft., a 4-story cold storage warehouse, 300 by 100 ft., a 3-story fireproof general warehouse, 240 by 100 ft., and a covered shed, 160 by 50 ft.

Seattle, Wash.—The Northern Pacific Railway Co. is stated to have awarded the constract for constructing a wharf, to be known as Pier No. 2, to the Seattle Bridge Co. Estimated cost of wharf proper, $60,000, with $20,000 additional for the superstructure or warehouse and office rooms.

Benton Harbor, Mich.—The Board of Trade has requested the City Council to call a special election to vote on the issue of $200,000 bonds for general improvements.

Boston, Mass.—Governor Crane has appointed Pres. Henry S. Pritchett, of the Massachusetts Institute of Technology, Col. Samuel M. Mansfield, Corps of Engrs., U. S. A., New York, and Richard H. Dana, of Cambridge, as the committee to consider the advisability of constructing a dam across Charles River, between Boston and Cambridge.

NEW INDUSTRIAL PLANTS.

The Penberthy Injector Co., Detroit, Mich., has let contracts for a 2-story, 50 x 70-ft. brick factory building in Windsor, Ont., in which a power plant of about 50 H.-P. will be installed.

The Manistee, Mich., Novelty Co. is building a 3-story, 62 x 170-ft. main building, 30 x 40 and 18 x 30-ft. engine and boiler house, 40 x 50-ft. dry kiln, and a 3-story, 50 x 100-ft. warehouse. A 75 to 100-H.-P. engine, a 100 to 125-H.-P. boiler, dust-collecting system, a 150-light dynamo, power elevators and a few wood-working machines will be installed.

Fred Q. Hartman, Danville, Pa., will erect a new mill in Berwick, Pa., the main building to be brick, 53 x 344 ft.

The Globe Fertilizer Co., 321 Equitable Bldg., Louisville, Ky., expects to build large sulphuric acid and fertilizer plants, but plans have not been completed.

James Orr, South Attleboro, Mass., will erect a 4-story, 152 x 45-ft. main building with a 56 x 35-ft. wing, a 56 x 32-ft. engine and boiler room, a 100 x 50-ft. dye-house and a 60 x 20-ft. dry house, to be used to color, spool, warp and twist cotton and worsted yarns.

The West Columbus Shoe Co., Columbus, O., will erect a 3-story, 40 x 120-ft. factory in the spring, and expects to purchase a 20-H.-P. engine.

The J. C. Grant Chemical Co., 110 W. Lake St., Chicago, will erect a factory at E. St. Louis to cover 150 x 136 ft. An electric power plant of 30 to 50 H.-P. will probably be installed.

A. J. & F. F. Bentley, Niles, O., and others, have formed the Ohio Galvanizing & Mfg. Co., with a capital of $100,000, for making galvanized sheet iron, range boilers, tanks, etc. The company is in the market for all kinds of machinery, and expects to be making galvanized iron by the first of the year.

The Randleman, N. C., Hosiery Mills are erecting a 2-story, 40 x 90-ft. building, and are in the market for a 40-H.-P. boiler, a 30-H.-P. engine and a 75-light dynamo.

The Fernholtz Brick Mchy. Co., St. Louis, Mo., has put in the foundation for a 2-story, 80 x 100-ft. factory, to be equipped with modern machinery.

The National Printing & Engraving Co., 346 Wabash Ave., Chicago, expects to remove its plant to Niles, Mich., and is erecting 100 x 300 and 60 x 300-ft. buildings. The company is in the market for a 20-H.-P. gas engine.

The Diamond Boiler Works, Minneapolis, Minn., are building a 60 x 110-ft. boiler shop. The power plant will have a capacity of about 35 H.-P.

The Southern Engine & Boiler Works, Jackson, Tenn., will erect a 160 x 115-ft. machine shop, engine room 40 ft. square, 24 x 40-ft. boiler room, 31 x 50-ft. blacksmith shop and a 70 x 120-ft. foundry. Machine tools and two 10-ton electric traveling cranes will be installed.

The Schroon River Pulp & Paper Co., Warrensburgh, N. Y., is erecting a 200 x 42-ft. machine room, 62 x 80-ft. engine and beater room and a boiler room 42 ft. square. A steam plant of 300 to 350 H.-P. will be used.

The Hydraulic White Brick Co. has been organized at Wilmington, N. C., and will erect a new factory. Andrew Smith, Vice-Pres. & Gen. Mgr.

E. Gerhard & Son, Fredericksburg, Pa., want bids for running their shirt factory electrically from a water power plant 4 miles distant.

Kramer Bros., Wellington, Kan., will erect a 20-ton ice plant.

The New Castle, Ind., Bridge Co. is erecting a 100 x 300 plant, with a number of smaller buildings, at Indianapolis.

BUSINESS NOTES.

The Ball Engine Co., Erie, Pa., reports the receipt of the following orders: A 300-H.-P. and an 80-H.-P. engine for the Latrobe, Pa., Steel Co.; a 300-H.-P. side crank engine for the Sagamore Coal & Coke Co., Bramwell, W. Va.; a 225-H.-P. horizontal tandem compound engine, direct-connected to a 132-Kw. Westinghouse alternating machine, for the Cloquet, Minn., Lumber Co., and for engines direct-connected to generators, for the Philadelphia, Pa., Post Office.

The National Portland Cement Co., Ltd., Janes Bldg., Toronto, Ont., is engaged in the construction of the largest cement mill in Canada, for which most of the machinery has been purchased. W. B. Bogardus is chief engineer of the works.

The F. D. Cummer & Son Co., Cleveland, reports the following recent sales of its Cummer dryers: One to the Cleveland Iron Ore Paint Co., for drying iron ore; one to the St. Louis Portland Cement Co., for drying coal; one to the Acme Mfg. Co., Wilmington, N. C., for drying marl; one to the Silver King Mining Co., Park City, Utah, for drying concentrates and sticky slimes; one to the Green Island Cement Co., Hong Kong, China, for drying blue clay, this being the third order from the company for Cummer dryers.

Pres. Henry Vogt of the Henry Vogt Machine Co., Louisville, has been visiting large manufacturing plant, in different parts of the country to secure hints for laying out the company's new 15-acre plant. It is expected that the new works will be in operation early in the spring, and will turn out a new water-tube boiler, as well as absorption ice and refrigerating machinery.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Nov. 12.	Grand Rapids, Mich	Oct. 12
	Adv., Eng. Record, Oct. 12, 26.	
Nov. 12.	Troy, N. Y	Nov. 2
Nov 12.	Harrisburg, Pa	Nov. 9
Nov. 15.	Mantua, O	Nov. 9
Nov. 15	Cincinnati, O	Oct. 9
Nov. 18.	Portland, Ore	Nov. 2
Nov. 20.	Scammon, Kan	Oct. 26
	Adv., Eng. Record, Oct. 26.	
Nov. 20.	Meters, Cleveland, O	Nov. 2
Nov. 21.	Boston Mass	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Nov. —.	West Lebanon Ind	Oct. 19
Nov. —.	Farmersville, Tex	Oct. 12
Dec 1.	Bement, Ill	Nov. 9
Dec 2.	Fayette, Miss	Nov. 9
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 4.	Sale of pumping works Chicago, Ill	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Dec. 10.	Wilmington, O	Nov. 9
Dec 17	New York, N Y	Oct. 19
Dec. —.	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. —.	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
——	Johnson City, Tenn	Nov. 2

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close		See Eng. Record.
Nov. 11.	Swissvale, Pa	Nov. 9
Nov. 11.	Canon City, Colo	Nov. 9
Nov. 11.	Duluth, Minn	Nov. 9
Nov. 11.	Jacksonville, Ill	Nov. 9
Nov. 11.	Ft. Dodge, Ia	Nov. 9
Nov. 12.	New Rochelle, N. Y	Nov. 2
Nov. 13.	Brooklyn, N. Y	Nov. 2
Nov. 13	New York, N. Y	Nov. 2
Nov. 14.	Moorestown, N. J	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Nov. 15.	Pittsburg, Pa	Nov. 9
Nov. 16.	Chicago, Ill	Nov. 2
Nov. 16.	Roswell, N. Mex	Oct. 19
Nov. 18.	Sheridan, Ind	Nov. 2
Nov. 18.	Kokomo, Ind	Nov. 2
Nov. 18.	Providence, R. I	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Nov 19.	Auburn, Ind	Nov. 2
Nov. 20.	Durham, N. C	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Nov. 23.	Canton, O	Nov. 9
Nov. 29.	Binghamton, N. Y	Nov. 9
Nov. 29.	Glenville, O	Nov. 9
Dec. 1.	Pasadena, Cal	Nov. 9
——	Washington, Ia	Nov. 2
——	Pomona, Cal	Nov. 9

BRIDGES.

Bids Close		See Eng. Record.
Nov. 11.	Superstructure, Buffalo, N. Y	Nov. 2
	Adv., Eng. Record, Nov. 2.	
Nov. 12.	Sherbrooke, Que	Oct. 26
	Adv., Eng. Record, Oct. 26, Nov. 2.	
Nov. 12.	Urbana, Ill	Nov. 9
Nov. 12.	Lafayette, Ind	Nov. 9
Nov. 14.	Walhalla, S. C	Nov. 9
Nov 16.	Lake Charles, La	Oct. 26
Nov. 16.	Jasper, Ga	Nov. 9
Nov. 20.	Bennington St. bridge, Boston, Mass	Nov. 9
Nov. 20.	Brooks St. bridge, Boston, Mass	Nov. 19
Nov. 25.	Maxtown, O	Nov. 9
Nov. 30.	Cincinnati, O	Nov. 9
Dec. 12.	Saginaw, Mich	Nov. 9
Dec. 14.	Melan arch bridge, Des Moines, Ia	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Dec. 14.	Steel bridge, Des Moines, Ia	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Feb 28.	Sidney, N. S. W	June 22
	Adv., Eng. Record, June 22 to July 13.	
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

Bids Close		See Eng. Record.
Nov. 11.	Jacksonville, Ill	Nov. 9
Nov. 11.	Hutton, Ill	Nov. 9
Nov. 12.	New York, N. Y	Nov. 2
Nov. 12.	Troy, N. Y	Oct. 26
Nov. 12.	Wellsville, O	Oct. 26
Nov. 13.	Toledo, O	Oct. 19
Nov. 14.	Mobile, Ala	Nov. 2
Nov. 15.	Brooklyn, N. Y	Nov. 9
Nov. 18.	Toledo, O	Oct. 26
Nov. 18.	Toledo, O	Nov. 9
Nov. 19.	East Chicago, Ind	Nov. 9
Nov. 23.	Washington D. C	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Dec. 2.	Toledo, O	Nov. 9
Dec. 3.	Jeffersonville, Ind	Nov. 2

POWER, GAS AND ELECTRICITY.

Bids Close		See Eng. Record.
Nov. 11.	Casey, Ill	Nov. 9
Nov. 14.	Cable, Baltimore, Md	Nov. 9
Nov. 18.	Alameda, Cal	Nov. 9
Nov. 18.	Franchise, Oakland, Cal	Oct. 26
Nov. 20.	Wiring post office, Kansas City, Mo	Nov. 2
	Adv., Eng. Record, Nov. 2.	
Nov. 20.	Columbia, S. C	Nov. 9
Nov. 21.	Philadelphia, Pa	Nov. 9
Nov. 23.	Zion City, Ill	Nov. 2
Nov. 26.	Lancaster, Pa	Nov. 9
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 2.	Franchise, Whittier, Cal	Nov. 9
Dec. 10.	Wilmington, O	Nov. 9
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
——	Gas plant, Boonton, N. J	Nov. 9

GOVERNMENT WORK.

Bids Close		See Eng. Record.
Nov. 14.	Portland, Ore	Oct. 19
Nov. 14.	Bldg. for fire apparatus, Ft. Adams, R. I.	Nov. 9
Nov. 15.	Guard house, Ft. Warren, Mass	Nov. 9
Nov. 18.	Boston, Mass	Nov. 2
Nov. 19.	Ft. Terry, N. Y	Oct. 19
	Adv., Eng. Record, Oct. 19, 26, Nov. 9.	
Nov. 20.	Ft. MacKenzie, Wyo	Oct. 26
Nov 20.	Wiring, Kansas City, Kan	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Nov. 20.	Bake house, Ft. Adams, R. I.	Nov. 9
Nov. 21.	Savannah, Ga	Oct. 26
Nov. 21.	Mobile, Ala	Oct. 26
Nov. 22.	Sullivans Island, S. C	Oct. 26
Nov. 23.	San Francisco, Cal	Oct. 26
Nov. 23	Htg. bldg., Philadelphia, Pa	Nov. 9
Nov. 23.	Ft. Barrancas, Fla	Nov. 9
Nov. 26.	Pawhuska, Okla. Ter	Nov. 9
Nov. 27.	Annapolis, Md	Oct. 26
Nov. 28.	Ft. Sill, Okla. Ter	Nov. 9
Nov. 29.	Htg. and vent., Kansas City, Kan	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Nov. 30.	Slips, Norfolk, Va	Nov. 9
Nov. 30.	Bldg., New York, N. Y	Nov. 9
Nov. 30.	San Francisco, Cal	Oct. 12
Dec. 2.	Htg. apparatus, Clinton, Ia	Oct. 19
	Adv., Eng. Record, Oct. 19, 26.	
Dec. 3.	Wiring, etc., Clinton, Ia	Oct. 19
	Adv., Eng. Record, Oct. 19, 26.	
Dec. 3.	Coaling plant, Stanley Point, Manila Bay P. I	June 15
Dec. 4.	Tampa, Fla	Nov. 9
Dec. 7.	Quay wall, San Francisco, Cal	Nov. 9
Dec. 11.	Milwaukee, Wis	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Dec. 17.	Creston Ia	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Dec. 21.	Washington, D. C	Nov. 9

BUILDINGS.

Bids Close		See Eng. Record.
Nov. 11.	Hospital, Johnson City, Tenn	Oct. 12
	Adv., Eng. Record, Oct. 12 to Nov. 9.	
Nov. 11.	School, Scranton, Pa	Nov. 9
Nov. 11.	Church, Emporia, Kan	Nov. 9
Nov. 12.	Dwellg., National Home, Wis	Nov. 9
Nov. 12.	City hall, Butte, Mont	Nov. 9
Nov. 13.	Bus. bldgs., Paterson, N. J	Nov. 9
Nov. 14.	Pub. bldg., Turtle Creek, Pa	Nov. 9
Nov. 14.	Pub. bldg., National Soldiers Home, Va	Oct. 26
Nov. 14.	Add'ns, etc., to Capitol, Tallahassee, Fla	Oct. 5
Nov. 14.	School, Milwaukee, Wis	Nov. 2
Nov. 15.	School, San Marcos, Tex	Nov. 2
Nov. 15.	Church, Gatesville, Tex	Nov. 9
Nov. 15.	Bus. bldg., Springfield, O	Nov. 9
Nov. 18.	Htg. Pub. bldg., New York, N. Y	Nov. 9
Nov 18	Htg. school, Kingston, Ont	Nov. 2
Nov. 18.	School, Schenectady, N. Y	Nov. 2
Nov. 18.	Court house, Jackson, Miss	Oct. 19
Nov. 18.	School, Brooklyn, N. Y	Nov. 9
Nov. 18.	School, South Bend, Ind	Nov. 9
Nov. 20.	Court house, Asheville, N. C	Nov. 2
Nov. 20.	Pub. bldg., Toronto, Ont	Nov. 9
Nov. 21.	Excav. at library, New York, N. Y	Nov. 9
Nov. 22.	Court house, Greenville, Ga	Oct 12
Nov. 30.	Capitol plans, Harrisburg, Pa	Aug. 31
Nov. 30.	School plans, Oshkosh, Wis	Nov. 9
Dec. 1.	Library plans, Fresno, Cal	Oct. 26
Dec. 1.	Bus. bldg., Mobile, Ala	Nov. 9
Dec. 2.	Jail, Crockett, Cal	Nov. 9
Dec. 2.	Court House, Hazelhurst, Miss	Oct. 19
Jan. 1.	School, Flint, Mich	Nov. 2
——	Htg., etc., bank bldg., Saltillo, Mex	Nov. 9

MISCELLANEOUS.

Bids Close		See Eng. Record.
Nov. 12.	Ditch, Mounds View, Minn	Nov. 9
Nov. 12.	Sioux City, Ia	Nov. 9
Nov. 14.	Dredging, Boston, Mass	Nov. 9
Nov. 16.	Garb. crematory, Canton, O	Oct. 26
Nov. 16.	Levee work, Port Allen, La	Nov. 2
Nov. 18.	Retaining wall, Cincinnati, O	Nov. 9
Nov. 19.	Shed, New Orleans, La	Oct. 26
	Adv., Eng. Record, Oct. 26, Nov. 9.	
Nov. 25.	El. Ry. power house, Tribes Hill, N. Y.	Nov. 9
Nov. 26.	El. Ry., Celina, O	Nov. 9
Dec. 31	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 2

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The New Orleans Water Situation.

The history of the water supply of New Orleans is, to the non-resident, as entertaining and full of strife as it is possible to make an affair of this sort. Several years ago, Col. L. H. Gardner presented an interesting account of the involved litigation over the supply before the American Water-Works Association, and within a few days the Louisiana Supreme Court has filed an elaborate opinion in a suit involving the franchise of a company having a monopoly of a supply from the Mississippi River, in which company the city of New Orleans is the largest stockholder, but with which it has nevertheless been at pretty constant warfare. To the student of municipal affairs few such complicated stories are presented as that told by Col. Gardner and in the opinion of the court, and it is worth while here to point out a few of its strange features as a warning against a mixed public and private ownership of such plants.

When it was finally determined in 1833 to build water-works for the city, a company was formed for the purpose, the city taking one-sixth of the total capital stock. It may be remarked that with the slyness characteristic of similar incorporations of the time elsewhere, the name of the company was fixed as "The Commercial Bank." The life of the company was placed at thirty-five years; and when that term expired the property was taken over, as provided for in the charter, by the city. The value of the property was appraised at the time at $2,000,000, probably two or three times its true worth, according to the Supreme Court, and the city paid for the portion not covered by its own interest as a shareholder by issuing bonds worth much less than par. Honors in the transaction were fairly even therefore.

From January, 1869, to March, 1878, the management of the works was in the hands of city officials. Rates were high. No attempt was made to improve the quality of the supply, and the earnings dwindled to such a figure that the payment of interest on the bonds was a very uncertain occurrence. To relieve the situation the Legislature decided to authorize the incorporation of the New Orleans Water-Works Company, and after amending the original terms of the proposed charter so that private capitalists could be induced to take the matter up, the city's property was finally transferred to this corporation in 1878. The company was capitalized at $2,000,000, of which over half was subscribed in one way or another by the city. In spite, however, of this ownership, the city has been represented on the board of seven trustees by only two or three members, who were in a minority and unable to change methods of management had they desired to do so. The company was required to furnish water at rates not exceeding those previously charged by the city. After it went into business it was frequently sued by consumers for making such charges, and the Supreme Court several times directed it to adopt the rates fixed by its charter. The charter allowed the company a monopoly for fifty years of supplying the city with water, and it was permitted to construct such works "as may be required for securing and carrying a full supply of pure water to said city and its inhabitants." It is perfectly well known that although the company has been paying dividends ever since its incorporation, it has never furnished what may be reasonably called a pure supply of water. Some time ago, when the citizens voted to build sewerage and water-works in order to put the city in a satisfactory sanitary condition, they were confronted with the fact that a monopoly of the privilege of water supply was already in the hands of this company, which, although owned mainly by the city, was not managed as the taxpayers desired. In order to obtain the right to construct works of the character it desired, the city appealed to the legislature for relief. The latter appointed an investigating committee, which rendered a report containing such intricate discussions of law and fact that the legislature straightway turned the whole matter over to the Attorney-General with authority to act in the premises as he deemed proper. Thereupon, nearly two years ago, the State sued to have the company's franchise declared forfeited.

After an unusually long period of consideration, the Supreme Court has decided that the company has misused the franchise repeatedly and that it has persistently disregarded its charter provisions concerning rates; therefore, the Court has decreed the forfeiture of the charter and all the franchises conferred on the company and the latter is ordered to pay the cost of the legal proceedings. The city is thus able to go ahead with its municipal water-works, but in so doing it has inflicted upon itself a serious loss as the leading stockholder in the company. The lesson of this affair is that a public utility undertaking under mixed private and public ownership is a source of constant bickering and probably of serious eventual loss. The interests involved are too conflicting to be harmonized in any way.

The Short-Circuiting Cat is apparently not the least of the annoyances that have to be borne by the station managers of long-distance electric-power transmission institutions. From Lockport, N. Y., comes the report that at Hoffman, a small hamlet west of the city, an innocent pussy climbed a pole and tried to walk on a feed wire of one of the lines of the Niagara Falls Power Company. Her tail touched a parallel wire, the circuit was closed and fuses blew. The body, it is stated, did not drop to the ground, but fell across both wires; and it was two hours, the report continues, before the cause of the trouble was located, a number of electric railway and street lighting plants in western New York being in the meantime without power.

The Rankin Bridge.

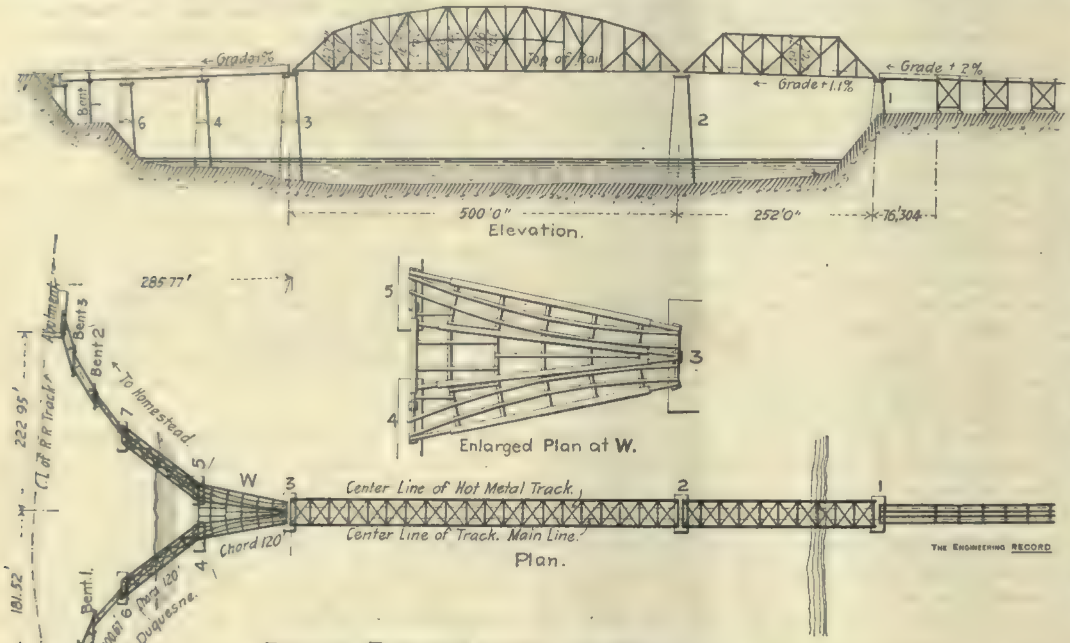
The main line and the hot-metal track of the Union Railroad cross the Monongahela River at Rankin, Pa., on a double-track through bridge near the Homestead Steel Works and a mile and a half below the Port Perry crossing of the same railroad, which was described in The Engineering Record of April 28 and May 19, 1900. The Rankin Bridge has a total length of about 2,211 feet, crosses the river channel with two main spans 500 feet and 252 feet long on centers of piers, and has plate girder approach viaducts on both shores. At the north end of the bridge the tracks curve about 90 degrees and run downstream to the Carrie furnaces, and at the south end they run in single lines, each of which curves 90 degrees in opposite directions, one running upstream to Duquesne, and the other downstream to Homestead. The bridge is notable for the massive construction required for the very heavy loading specified, which produced a weight of about 5,000 tons for the superstructure, and for the special design of the river end of the south approach, where the crossing and diverging of the tracks in the Y-shaped junction resulted in an elaborate arrangement of heavy plate girders, forming a triangular platform about 80 feet wide and 120 feet long, supported over the river on three masonry piers.

The two tracks are 14 feet 4½ inches apart. One of them will be chiefly used to supply coke and ore to the Carrie furnaces and the other one for a hot-metal route between the Carrie furnaces and the Homestead works. Ladle cars will be run over the hot-metal track, which will have two double lines of rails supported on 10-inch I-beams 18 inches apart instead of on wooden ties, and there will be a wide and deep steel trough enclosing the track and lined with fire brick, similar to that described on the Port Perry bridge, to prevent radiation of heat and to protect the structure and adjacent trains, boats or people from the molten metal in case it should spill or spatter.

The live load assumed for each track consists of two 192½-ton locomotives followed by a train load of 5,000 pounds per lineal foot, and the dead load of the 500-ft. span amounts to about 7,500 pounds per lineal foot. In the calculations an equivalent uniform load was substituted for the locomotive excess, and to determine it the diagrams here presented were prepared to give a comparison with the loadings which would be imposed by the locomotive-excess weights of other railroads. One diagram of spans from 100 to 550 feet, varying by 25-foot increments, shows the equivalent load for two 192½-ton locomotives to vary from 3,390 pounds to 3,690 pounds, while for two 150-ton locomotives, Chicago & Alton Railroad standard, it varied from 2,260 pounds to 2,900 pounds, and for two 125-ton locomotives of the Pennsylvania Railroad standard it varied from 1,940 pounds to 2,240 pounds. In the larger scale diagram, made for deck-girders of 10 to 130-foot spans, the corresponding equivalent uniform loads were respectively 3,550 to 6,750 pounds; 2,475 to 5,300 pounds, and 2,050 to 5,000 pounds, although the equivalent for the last case was only 3,500 pounds for a span of 27 feet. In the first diagram the curves are very flat and regular, and in the second diagram they are, as might be expected, much sharper and irregular, some of them even reversing for the shorter spans. Another diagram made for maximum end shears in spans of 10 to 130 feet gave 130,000 pounds for the two 192½-ton locomotives on a 107½-foot span; 170,000 pounds for the two 150-ton locomotives on a 120-foot span and 147,000 pounds for the two 125-ton locomotives on a 120-foot span. In this diagram the curves were very regular and were flat or tangential, except near the origin.

Careful computations were made of the deflections of the trusses under live and dead loads, both by analytical and graphical methods, and the camber was calculated to be a little greater than the maximum deflection, and was obtained by adding variable increments to the sub-panel lengths of the top chords, the bottom chord sub-panel lengths being uniformly 24 feet 9 13/32 inches. The deflections and distortions of members in the 550-foot span were plotted in the simple diagrams here given, and they were also computed from the lengths and unit stresses of the respective members, as shown in the table, which serves also as a strain sheet for vertical loads. In it P is the stress per square inch, 1 is the length in feet, E is the modulus of elasticity, assumed to be 29,000,000 pounds per square inch, and μ is the stress in a member due to a load of one pouhd at the center of the truss. The total deflection thus obtained by the analytical method was 6 39/64 inches, and by the graphical method was 6 53/64 inches.

The calculations were made in accordance with Mr. D. A. Molitor's graphical method of determining the distortion of framed structures, and with Professor J. B. Johnson's analytical method.



PLAN AND ELEVATION OF THE RANKIN BRIDGE.

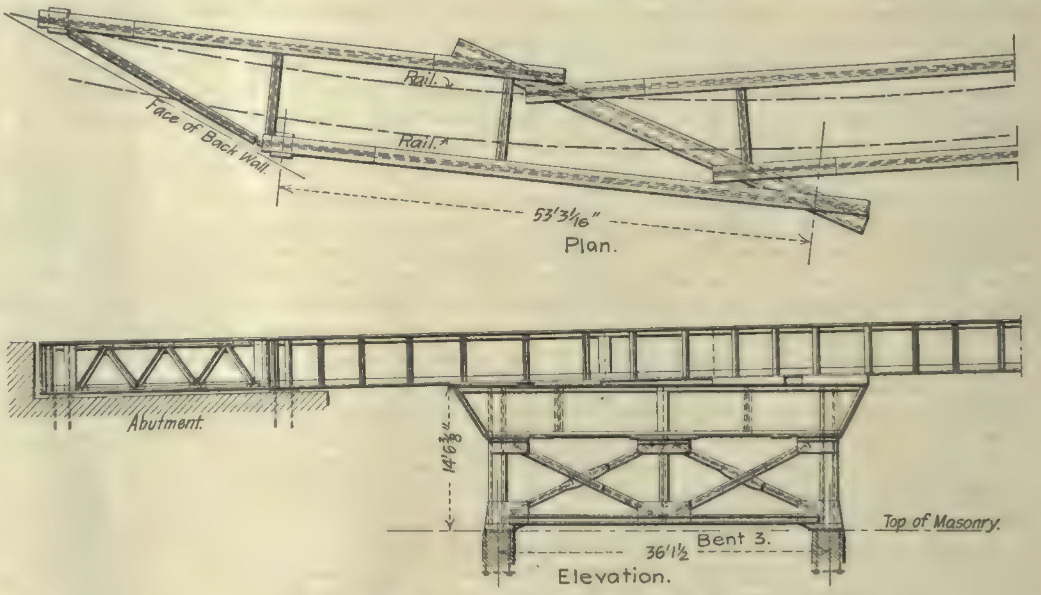
The graphical method has been found the most expedient in making camber calculations, inasmuch as the position of each bottom chord pin can be determined by making one diagram, as here shown. The camber line for the unloaded truss, as shown in the diagram, serves to show the erector the amount of blocking required under each of the bottom chord pins. In determining the amount of blocking required or the deflection at each panel point by the analytical method it would be necessary to make a separate calculation for each panel in a truss, placing the load at the point in question and finding the stresses and values of μ for each change in position of the load. In the camber calculations for the truss here described the analytical method was used as a check on the graphical method for the deflection at the center of the truss. The changes due to change of temperature have not been considered, and the vertical displacement due to temperature effect has been neglected. Unfortunately levels were not taken on the completion of this work, therefore a comparison of the computed and actual deflections of the bottom chord could not be made.

The trusses for the 500-foot span are 495 feet 8⅛ inches long, 81½ feet in maximum depth and 33 feet apart on centers. The top chord changes its inclination at every main panel point except the middle one. Each panel is subdivided by a middle vertical member which is pin-connected to the main diagonal and to the lower chord bars. The sub-verticals are also pin-connected at the center to the longitudinal and diagonal secondary members indicated in the elevation diagram, and to floor-beams just above the bottom chord bars. The tops of the sub-verticals and the ends of the longitudinal members are flange-riveted to the main truss members and all main panel points are pin-connected. There is a top lateral strut, a floorbeam and a transverse vertical sway bracing at every panel and sub-panel point, and stiff top and bottom lateral X-bracing in every panel. At the panel next beyond the hip joint there is no intermediate horizontal transverse sway brace strut, and there is only one set of X-braces there, but in every other panel between this point and the center of the span there is an intermediate strut and an upper and a lower set of X-braces. All the truss connections of the lateral and sway brace systems are field riveted.

In each portal there is a top and a bottom horizontal strut, about 16 feet apart in the clear, which are connected by a strut between their center points, and one panel of X-bracing. Each strut consists of two plate girders with single flange angles. One girder has its web riveted across the upper side of the flanges of the inclined end post, and the other is opposite to it and riveted across the flanges on the under side of the end post. The lower strut has solid-web triangular knee-braces on the under side at both ends. The braces between the main struts have I-shaped cross-sections and are made of two pairs of angles, latticed, and have their flanges riveted to double connection plates at their middle intersection and on the end posts at the corners of the panel. The cross-sections and connection details of the top lateral struts are similar to those of the portal braces.

The bottom lateral diagonals are pairs of angles riveted together back to back to make T-shaped sections. In each panel one of these T's has the vertical flange down, and the other has it up, so that they clear each other and allow the horizontal flanges to be riveted together at intersections in the middles of the panels. The ends of the diagonals are field riveted to horizontal plates on the bottoms of the vertical and sub-vertical posts. The diagonals which have their vertical flanges up have their horizontal flanges riveted directly to the upper sides of the connection plates; the other diagonals have their horizontal flanges riveted to the under sides of the horizontal flanges of short connection angles, which are riveted to the upper sides of the plates.

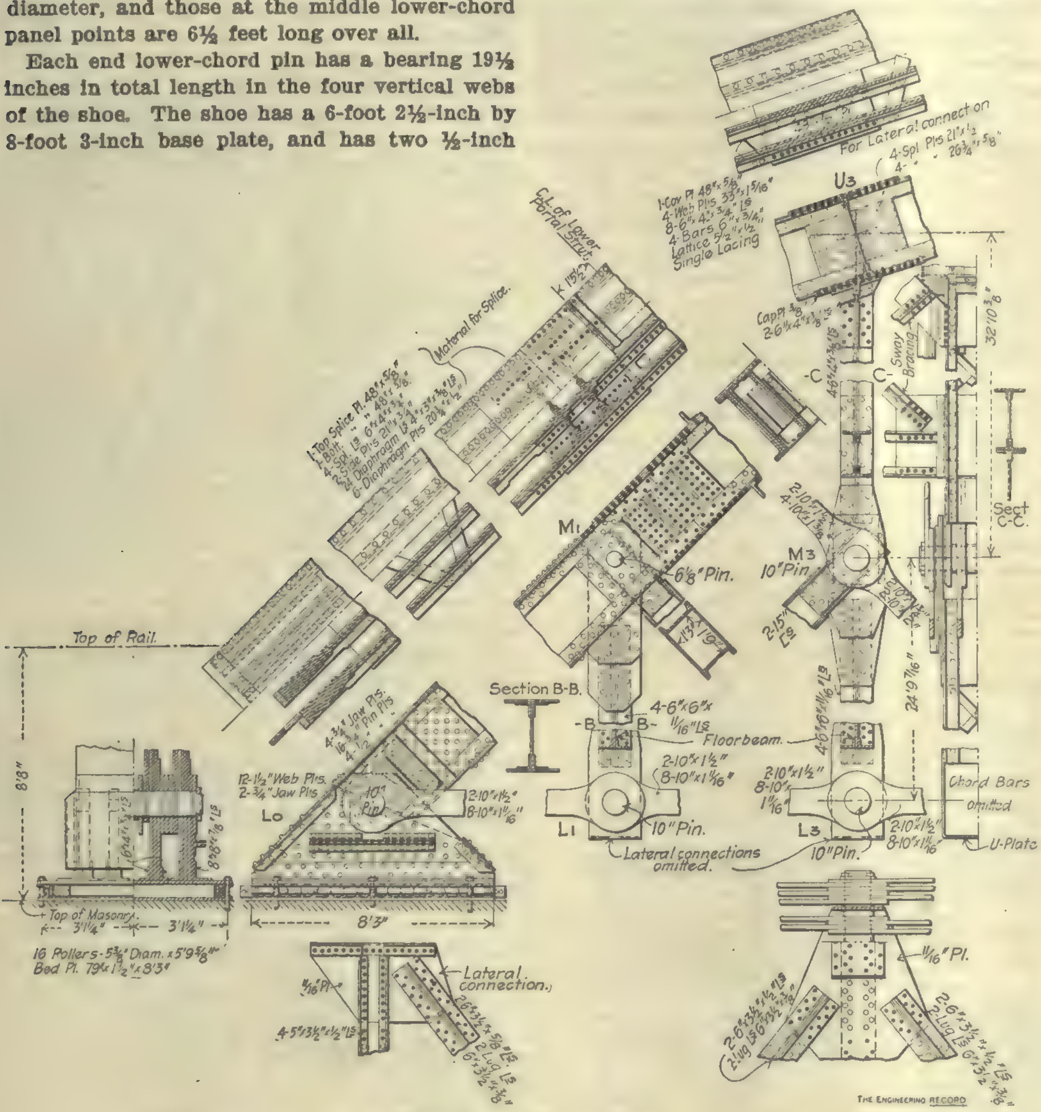
Each track is carried on two lines of plate girder stringers 4¼ feet deep. Under the main track each pair of stringers has two intermediate vertical sway-brace frames and has zigzag top-flange lateral angles in each panel. The hot-metal track is carried on I-beam ties riveted to the top flanges of the stringers, and so much stiffness is provided by them and by the continuous solid plate trough which is riveted to the transverse beams that no other sway or lateral bracing is provided for that track.



SPAN BETWEEN ABUTMENT AND BENT 3.

The top chord throughout is 33 inches deep and 48 inches wide over all, and has four webs, eight 6 x 4-inch flange angles and four vertical reinforcing plates 6 inches wide, riveted to the lower sides of the web plates opposite the flange angles to balance the cross section. The maximum cross-sectional area is 336 square inches, and all the pins, except in the middles of the end posts, are 10 inches in diameter. The vertical posts are made of latticed built channels with their webs in longitudinal planes and stiffened by vertical diaphragms in transverse planes. The maximum cross-section is 83 square inches. The end main diagonal is composed of two 10 x 1¾-inch and two 10 x 2-inch eye-bars in the lower half, and two 10 x 1½-inch and four 10 x 1⅜-inch eye-bars in the upper half, which has a cross-section of 85 square inches. The middle panels of the bottom chord each have four 10 x 2⅛-inch, and ten 10 x 1 11/16-inch eye-bars, with a cross-section of 254 square inches. All the truss pins are 10 inches in diameter, and those at the middle lower-chord panel points are 6½ feet long over all.

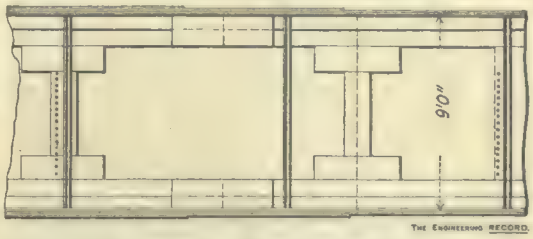
Each end lower-chord pin has a bearing 19½ inches in total length in the four vertical webs of the shoe. The shoe has a 6-foot 2½-inch by 8-foot 3-inch base plate, and has two ½-inch jaw plates by which it is locked to the inclined end post, which has corresponding jaw plates. On the end of the shoe there is a cover-plate in the same plane as the cover-plate of the end post, and a cover splice plate riveted to the bottom of the latter makes a sliding joint between the shoe and end post and closes the former to exclude dust. A narrow plate is riveted across the other end of the shoe to close the lower part of it and yet allow clearance for inserting the eye-bar heads. A horizontal connection plate is field riveted to the web of the shoe on the side toward the center of the bridge, to receive the end lateral strut and diagonals. The collision post and end sub-vertical are pin-connected to the middle of the inclined end post, and just above their pin the post is spliced with field-riveted web and cover plates. There is a transverse diaphragm to stiffen the end-post webs close to the splice each side, as shown in the detail marked M_1, and the splice was field-riveted before the post was erected.



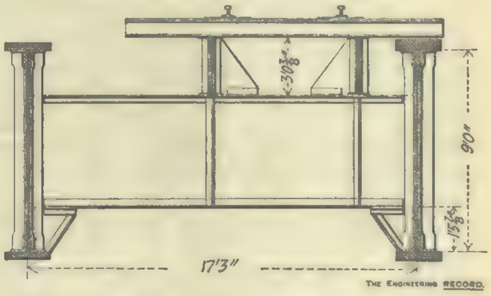
DETAILS OF HEAVY TRUSS.

The general character of the details and connections are shown by the illustrations of the half cross-section of the bridge and by the views of panel points, U_3, M_3 and L_3. The sub-vertical posts are riveted to the under sides of the flanges of the top chords through flange angles and cap plates, and the upper ends of the sway-brace diagonals are field-riveted to corner diaphragm plates which connect the verticals and the top lateral struts. Short sections of shop-riveted transverse web plates project beyond the inner flanges of the sub-vertical posts and receive the connection rivets of the lower ends of the bottom and intermediate sway brace struts and diagonals. The top lateral struts are connected to the top chords by wide horizontal plates, which are field-riveted to their bottom flanges and to both inner flanges of the top chord, and are shop-riveted to the top flanges of the struts, and receive the field-riveted connections of the ends of the diagonals. The main vertical posts have their webs reinforced for about 9¾ feet above their lower ends and connected together by a bent U-plate with its horizontal portion just below the ends of the web. The webs are also connected by the usual transverse vertical diaphragm clearing the heads of the lower-chord bars, and receiving in its flanges the 76 field rivets which secure the end of the floorbeam, and, on the outside of one truss only, the much smaller number of field rivets in the connection for the cantilever bracket frame carrying the 4½-foot sidewalk.

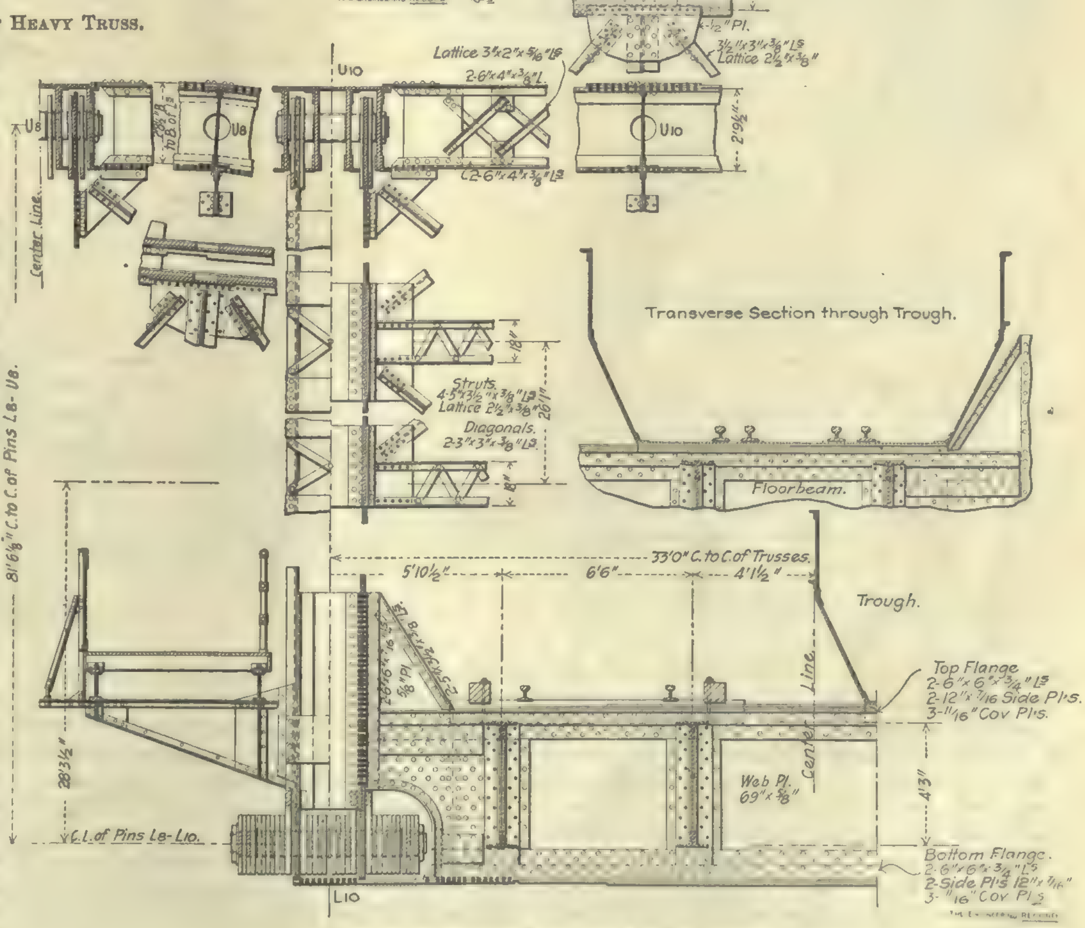
The floorbeams are nearly 7 feet deep over all, with two angles and two vertical web side plates in each flange continuous for the full length of the floorbeam. The web has a single plate extending nearly from lower-chord pin to lower-chord pin, and spliced at the ends to shop-riveted gusset plates about 3½ feet wide and 9¾ feet high. These gussets are spliced to the



SPLICE OF MAIN GIRDERS AT W.

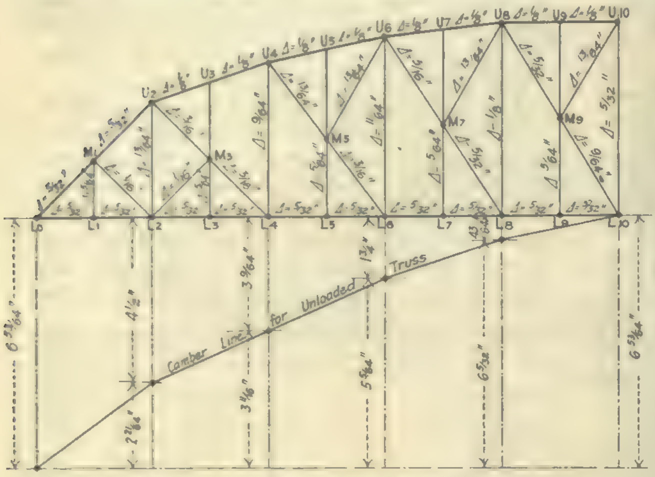


STRINGER AND FLOORBEAM BRACING.



HALF CROSS-SECTION SHOWING HEAVY TRUSS.

web and to the side flange plates by heavy double cover plates, shop riveted, and have heavy vertical angles for the vertical post connections which extend nearly 4 feet above the top flanges, the corresponding projecting part of the gusset being stiffened with angle flanges to form a solid knee-brace. The lower part of the gusset plate is cut out to a radius of 18 inches to clear the lower chord eye-bar heads and is stiffened with curved flange angles. A heavy wide horizontal plate is field-riveted to the end of the bottom flange of the floorbeam and to the U-plate on the bottom of the vertical post, and receives the connections of the bottom lateral diagonals. At the stringer connections the floorbeam web is fillered out to the face of the web side-flange plates, and receives 26 rivets through the end vertical angles of each stringer.



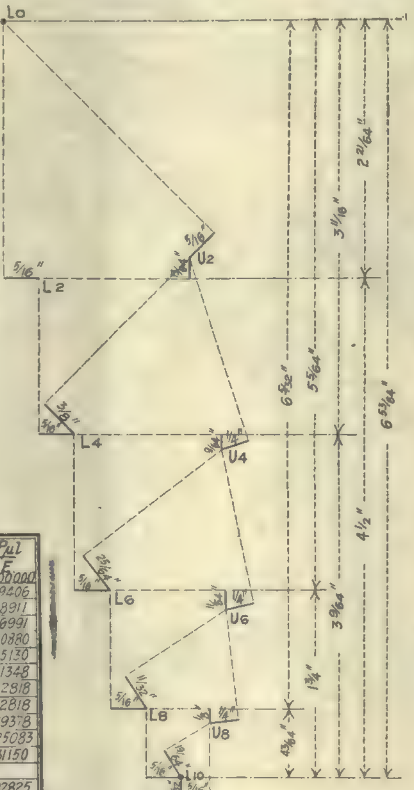
Half Diagram of 500 Foot Span Truss.

Member.	Stress due to D.L	Stress due to L.L over entire Bridge	Stress due to D.L + L.L	Area in Sq In's	Stress P per Sq In	Uncamber'd Length in Feet l	Distortion due to Pl/E Feet	In	Values of μ	D=Σ Pμl/E E=29000000
L0-M1	+[illegible]	+[illegible]	+3498000	319.02	11000	35.0603	.01330	5/32"	0.7072	0.009406
M1-U2	+[illegible]35000	+ 578000	+3313000	319.02	10418	"	.01260	5/32"	0.7072	0.008911
U2-U3-U4	+1732000	+1575000	+3307000	276.77	11949	52.1334	.02148	1/4"	0.7910	0.016991
U4-U5-U6	+1945000	+1770000	+3715000	309.77	11992	50.6949	.02096	1/4"	0.9960	0.020880
U6-U7-U8	+2045000	+1860000	+3905000	327.71	11916	49.8568	.02063	1/4"	1.2180	0.025130
U8-U9-U10	+2[illegible]	+[illegible]	+4050000	335.96	12055	49.5833	.02061	1/4"	1.5210	0.031348
L0-L1-L2	-1295800	-1178000	-2473800	165.00	14993	49.5833	.02563	5/16"	0.5000	0.012818
L2-L3-L4	"	"	"	"	"	"	.02563	5/16"	0.5000	0.012818
L4-L5-L6	-1644000	-1495000	-3139000	208.80	15034	"	.02567	5/16"	0.7549	0.019378
L6-L7-L8	-1963000	-1593000	-3556000	236.32	15048	"	.02573	5/16"	0.9749	0.025083
L8-L9-L10	-1990000	-1810000	-3800000	253.80	1497[illegible]	"	[illegible]	5/16"	1.2167	0.031150
U2-L2	- 218300	- 248[illegible]	- 466[illegible]	46.00	101[illegible]	"	[illegible]	[illegible]/64"	0.	
U4-L4	+ 215000	+ 197500	+ 412500	82.82	4981	65.7292	.01129	9/64"	0.2500	0.002825
U6-L6	+ 156000	+ 140000	+ 296000	53.44	5539	76.2865	.01457	11/64"	0.2910	0.004239
U8-L8	+ 13[illegible]	+ 56000	+ 189000	50.44	3727	81.5000	.01048	1/8"	0.3620	0.003794
U10-L10	+ 109[illegible]	+ 124[illegible]	+ 233200	50.44	4623	"	.01299	5/32"	0.	
U2-M3	- 590000	- 540000	- 1130000	85.00	13294	35.0603	.01607	3/16"	0.3530	0.005673
M3-L4	- 495000	- 452000	- 947000	75.00	12627	"	.01527	3/16"	0.3530	0.005390
U4-M5	- 435000	- 390000	- 825000	70.00	11786	41.1668	.01675	13/64"	0.3660	0.005131
M5-L6	- 358000	- 325000	- 683000	62.50	10928	"	.01547	3/16"	0.3660	0.005662
U6-M7	- 320000	- 286000	- 606000	60.00	10100	45.4921	.01584	3/16"	0.4410	0.006985
M7-L8	- 242000	- 220000	- 462000	55.00	8400	"	.01318	5/32"	0.4410	0.005812
U8-M9	- 239400	- 218000	- 457400	55.00	8316	47.6990	.01367	5/32"	0.5850	0.007996
M9-L10	- 159600	- 147000	- 306600	43.76	7007	"	.01152	9/64"	0.5850	0.006739

P = Stress per Sq. In.
l = Length in Feet.
E = Modulus of Elasticity = 29 000 000 Lbs per Sq. In
μ = Stress in Member due to a Load of 1 Lb. at Center of Truss.

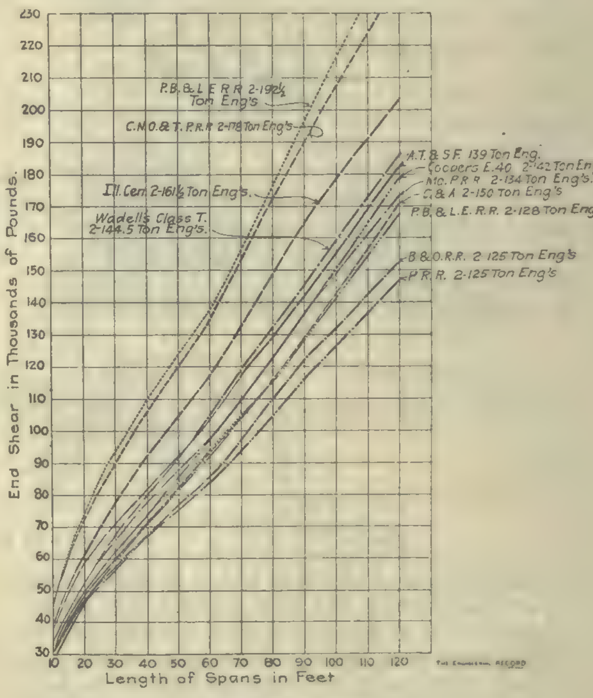
1/2 Deflection at L10 = 0,275159
Total " " " = 0,550318 = 6 39/64"

Table for Calculation of Deflections at Panel Points in 500 Foot Span.

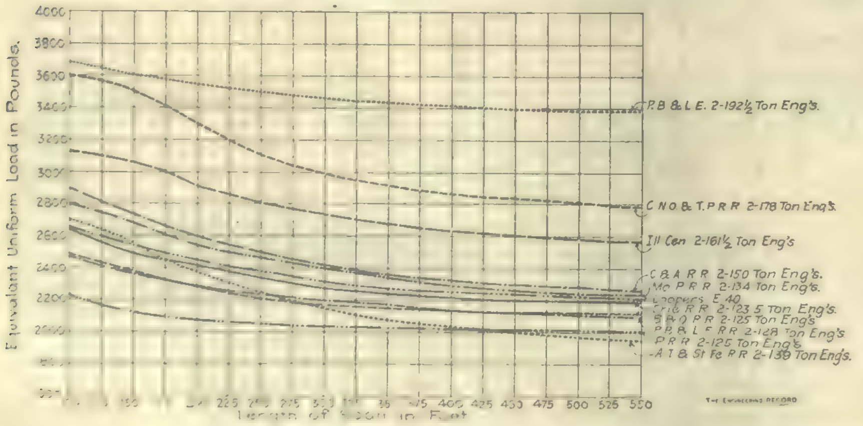


Distortion of Truss Members Under Live and Dead Load Stresses.

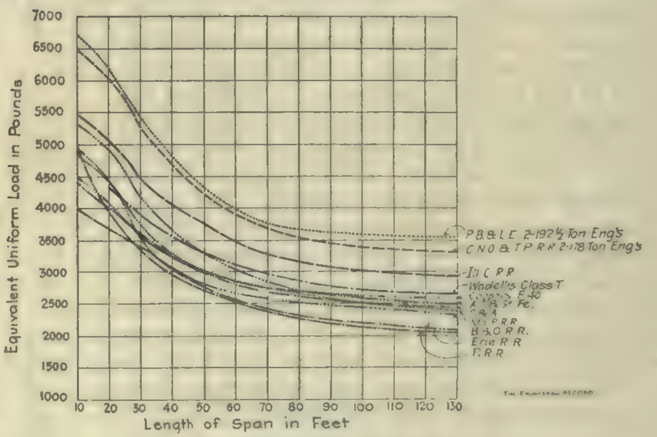
DISTORTIONS AND DEFLECTIONS OF HEAVY TRUSS, MAIN SPAN.



SHEAR DIAGRAM.



EQUIVALENT LOADS, LONG SPANS.



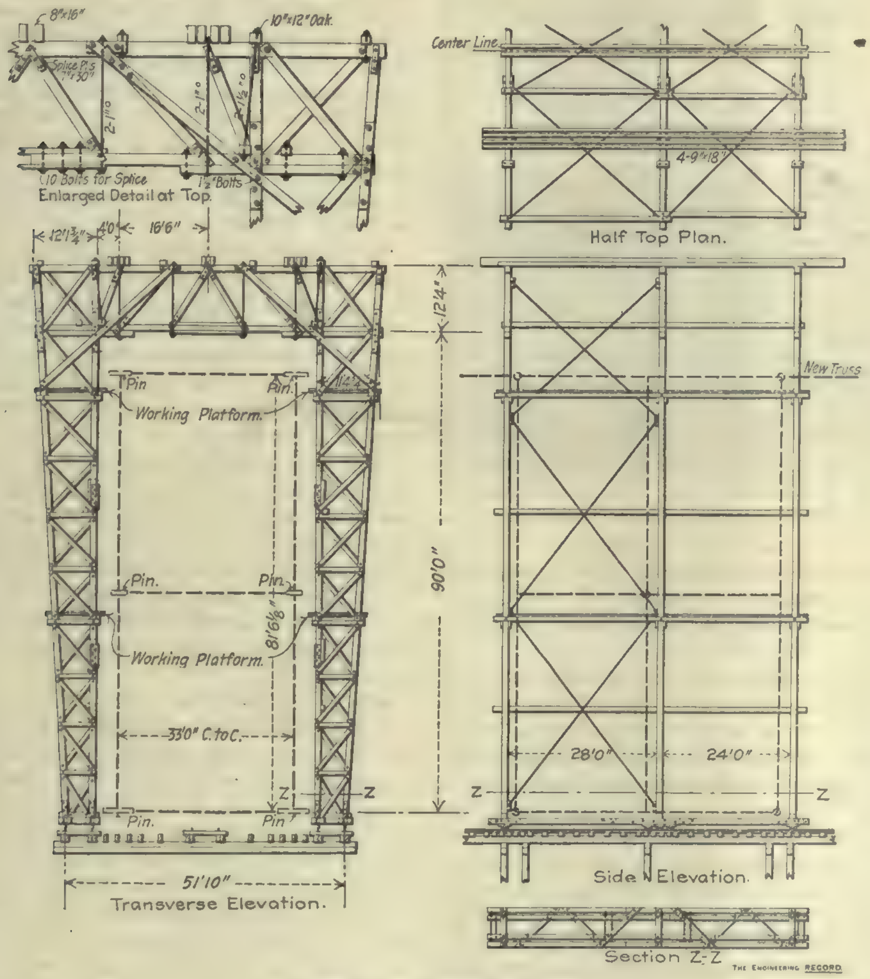
EQUIVALENT LOADS, SHORT SPANS.

The top chord was shipped in two-panel lengths, with the angles and cover plates continuous from end to end of each, but the webs were shop-spliced at the sub-panel points. The character of the floorbeam, lateral and sway-brace connections at the sub-vertical posts corresponds with those at the vertical posts and the other details there are indicated in the elevations of points U₃, M₃ and L₃, where only the inside half of the transverse elevation is shown.

The two main spans were erected on ordinary falsework, with a transverse bent under each panel point in the plane of each floorbeam. At the main panel points the bents were double, and at the sub-panel points they were single. Each single bent was two stories high, the lower story consisting of eleven piles from 5½ to 10 feet apart in water about 10 feet deep, and driven about 10 feet into the hard bottom. The upper story, 35½ feet high, had three vertical and eight batter posts set on a 68-foot cap on the pile tops and having a double cap 58 feet long. The caps and posts were all of 12 x 12-inch timber, and were spliced at all intersections by the 12 x 3-inch diagonal braces or by double scabs, not shown in the diagram of the bent. The double bents consisted of two independent single bents 3 feet apart on centers. The bents were connected longitudinally by 22 lines of 8 x 16-inch stringers on the upper caps; by four lines of 12 x 12-inch ledgers on the lower caps, and by four lines of zig-zag 3 x 10-inch braces between the upper and lower caps in the planes of the principal batter posts. These diagonals were run from the tops of the double bents to the tops of the piles in the single bents, and in the last two panels at each end they were intersected by diagonal braces in the opposite direction. The falsework for the 252-foot span was the same as for the 500-foot span, except that only single bents were used, and that all longitudinal diagonals were omitted in the second and third panels each side of the center, and that there were only twelve 8 x 16-inch stringers on top of the falsework.

The 500-foot span was erected by a three-bent timber traveler 107 feet high, 66 feet wide, and 88 feet long, over all. It had an inside clearance of about 92 x 41 feet, and ran with twenty double-flange wheels on two 4-foot 11-inch tracks, 46 feet 11 inches apart on centers. Each of the two traveler rails and each of the two rails of the standard gauge material track in the middle were carried by two 8 x 16-inch stringers of about 23 feet clear span. Each bent had two 12 x 12-inch vertical posts spliced in two places with two steel and two wooden cover plates, and two 10 x 12-inch batter posts fastened to them, with 3 x 8-inch transverse struts and X-bracing bolted on. The top of each bent consisted of a transverse Howe truss 12 1/3 feet deep over all. The top chord was a single piece of 12 x 16-inch timber 66 feet long, and the bottom chord was two pieces of 12 x 12-inch timber spliced in the middle. The inclined posts were 10 x 12-inch, notched and scabbed at the ends, and the vertical rods were two 1-inch rounds. The three bents were secured together by the longitudinal horizontal pieces shown on the sides and top, and by six panels of top lateral diagonals. On each side of the traveler two of the vertical posts were braced together by three panels of diagonal rods so as to form a rigid tower, but the third post was secured to them by the longitudinal members only. Each of these diagonal members consisted of two rods from 1¼-inch to 1⅝-inch in diameter, with pin connections to steel plates bolted to the vertical posts. The top lateral rods were in pairs, and were 1 inch and 1¼ inches in diameter, with screw ends and nuts bearing on angle washers.

Across the top of the traveler caps there were three sets of longitudinal lifting beams; the middle one consisted of two 8 x 16-inch pieces and each side group consisted of four 9 x 18-inch pieces. The other longitudinal pieces were 8 x 10-inch, except in the sills, which each had two pairs of 10 x 12-inch pieces fastened together with 12 x 12-inch headers and pairs of 1-inch rods, and braced with 3 x 8-inch zig-zag planks. Working platforms were built in each side of the traveler, and extended from end to end at the convenient heights for making the upper and intermediate truss pin connections. The traveler for the 252-foot span was similar to that for the 500-foot span, except that it ran on single rails 20½ feet each side of the center line, and that all bracing was of planks bolted on. The main timbers were 10 x 10-inch and 8 x 10-inch, and the lifting beams on top were pairs of 7 x 18-inch pieces. There were four panels of lateral X-bracing in the top, and three panels of longitudinal X-bracing between two of the vertical posts on each side. It had a clearance about 59 feet high and 39 feet wide, and was about 71 feet high, 60 feet wide and 60 feet long in extreme dimensions.

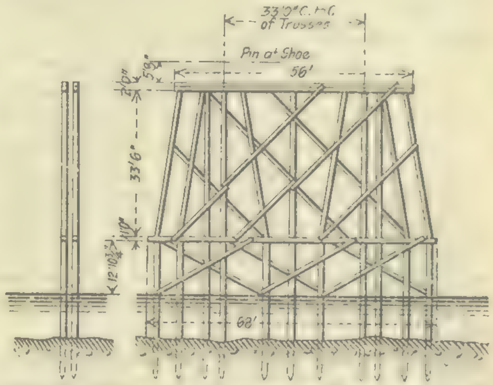


Traveler for the 500-Foot Span.

At one end of the bridge the approach viaduct consists of one 76-foot plate girder span and twenty-six 30-foot plate girder spans. All these spans are supported on trestle bents consisting of two vertical columns, a deep transverse girder to which the four longitudinal girders are web connected, two stiff sway-brace diagonals and a bottom transverse strut, all connections being riveted. The twenty spans nearest the river are on a tangent and the trestle bents are connected in alternate pairs by longitudinal struts and X-bracing, making every other panel a tower. The remaining seven spans support tracks which are horizontally deflected to a curve of 319½ feet radius. Here the tower construction is modified by the omission of the longitudinal struts and the insertion of a single knee-brace from the middle of the longitudinal girder to the foot of the trestle column in every alternate panel.

At the other end of the bridge there is a triangular platform supported on four very heavy divergent plate girders about 9 feet deep and nearly 120 feet long, as indicated by the double lines in the enlarged plan. At the end of the 500-foot span these girders rest on bed plates on the top of the pier, and are connected by heavy floorbeams with two principal sections and four very short lengths, all parallel to the axis of the pier, and oblique to the longitudinal girders. At the opposite ends the two outside girders rest on the piers and are web-connected to a floorbeam about 70 feet long, parallel with the axis of the two piers. This floorbeam is supported on the masonry by a shoe about 14 feet from each end, and thus forms a continuous girder supported at four points. Between the shoes and the ends the floorbeam is only 5 feet deep, and receives the track stringers across its upper flange; between the shoes it is 9 feet deep and has web connections to the two inside main longitudinal girders and to the stringers.

The main longitudinal girders are connected together by four lines of intermediate transverse girders 5 feet deep, which are web-connected to them about midway between the top and bottom flanges, and carry the 30-inch stringers across their top flanges. These intermediate floorbeams are not parallel to the end floorbeams, but those in each set are approximately on chords of arcs concave toward the 500-foot span. They have solid-web knee-braces with flange angles from each end to the bottom flange of the main girder, and similar braces from the upper sides of the top flanges to the top flanges of the stringers. On account of the curvature of the tracks which they support, the stringers are not in straight lines, but form chords which start near one girder at one end of the span, cross over close to the other girder at mid-span, and return to the first girder at the opposite end of the span. Additional stringers are interpolated between the track stringers and between the center main girders to form a support for a continuous I-beam floor over the whole of the triangular space between the three masonry piers nearest the end of the 500-foot span.



Double Falsework Bents.

One of the main girders is 116½ feet long over all, and the others vary slightly from it in length. Each is made with 107¾ x 9/16-inch web plates in sections 15 feet long, spliced with three sets of double plates giving long top and bottom lines of rivets as shown in the elevation of a typical panel of the girder. Each chord is composed of two 8 x 8 x 7/16-inch angles, two 16 x ⅝-inch vertical side plates, and a maximum of five 24 x ⅞-inch flange cover plates. Each side plate or angle in the flange is made in two pieces with the joints arranged so that no two are close together, and all are spliced by short cover pieces of the same section. The vertical web stiffeners are crimped 6 x 4-inch angles about 10 feet apart. The girders have fixed bearings at one end and are seated on expansion rollers at the other end.

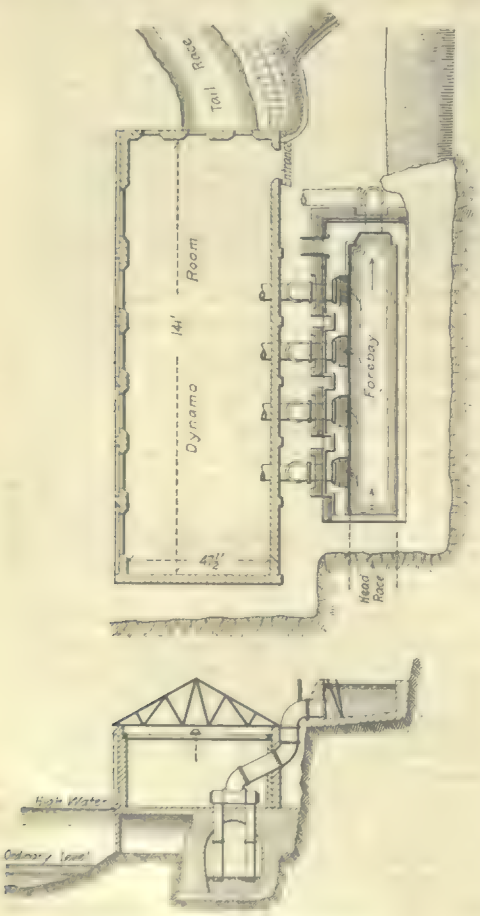
The spans between piers 5-7 and 4-6 are essentially duplicates and each has a pair of parallel 9-foot girders 120 feet long over all, set on a considerable skew and connected together by floorbeams and knee-braces as shown in the cross section, which illustrates the general features of arrangement of a pair of girders in the triangular platform already described. In this span there is a lateral system of X-braces riveted to the bottom flanges of the stringers and the top flanges of the floorbeams. As these spans are on a considerable grade there are wedge-shaped bed plates riveted to the lower flanges at the ends for bearings on the roller nests, and masonry plates at the expansion and fixed ends respectively.

Between pier 7 and the abutment, and between pier 6 and the abutment, the single tracks are carried directly by pairs of longitudinal girders, without floorbeams or stringers. In each case they are arranged in three skew spans, the middle one and the adjacent ends of the others being supported on very oblique trestle bents, as shown in the part plan and elevation. The trestle bent has a double-web plate girder 5 feet deep, connecting the tops of the two vertical posts, and supporting across its top flange the ends of the longitudinal girders, which lap far past each other. The grade of the longitudinal girders is provided for by the wedged-shaped cast bed plates with which they are seated on the horizontal caps of the trestle bents. The girders are only 5 feet deep, and in order to bring their top flanges to the required height at piers 6 and 7 they are seated there on bolsters 4½ feet high, which are made by riveting a web plate and stiffener angles to the bottom flange of the girder, so as to have the effect of an extension of the girder web beyond the lower flange, making it act as a longitudinal knee-brace with inclined flange stiffening angles.

The bridge was designed and constructed under the direction of Mr. W. H. Smith, chief engineer of the Union Railroad; Mr. E. K. Morse was the consulting engineer for the substructure, and the superstructure was built and erected by the Keystone branch of the American Bridge Company, Mr. C. C. Schneider, chief engineer. Mr. Emil Swensson was the engineer of the Keystone branch when the work was commenced and during its construction was succeeded by Mr. James K. Lyons.

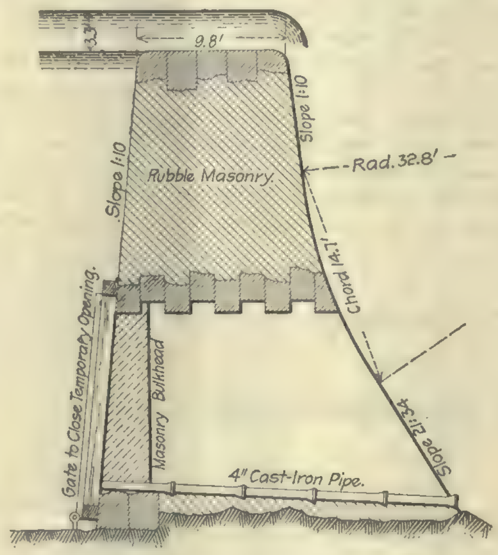
The Saut-Mortier Power Station on the River Ain.

The river Ain, which flows through the provinces of Jura and Ain, in France, has a fall of about 0.3 per cent., increasing considerably where rapids occur. Of these the principal ones are at Saut-Mortier, in the commune of Cernon. The development of the water power at this point was recently described by Mr. J. Claudet in "Le Genie Civil," from which the following notes were taken. At the point in question the fall is very rapid, the volume of water discharged being 140 cubic feet per second at low water, rising to 24,700 cubic feet at times of flood. The minimum discharge with a fall of 62 feet would not afford more than 600 net horse-power, an amount too small to justify the expense of the development. The promoters therefore sought a means of increasing the volume of water, and the lake of Chalain presented a simple and satisfactory solution of the problem. It is situated 28 miles above Saut-Mortier, and at an elevation of 105 feet above the river at its nearest point, 1,400 yards distant, and separated from it by a rocky ridge. Its area is 500 acres, and its depth reaches 111 feet. By drawing on the lake during periods of drought until its level is lowered 33 feet, a reserve of 70,600,000 cubic feet can be created, increasing the available amount of water at Saut-Mortier to 565 cubic feet per second, equivalent to about 3,000 net horse-power. As this satisfied the promoters of the enterprise, the work is now in progress.



Arrangement of Station.

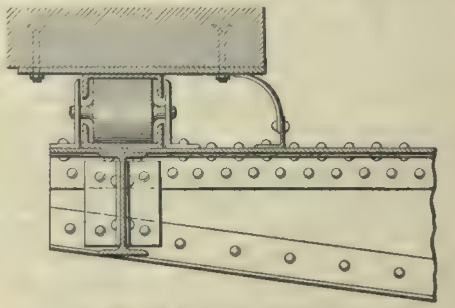
The work at Saut-Mortier comprises a dam 33 feet high and 148 feet long, across the Ain, a head-race 4,920 feet long, of which about 410 feet is tunnel, the power station and a tail-race. As the Ain is classed as a navigable river at this point, a canal and lock are provided to allow boats to pass the dam. The power station was designed to take care of the minimum supply of water, as before mentioned. On the head-race there is a spill-way 330 feet long, just before the entrance to the tunnel, which controls the water level, the waste going directly to the river.



Section of Dam.

The dam is placed at a narrow portion of the channel, where the rocky banks furnish solid abutments. It is built entirely on bed rock. The plan is in the arc of a circle, with the convex side up stream, the deflection of the curve at the center being nearly 10 feet from the straight line. The crest of the dam is slightly lower in the middle than at the two ends, to allow the first overflow to come at that point. The cross-section is shown in the accompanying cut. The assumptions provide for a vertical pressure not to exceed about 12,000 pounds per square foot of horizontal section, all tensile stress being avoided. The width at the top thus obtained was increased by about 1½ feet to allow for the impact of the water. The dam is of masonry throughout, laid in Portland cement mortar. The crest is laid with large stone, and the up-stream face plastered with cement. The work, when done, proved to be perfectly tight.

The construction was a difficult matter, as the river is liable to rise 6 or 8 feet after a slight rain. To avoid damage from these sudden floods an arched opening about 7 feet wide was built in the middle of the dam, and provided with a sluice gate measuring 13.4 x 14.7 feet, revolving about a horizontal axis lying below the bottom of the opening, as shown in the cross-section of the dam. The purpose was to allow the gate to lie flat on the river bottom in front of the dam until the work was completed, then to raise it to close the opening, making a tight joint with the masonry by means of rubber packing at the edges, and then to fill in the space behind with solid masonry. About the time arranged to carry out this operation, a heavy flood occurred, and the water raised the gate, forcing it violently against the masonry. It happened that a piece of wood was caught between the gate and the wall and prevented the gate from closing tightly, there being a space 4 inches wide on the right-hand side. A diver also reported that one of the hinges at the bottom was broken. It was out of the question to lower the gate and attempt the manoeuvre again under better conditions, so the gap was closed as well as possible, and a stone wall laid in quick-setting cement built next the gate. A 4-inch pipe was laid through the bottom of the wall, to remove as far as possible the water gathering between the gate and the wall, thus keeping the chamber dry until the entire space was built up solid.



End of Head Race Gate.

On the right-hand end of the dam, facing downstream, are the three discharge gates, about 3.3 x 5.8 feet in size of opening, and also the entrance to the head race. On the left-hand end is the canal for boats, which is 754 feet long, 36 feet wide, and admits of a depth of water of 31 inches. A movable dam of the shutter type is located at its lower end.

The head race is rectangular in section, 15 feet wide, and has a depth of 7½ feet. Its bottom has a slope of 0.05 per cent., and it is cut into the side of a rocky hill. The wall forming its down-hill side is 40 inches thick at the top, the inside face being vertical, and the outside face having a batter of 1 in 5. The uphill side is built against the slope, averaging 16 inches in thickness.

When the work was begun, the volume of water avilable was estimated as 425 cubic feet per second and the head-race was made of a width of 15 feet, but only 6½ feet in depth. Afterwards the plan of utilizing the lake of Chalain was decided upon, increasing the water supply to 565 cubic feet. In order to deliver this amount of water without widening the race, its depth was increased a foot by extending the walls that amount. This could not be done in the tunnel portion, so the walls were carefully plastered with cement, in order to gain the increased rate of flow due to the smoother surface. For a distance of 27 yards the canal is exposed to damage from rocks falling on it from above, and is therefore covered with a circular arch, in part of stone work and part of a cement concrete 3 inches thick, in which are imbedded ⅝-inch steel rods, spaced about 4 inches apart, bent to the curve of the arch. It is reinforced at intervals of about 5½ feet with ribs 3 inches high and 5 inches wide, in which is a band of 1¾-inch hoop iron.

Mention has already been made of a waste weir 328 feet long, formed in the side wall of the head-race at its down-stream end. An emergency waste-way is also provided near the dam itself. Furthermore, to allow of emptying and cleaning the canal, there are three discharge openings 7 feet wide, having iron gates, at different points in its length, which would serve as waste weirs in case of need.

The water level in the head-race is regulated at its inlet by a steel-framed head gate 14.7 feet wide and 8.2 feet high, which works on rollers bearing in channel irons fixed in the side walls, as shown in the accompanying illustration. The joint is made tight by a thin steel plate riveted to the gate and bent so that the force of the water will press it against the iron facing of the masonry.

Immediately above the power house the nature of the ground made it necessary to carry the head-race in a tunnel. The section is circular throughout, the diameter being 12.4 feet. Where the ground was wet, and pressure apt to occur, a stone arch 27 inches thick was used, resting on a concrete foundation forming the invert, while in good rock a simple masonry lining 16 inches thick was put in. The water rises in it to a depth of 10.5 feet, the dimensions being calculated to give the same discharge as the rectangular portion of the canal, filled to its normal depth of 7½ feet.

The power house is 147 x 47.5 feet in plan, and contains five units, four of which are now in place. The construction presented some difficulties because of the narrow space between the river and the high bank, and because of the great variation in water level. The tail race is carried the whole length of the building, immediately under the turbines. It is in the form of an arched canal with a flat bottom, its width being 16.4 feet just above the floor, which is 7½ feet below low-water mark. The velocity of the water does not usually exceed 4.6 feet per second. This arrangement does not appear logical, since the arch of the tail-race has to support the weight of the turbines just where it is pierced by two 40-inch circular apertures for the turbine draft tubes. The more natural arrangement of placing the tail-race further downsteam, and leading the water to it through transverse canals, one for each turbine, was carefully considered, but was finally rejected because the proximity of the river would have made it difficult to keep the excavation dry during the work. This difficulty would not only have retarded the progress of the work, but would also have raised its cost considerably above that of the method adopted. The intake basin is placed at the foot of the head-race tunnel and is only 14.8 feet wide. The turbines are double, and the water comes to each through a steel penstock 5½ feet in diameter, and escapes through two vertical draft tubes, one for each wheel. The length of the tubes was determined by the necessity of placing the turbines above the highest known water level, which is 2 feet above the floor of the power house, and on the other side by the level at which the tail water is maintained during times of drought, which is 18.3 feet below extreme high water. The racks and gates for each turbine are located in the recesses in the intake canal wall. The water was let in in November last, and there were no leaks in any part.

The net power developed after the installation of the fifth unit will be 3,000. The turbines are of 700 horse-power each, and were built by Piccard & Pictet, and are direct connected to Oerlikon alternating current generators which deliver current at 7,500 volts. The current is distributed for general lighting and power purposes to towns in the surrounding region within a radius of 12 miles.

Septic Tanks and Contact Beds at Plainfield, N. J.

By Andrew J. Gavett, City Surveyor.

The city of Plainfield, with a population of about 16,000, is situated on the Central Railroad of New Jersey, 24 miles from New York City. A water supply system was introduced by a private company in 1891, and a sewerage system was constructed by the city in 1895. Separate sewers are used for storm water and sewage, and the sanitary sewers, from 8 to 24 inches in diameter, discharge onto intermittent filtration beds.

The disposal system has been very bitterly opposed from the first by residents in the vicinity of the filter beds, and this opposition has continued to the present time. It is claimed by the objectors that the beds are located too near their residences, and that this proximity is depreciating the value of all land in the vicinity. They also claim that the sand in the beds contains too much fine material to filter properly, so that the water remains too long upon the surface. A suit for $10,000 damage was brought against the city by the proprietor of a near-by summer boarding house, but a decision favorable to the city was rendered by the Superior court on the law points involved in the case.

When it became necessary, in 1900, to consider means for enlarging the capacity of the disposal plant, the feeling against adding more sand filtration beds was very pronounced. Mr. Joseph O. Osgood, of New York City, was engaged as consulting engineer, and after a very thorough consideration of the experiences and investigations of other cities in this country and abroad, he recommended, and the Committee on Streets and Sewers adopted, the plan of disposal which is now nearing completion. This comprises two septic tanks, side by side under one roof, and a double set of bacterial contact beds, eight in all, so located that the works are 200 feet from the nearest streets, and operated in such a manner that the sewage does not appear on the surface until discharged into Green Brook.

The New Disposal Works as Seen across the Old Sand Filter Beds.

The present number of house connections in Plainfield is about 1,500, and the flow of sewage in ordinary weather is about half a million gallons daily, of which nearly two-thirds occurs in the twelve hours between 8.30 in the morning and 8.30 in the evening. The above amount is considerably increased in long continued or very severe rains (ordinary rains having no effect whatever upon the flow), but it is considered one of the advantages of this system of disposal that the addition of large quantities of clear water to the sewage flow, if the changes in rate of flow are not too rapid, does not much affect the efficiency of the works.

The septic tanks are about 50 x 100 feet each, and 7 feet deep, the water rising only 6 feet above the bottom.

The sewage is taken from one of the old gate chambers, and flows continuously through a 15-inch pipe to the small influent chamber, where it may be diverted to either tank by a wooden gate. The sewage flows downward, then out into the tank about 2 feet above the floor and close to the partition wall between the two tanks. In front of the outlets are baffle walls to deflect the flow and cause the sewage to move slowly and evenly across the whole width of the tank to the outlet openings, of which there are twelve in each tank, at such a height as to take out the clearest water, leaving the sediment below and the thick scum above.

In this slow passage through the length of the tank "a considerable part of the organic matter in suspension is either liquefied or passes off as gas, the coarser particles remaining in the sludge with the inorganic sediment, to be further acted upon by the bacteria."

In leaving the tank the water passes upward behind a weir and over it into a channel, thence to the first set of contact beds.

In the septic tank the air and light are excluded as much as possible, but after leaving the tank the effluent is aerated by passing over the weir in a thin sheet, and by falling into the channel, the weir and channel extending the full length of each tank, 100 feet in all. They are covered by flag stones, alternating with wooden removable covers.

At one end of each tank a 1½-inch gas pipe extends through the roof, the pipes having funnel-shaped tops capped with fine brass netting. It is expected that the inflammable gas resulting from the breaking up of the organic matter in the sewage will be burned at these vents.

The gate houses and the roof over the septic tanks are of wood, with tar and gravel covering; the gate chambers, manholes and part of weir wall are of brick and blue stone, but all the remaining construction is of Portland cement concrete, composed of one part Dragon Portland cement, three parts sharp yellow sand from Amboy, N. J., and five parts crushed trap rock.

The contact beds are in two sets of four each, the first set 5.42 feet higher than the second, each bed being 92 x 106 feet in plan and 5 feet deep. The floor is 5 inches thick and all walls, except the center walls containing pipes, are one foot in thickness. This light construction was made possible by the fact that the walls are supported on one side by the stone or slag of the beds and on the other by the earth embankment.

On the concrete floor of each bed, fourteen lines of 4-inch horseshoe tiles are laid, radiating from the gate chambers, and coarse stone is spread between and over them to a depth of 6 inches; above this is placed the working material, 3½ feet in depth, and finally a foot of coarse stone, to serve as a roof.

In the upper set of beds the working material is trap rock varying in size from ¼ to 1½ inches, and in the lower set slag is used in some beds and cinders in others, somewhat smaller in size than the stone in the upper beds. The contractor was allowed to use either of these materials, and it was found necessary to use all of them in order to insure the completion of the work within a reasonable time. In the top foot of filling material distributing pipes are laid from the gate chambers, consisting of vitrified sewer pipes, from 12 to 3 inches in diameter, laid with open joints except the 12-inch pipes, which are cemented.

The partially purified sewage passes continuously from the septic tank through a 12-inch pipe built into the top of the middle wall to the gate chamber at the intersection of the division walls; here it is diverted by wooden gates to each of the four beds in succession. After one bed is filled to within one foot of the top (that is, to the top of the working material) the flow is turned to the next bed, each of the four receiving the flow in turn. The height of water in the beds is indicated by tell-tale balls above the roofs of gate chambers.

The sewage in the first bed, after being retained an hour or more, as may be found most efficient, is drawn off by opening a sluice gate (operated by wheel in the gate house) and passes through a pipe to the gate chamber of the second set of contact beds, where the same process is repeated. After the period of rest in the second set of beds, the effluent is turned into the brook.

Each bed receives a rest of an hour or more before each filling, and the material in the beds is sufficiently coarse to allow the air to be drawn down to the bottom of the bed each time.

It is not known yet at what rate sludge will accumulate in the septic tank, but provision is made for its removal, when necessary, through an 8-inch pipe connected with each tank by a gate valve and emptying it into the adjoining sand beds. As the sludge need be drawn off only at favorable times, the bed can be suitably prepared by drying, plowing and ditching.

At the outlet end of the septic tanks additional 8-inch valves are placed at the proper height to draw off the clearest water, so that when the sludge is to be emptied on one bed, this comparatively clear water may be turned onto another. These valves empty into a 12-inch pipe in the weir wall, which pipe may discharge onto any of the lower sand beds. The water in the channel may also be turned into this pipe without passing through the contact beds, in case it is needed for irrigation.

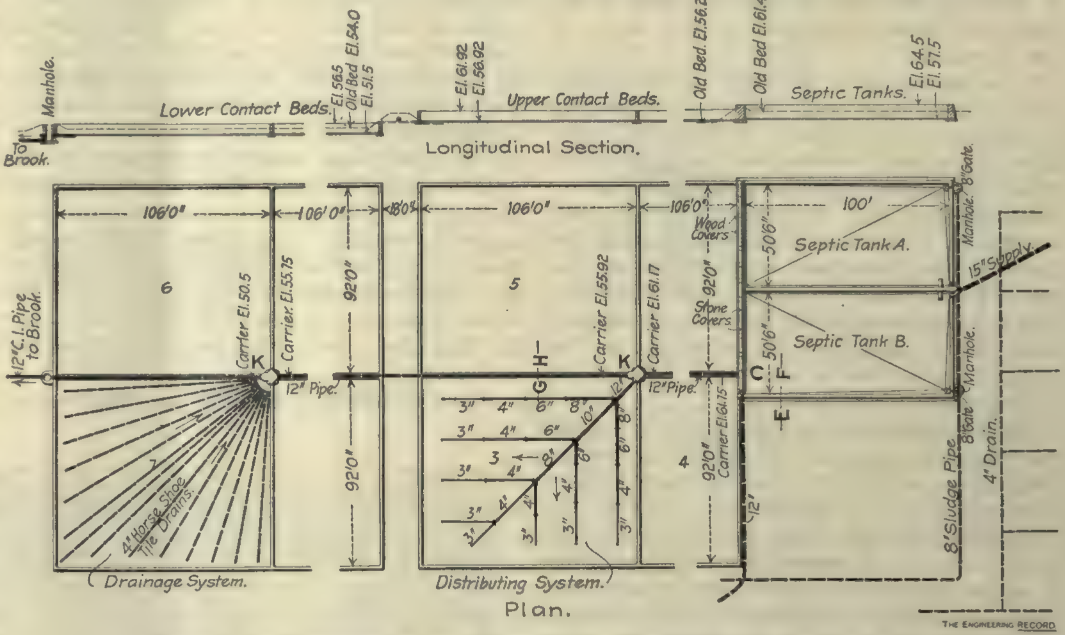
An 8-inch valve connects the two tanks, and another is connected, by an 8-inch pipe, with the lower part of the first gate chamber. Through this the water from the septic tanks may be turned directly to the lower contact beds without passing through the upper ones.

After the new works are in full operation, the sand filtration beds will be planted with various crops, and will be given only so much sewage or effluent from the septic tanks as will be beneficial to the crops; every effort will be made to give an attractive appearance to the entire plant, both new and old, and it is hoped that the long-continued objections to the disposal works will cease.

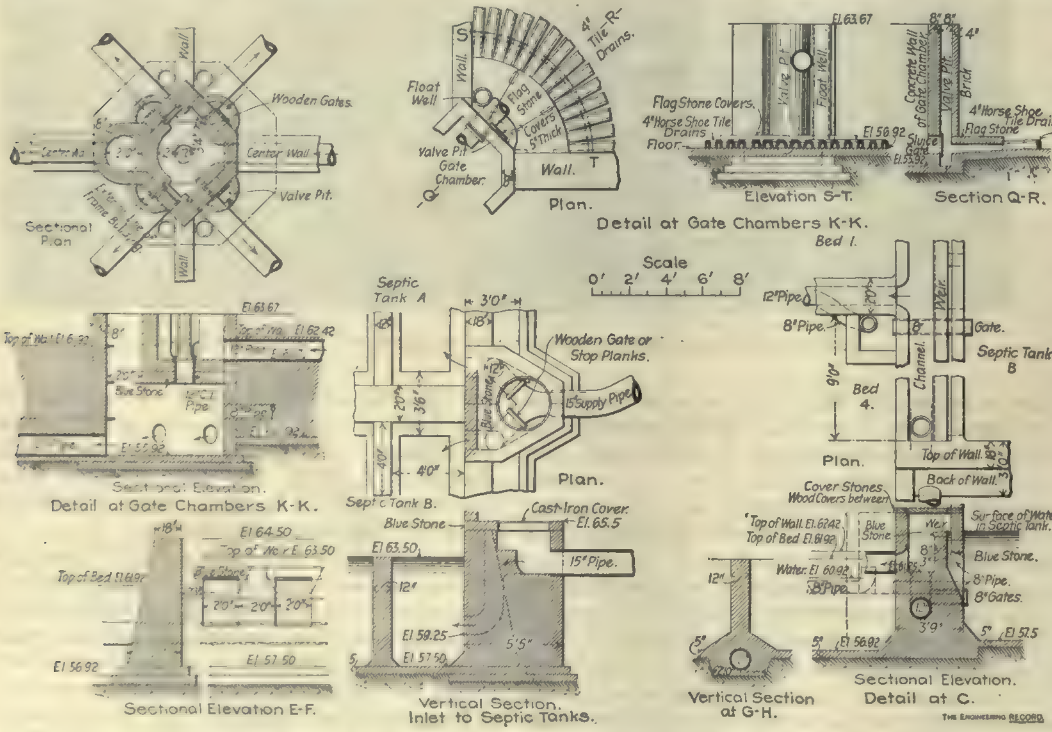
It is expected that two men will be required to operate the new works and one or two more, with horse and cart, will be needed part of the time to keep the irrigated beds in good order.

As an offset to this expense, the city will receive the crops grown on the beds and also a rental for the house and barns on the property, as well as for pasture and other land.

The cost of the new work with all expenses will be about $40,000, not including value of land. The construction prices were low, especially that for concrete, which was $4.25 per cubic yard; filling material for contact beds cost $1.45 per cubic yard, in place; the septic tank roof complete cost $1,900, and the gate houses $240 each.



General Arrangement of the Plainfield Septic Tanks and Contact Beds.



Details of Plainfield Septic Tanks and Contact Beds.

The Backflow of Impounded Water brought about a suit before the New Hampshire Supreme Court recently which involved a number of unusual features interesting to all builders and owners of dams. The three points at issue are summarized as follows in 50 Atl. Rep. 108, State v. Sunapee Dam Co.: "1, The legislature has authority to grant a private corporation the privilege of damming the outlet of a navigable lake so as to raise or lower the water level, even though the raising and lowering permitted interferes with the public rights of navigation and fishing. 2, Where a corporation was authorized by the legislature to erect a dam at the outlet of a lake and draw down its waters to a certain point, such grant was a complete defense to a suit for an injunction to restrain the corporation from changing the water level of the lake, where it appeared that the water had at no time been drawn down to a point below that authorized. 3, Where a corporation, authorized to construct a dam at the outlet of a lake, agreed with a littoral proprietor as to the height to which the water should be raised, and for many years maintained the water at that point, but because of unusual and excessive rainfall during one season and the negligence or incompetence of the dam foreman, it was so operated as to cause the water to rise above the stipulated point, there was such improbability of a recurrence of the injury that the littoral proprietors and others injured, while entitled to compensatory damages, were not entitled to an injunction restraining the corporation from making any change in the water level."

The Engineer Contractor.

Extracts from an article by Geo. E. Gifford, M. Am. Soc. C. E., in "The Polytechnic."

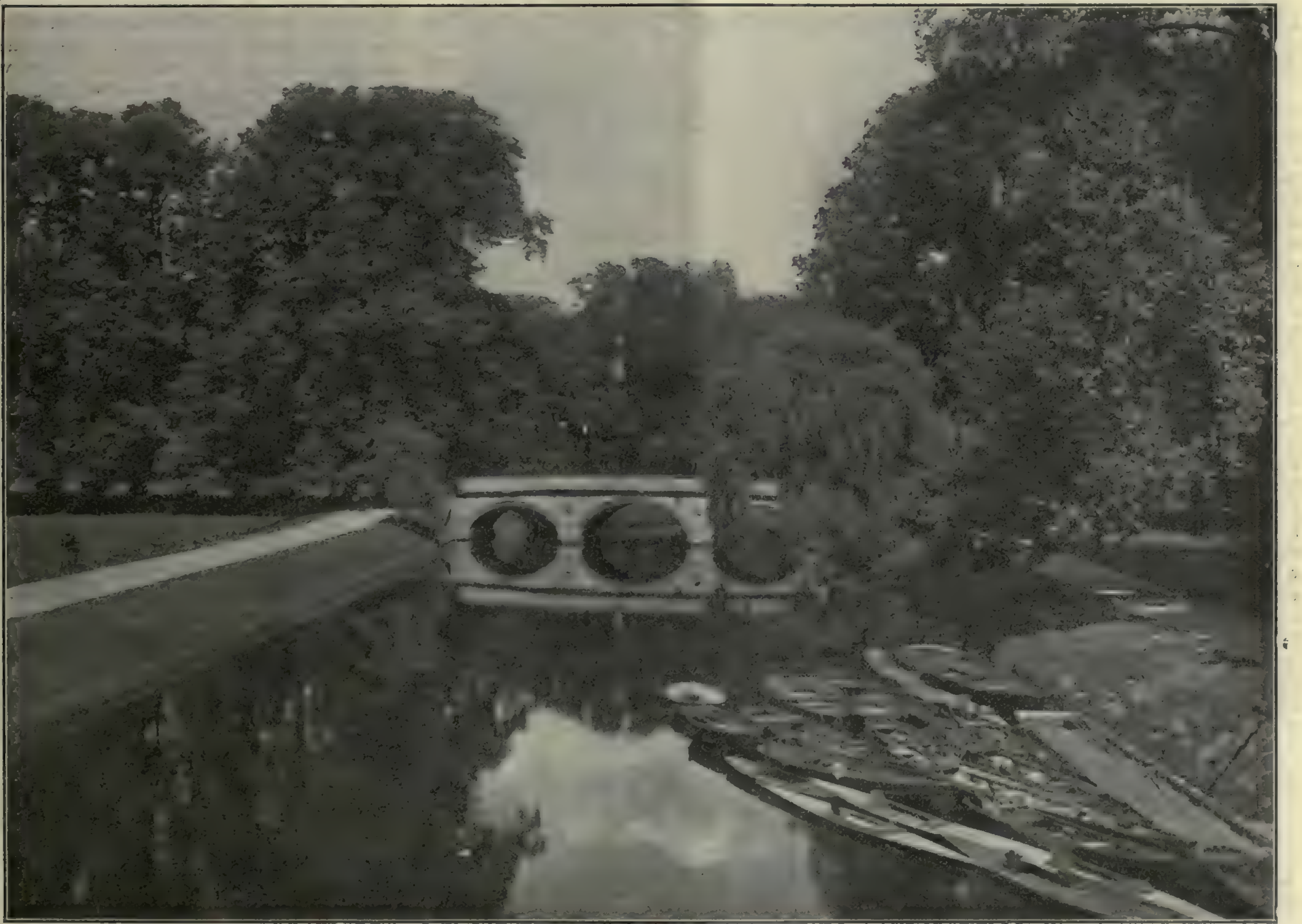
The contracting engineer doesn't have much to say in print usually. One reason is that he is modest. Another, and perhaps the principal, is that as a general thing he is too busily engaged in the endeavor to make cost keep within estimate, and to have a few dollars left over. His problems much more often involve dollars and cents than stresses and strains, and his theses are more frequently good, vigorous efforts addressed orally to his men, than articles for the technical press. Not the least of his troubles are his brothers in the profession, the consulting engineer, the chief engineer and the inspector. It certainly is a singular thing how different the same question of fact can look to two men with the same technical and practical training, simply depending upon whether it is a matter of pocketbook or principle. It is not believed, however, that this inability to see things as others see them is confined to our profession alone.

A technical education assists the contractor more in the estimating of quantities than in any other branch of his work, for the fixing of prices and the carrying on of the work are almost wholly matters of experience and common sense. Surely the accurate determination of the amounts of material of all kinds required in a large piece of construction is an important matter, and one in which the contractor cannot afford to make a mistake. This is where the engineer has the advantage over the man not specially educated, and in fact, is a place where his services cannot be dispensed with. It is remarkable with what accuracy preliminary estimates can be prepared after a little practice in any particular line of work.

In the bridge business, with which the writer is the most familiar, it is necessary in preparing a careful lump sum bid to make a complete list of every separate piece of steel entering into the structure, and carry out its weight from tables supplied by the manufacturer of structural steel. This, for a large bridge, as will readily be seen, is no small task, and the hurry in which it often has to be done leaves chance for many errors. Familiarity, however, soon enables a man to become very expert, both as to speed and accuracy. As an example, a recent lot of railroad bridges, six in all, no two alike, were estimated to weigh when finished 1,332,000 pounds, and on this weight a lump sum contract was based. The actual shipped weight of the six bridges was 1,330,411 pounds, a difference of a trifle over one-tenth of one per cent.; some weighing a little more and some a little less than the estimate. It is practically impossible to figure any closer than this, as the rolling mills do not undertake to roll with less variation than within two and one-half per cent. of figured weights.

The estimate just referred to was made from carefully prepared preliminary plans. Railroad companies and other large purchasers are beginning to realize that it pays them to work up plans in good shape before sending out for proposals. It used to be the custom for most railroad companies to require bidders on bridge work to furnish their own designs, based on standard specifications. To-day the people who follow this custom are likely to get scant attention, for the contractor can figure on plenty of work requiring far less trouble and time. The advantage to the purchaser in having good plans is evident from the greater number and closer bids he will get. A few years ago, when work was less plentiful, the bridge contractor was willing to do almost anything in the way of preliminary work; but it is a good thing, both for him and the consulting engineer, that conditions in this respect at least have changed.

The writer remembers a few years ago pre-



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLII, ENGLAND, BRIDGE ACROSS THE CAM.

A characteristic small English bridge of formal type and well suited to its surroundings.

paring a careful design in competition for a railroad drawbridge in the South. It probably took a week or so. The specifications had been prepared, presumably by the chief engineer, with great elaboration, printed and called "Standard Bridge Specifications of ——— Railroad." Every unit stress and formula was different from any specification ever seen before and involved an immense amount of trouble in their application, as none of the tables in the common hand books could be used. After diligent application the stresses were computed and sections proportioned, when by chance it was discovered that about the same results could have been obtained by using a well-known bridge specification, much more familiar and easier to use. The hard work was done then, however. Well, after spending so much time on the job it was decided that the writer should take the bid in person to the chief engineer. While at his office a conversation was started with a young assistant, a recent graduate. He thought he was pretty well up in the science of framed structures. These specifications, it seemed, were of his conjuration, and he was proud of them. He explained how he had taken certain well-known standard specifications and with much twisting and infinite pains had evolved new compression formulas, new percentages for impact, etc., which should give about the same sections as ordinary specifications. It was quite a lot of trouble, he said, to find these new constants, but he believed he had gotten up a specification which was original. It is doubtful if to-day the chief engineer would secure a design on such data, and perhaps not even a bid. Three or four other bridge companies had gone to the same expense as the one mentioned, but of course only one secured the contract.

But this is not so bad as to find that your design is better than the other fellow's, but your bid higher, in which case the other fellow gets the contract on your design and the purchaser gets the benefit of your engineering ability. An attempt to do business of this sort was discovered by the representative of a contracting concern a few years ago, where at considerable expense the company had sent an engineer over a line of railroad to get data for renewing structures, and had made designs and bids for several. One day a blue print plan of a bridge was seen at the office of a rival company which had a strangely familiar look, and upon further inquiry it developed that it was a reproduction of the original design, submitted by the concern referred to, and had been received with request for proposal. The original proposal was supposed to have been accepted and contract about to be entered into. By judicious inquiry all the new blue prints were located, and strangely, not a single bid was received lower than the original.

The matter of fixing prices in the preparation of bids is one that cannot be discussed generally. Every piece of work has its own peculiarities, and in no other way can the judgment of the engineer contractor be better displayed than in determining what it will probably cost to do it, and how much margin he can allow and not be above the other bidders. It's a very narrow road he has to travel, and one where a misstep may mean a great deal. Here is where experience comes in—experience aided by good judgment, and both by an engineering training. The contractor must know what similar work has cost in the past; what the market value of the various materials entering into the construction is and what it is likely to be when he is ready to buy them; the cost of transportation of the materials; the facilities for hauling, unloading, storing and handling; what special machinery or appliances can be used to facilitate or cheapen his work; what they will cost and whether it will pay to use them; what special risks will be incurred by the work under consideration and what it is worth to provide or insure against them; he ought to know almost everything.

The papers don't, as a rule, have much to say about how public work is accomplished. A great deal is said about the thing itself, what a magnificent piece of engineering it is, and what a great engineer the designer is. But many times there isn't a tenth part the common sense or ability required to design a thing that there is to successfully build it—and make money out of it. Not "what to do" but "how to do it" is the contractor's problem.

It is the contractor who has to lie awake nights worrying about disaster from fire, storm and flood, not the consulting engineer. The latter's interest is real, no doubt, in so far as he has a general desire for the successful and speedy completion of his work, but it is the former whose bank account suffers in case of loss. And then there is the labor question. This is becoming the most uncertain feature of contract work. Careful attention to details will eliminate a large proportion of risk from the elements or accident and one can insure against fire, but there is nothing to protect from loss by carelessness and negligence of employees or from strikes. For a bridge erection job in the South recently, a gang of men were engaged in New York and their transportation paid to the work. They were satisfied with their pay and the work progressed satisfactorily until a disagreement arose in New York between the labor union and the employers of the erection force. Upon receipt of a telegram from the union the gang stopped work one afternoon with all but two panels of a 250-foot railroad span erected, and the iron was left for several days on falsework over a treacherous mountain stream until new men could be found and sent to the work. Although none of the iron was damaged, the delay and extra expense incurred made the erection job a losing one, instead of showing a profit.

There are lots of chances taken in contract work; of the nine which turn out all right you never hear anything; of the one which brings disaster, physical or financial, you are more likely to know and say "how foolish." But it is often the acceptance of the chance that decides in favor of profit instead of loss. There is no field which offers better opportunities to the man with a technical education, brains and adaptability for it, than that of general contracting, and none offers so great a chance for the combination of education and business capacity. Note the increase in recent years of the large contracting firms composed wholly or in part of engineers.

Unusual Results Followed a Fire which recently partly destroyed the roof and two upper stories of a building on West Street, New York. The building was five stories high, of ordinary warehouse construction, with wooden beams supported on brick side walls about 25 feet apart. All the floors were heavily loaded with bales of paper very closely packed, not much of which was burned. The fire was extinguished without any collapse of the structure and no signs of danger about the building were immediately noticed, but after several hours the middle part of one of the side walls bulged and a portion about 50 feet long fell outward, allowing the ends of the floorbeams there to drop and all the upper floors to become inclined planes from which the bales slid outward on the adjacent one-story building, completely wrecking it. The explanation given by the engineer who examined the building and shored up the wreck is that the bales were so much swelled by the great quantities of water played on the fire that they exerted sufficient pressure on the brick wall to overthrow it.

Duty Trials of Four Holly Pumping Engines, Metropolitan Water-Works.

The official report, slightly condensed, of the duty trials of three 35,000,000-gallon pumping engines at Chestnut Hill and one 20,000,000-gallon engine at Spot Pond.

The tests were conducted by the engineering department of the Board, represented by Dexter Brackett, engineer of the Distribution Department, and the Holly Manufacturing Company, represented by Will J. Sando, manager, Water-Works Department, International Steam Pump Co. The engines were operated during the tests by the regular employees, and all observations were made by the assistants connected with the engineering department.

Description of plants.—The engines were all designed and built by the Holly Manufacturing Company, of Lockport, N. Y.—The contract for the engines at the Chestnut Hill Station was signed October 20, 1897, and the first engine was started on June 1, 1900, the second on July 2, and the third on September 27. The contract for the engine at the Spot Pond Station was signed September 20, 1898, and the engine was started November 1, 1900. They are all of the vertical triple-expansion self-contained type, with pump plungers directly under the steam cylinders and rigidly connected with the steam pistons. The pumps are of a new design, each engine having three single-acting outside-packed plungers, and six suction and six delivery valve chambers.

The engines at the Chestnut Hill Station are all made from the same patterns, and the Spot Pond engine is of the same general design, with larger steam cylinders and smaller pump plungers. The Chestnut Hill engines have a capacity of 35,000,000 U. S. gallons each against a head of 60 feet, and the Spot Pond engine has a capacity of 20,000,000 U. S. gallons against a head of 125 feet. All the engines have a stroke of 60 inches, those at Chestnut Hill being designed to make 30 revolutions and the engine at Spot Pond 25 revolutions per minute.

On the engines at the Chestnut Hill Station the steam inlet and exhaust valves for the high and intermediate-pressure cylinders, and the inlet valves of the low-pressure cylinders, are of the Corliss type; the exhaust valves for the low-pressure cylinders are of the poppet type. At Spot Pond the exhaust valves for the intermediate-pressure cylinder and the inlet valves for the low-pressure cylinder are also of the poppet type. All valves receive their motion from a lay shaft which is driven from the crank shaft by means of beveled gears. The cut-off on the high-pressure cylinder of each engine is controlled by an automatic centrifugal governor, and is also adjustable by hand. On the Chestnut Hill engines the cut-offs on both the intermediate and low-pressure cylinders are adjustable by hand. On the Spot Pond engine the cut-off on the intermediate-pressure cylinder can be so adjusted.

The cylinders are jacketed on barrels and heads. All valves are placed in the cylinder heads. There are receivers fitted with copper reheating coils between the high and intermediate-pressure cylinders and between the intermediate and low-pressure cylinders. The volumes are respectively 6¾ times, and 2¾ times, the volumes of the preceding cylinders.

The system of steam distribution through the jackets and receiver coils is as follows: The high-pressure jacket is supplied with steam from the main steam pipe at the same pressure as the steam at the throttle valve. The first receiver coil is supplied from the high-pressure jacket outlet, and the intermediate-pressure jacket is supplied at a reduced pressure from the first receiver coil outlet. The second receiver coil is supplied from the outlet of the intermediate-pressure jacket, and the low-pressure jacket from the outlet of the second receiver coil at a reduced pressure. The low-pressure jacket drain is trapped and discharged into the working side of the second receiver, and is then trapped to waste. The condensed water from the first and second receiver coils is discharged through ¼-inch pipes into the intermediate and low-pressure jackets. Each surface condenser at the Chestnut Hill Station contains 725 square feet of cooling surface, and that at the Spot Pond Station 785 square feet. The circulating water is taken from and returned to the suction main. Directly on top of each condenser there is an exhaust heater which contains 150 square feet of heating surface. The boiler feed pumps are attached to and driven by the main engines. An air compressor for charging the discharge air chambers is attached to and driven by each of the engines.

The engine bed-plates are supported upon the valve chamber castings, and also upon cast-iron columns. Each engine has two suction and two discharge pipes, and six valve chambers, three of which are located on either side of the center line of the plunger chambers to which they are connected. The valve chambers are also connected longitudinally by the suction main at the bottom and the discharge main near the top. The valves are of rubber, $4\frac{3}{16}$ inches in diameter, and the area of the waterway through each set of suction and discharge valves is 200 per cent. of the area of the pump plungers.

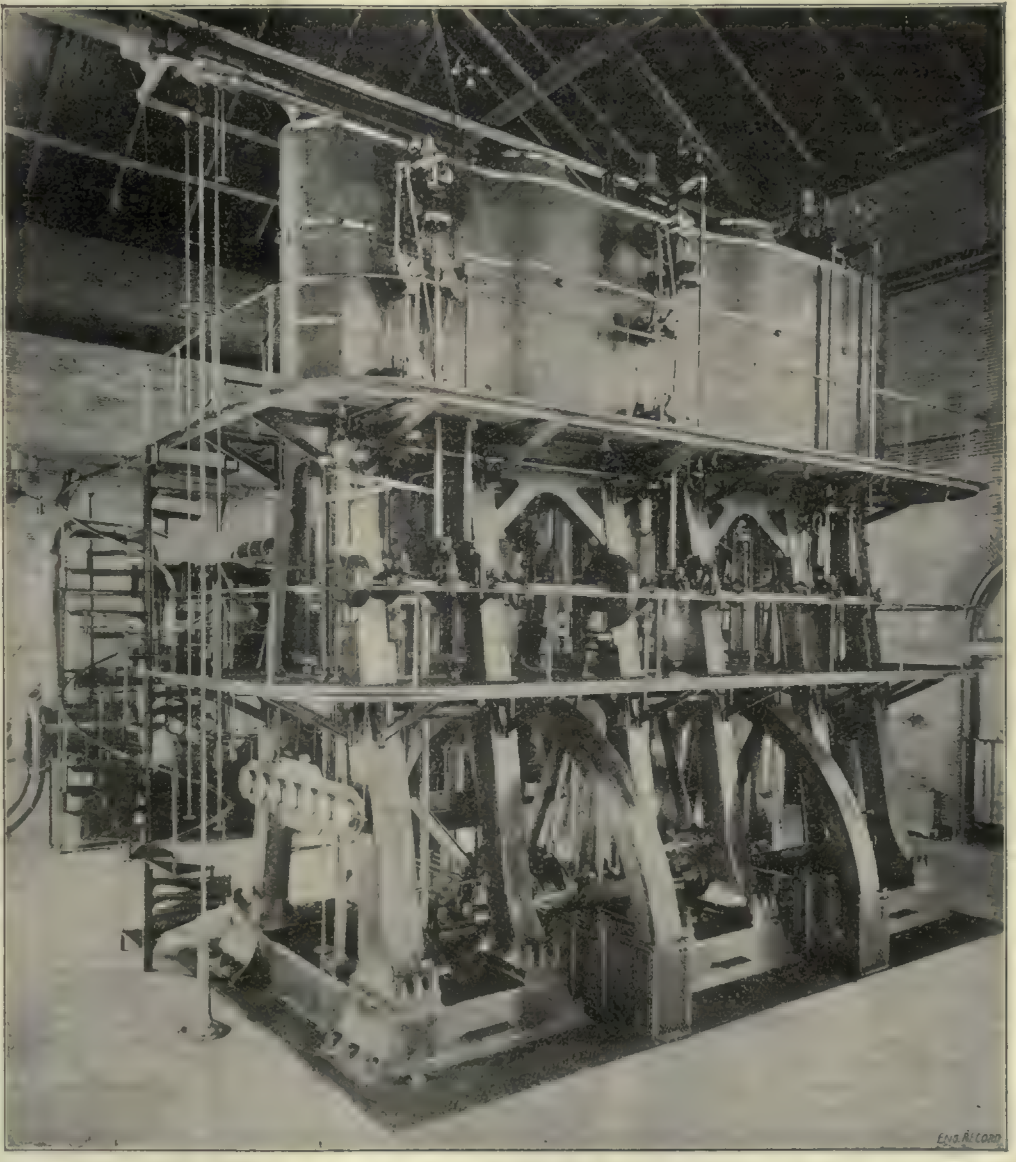
Steam at both stations was furnished by vertical fire-tube boilers designed by Messrs. Dean & Main, mechanical engineers. At the Chestnut Hill Station each boiler is 96 inches in diameter, 25 feet high, and contains 384 2-inch tubes 15 feet in length. At Spot Pond each boiler is 92 inches in diameter, 25 feet high, and contains 256 2¼-inch tubes 15 feet in length. At both stations the feed water, before entering the boilers, passed through a Green fuel economizer containing 144 tubes $4\frac{9}{16}$ inches diameter and 9 feet long, around which the escaped gases from the boilers passed on the way to the chimney. The boilers at the Chestnut Hill Station were built by the Atlantic Works, of East Boston, and those at Spot Pond by the Lake Erie Boiler Works, of Buffalo, N. Y.

Method of conducting trial.—The contracts provided that the engines should fulfil the following requirements:

Station	Chestnut Hill.	Spot Pond.
Max. plunger speed, ft.	300	250
Capacity at max. speed, U. S. gals. (24 hours)	35,000,000	20,000,000
Duty, ft.-lbs. per 1,000 lbs. commercially dry steam	145,000,000	150,000,000
Head to be pumped against, ft.	45	125
Steam pressure at throttle, lbs.	150	150

The contracts also provided that the trials should be of 24 hours' duration, that the capacity of the engines should be determined by weir measurement or some other method satisfactory to the conductors of the trials, that steam containing less than 1½ per cent. of entrained water, as determined by calorimeter measurement, should be considered as dry steam, and that in computing the duty the work performed by the engines should be based upon the displacement of the pump plungers.

The contract requirement for duty at both stations was based upon the quantity of steam used by the engines, and for this reason great care was taken to accurately determine the quantity used. At the Chestnut Hill Station all of the boilers were used to supply steam to the engines, so that there was no question regarding leakage between the boilers. At the Spot Pond Station a blank flange was placed in the connection between the boilers used during the trial and the remaining boiler, which was used to supply steam for the electric light engine and other purposes. At both stations all pipes from which there was a possibility of leakage were either closed by blank flanges or disconnected, so that any leakage could be discovered and measured. At the Chestnut Hill Station a leakage test of the boilers and steam piping could not be made on account of the necessity of continuously operating the machinery; but at the Spot Pond Station a blank flange was placed in the main steam pipe near the engine, and a pressure of 150 pounds was maintained on the boilers, economizer and piping for 24 hours. At the end of that time a sufficient quantity of water was weighed and pumped into the boilers to bring the water level to the same elevation as it was at the beginning of the test, and it was found that the leakage was at the rate of 36 pounds per hour. At the Chestnut Hill Station the quantity of steam used by any one of the engines, as determined by the water fed to the boilers, could not be measured, because all the engines are supplied with steam from one main line of steam pipe, and it was absolutely necessary that at least two of the engines should be continually operated, in order to maintain the supply of water to the Metropolitan District. For this reason all of the engines at this station were tested together.



The Holly Pumping Engine at Spot Pond.

The quantity of steam used by each engine was determined in the following manner. The condensed steam from the low-pressure cylinder was discharged by the air pump into a wrought-iron tank, from which it was drawn into a weighing tank. Another wrought-iron tank resting on a platform scale received the condensed steam from the low-pressure jacket. A wrought-iron tank received the condensed steam from the separators on all of the engines. The water from all these tanks, after being carefully weighed, was discharged into a suction tank, from which it was forced into the boilers by the feed pumps attached to the engines. The supply to the boilers was regulated by means of a by-pass, through which the discharge from the feed pumps could be returned to the suction tank.

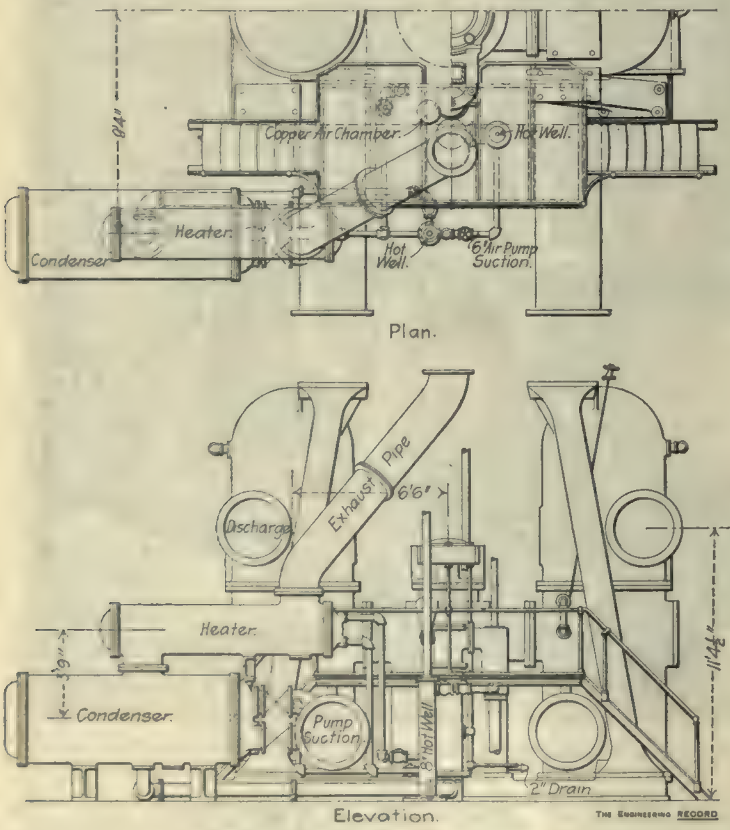
During the trial at the Chestnut Hill Station the electric light and economizer engines were not operated, the light for the building being supplied from the plant of the High-service Station. At the Spot Pond Station steam for operating the lighting engine was supplied from a separate boiler, which was disconnected from the boilers supplying steam to the engine tested.

At both stations the steam pressure at the engine was determined by a mercurial gauge connected at the engine throttle valve. The vacuum in the condenser was also determined by a mercurial gauge, and readings of both steam and vacuum gauges were taken every 20 minutes of the trial at the Chestnut Hill Station, and every 15 minutes at the Spot Pond Station. The elevation of the water in each of the pump wells was determined from readings of float gauges taken every 15 minutes during the test. The pressure of water in the force mains was determined from the average of readings taken every 5 minutes on the mercurial gauges connected with the force mains of each engine. The revolutions of the engine were observed every 20 minutes at Chestnut Hill and every 15 minutes at Spot Pond.

The condensed steam discharged by each of the air pumps was weighed every 20 minutes at Chestnut Hill, and every 15 minutes at Spot Pond. The condensed steam from the low-pressure jacket drains was weighed every 60 minutes at Chestnut Hill and every 30 minutes at Spot Pond. The discharge from the separator drains was weighed each hour at both stations. Observations were made and recorded each hour during the trial at each station of the steam pressure in the receivers between the steam cylinders, the temperature of steam at the throttle valve at the inlet of each steam cylinder, and at the low-pressure exhaust of all the engines, the temperatures of water in the drains from the low-pressure jackets, temperatures of water discharged from the air pumps, of water entering and leaving the condensers, of water in the several weighing tanks, and of air in the engine and boiler rooms. In the boiler room, records were made of the weight of coal fed to each boiler during every hour. The level of the water in each boiler, the steam pressures in the boilers, the amount of draft, the temperature of the feed water and of the flue gases entering and leaving the economizer, and the counter of the water meter on the boiler feed pipe were observed and recorded each hour. A sample of the flue gas was taken and analyzed each hour during both trials.

At both stations the condition of the fires at the beginning and end of the tests was as nearly the same as could be determined by the careful inspection of three persons, and the recorded weight very closely represents the actual quantity burned during the 24 hours.

All scales for weighing water and coal were tested and sealed immediately before each trial. All indicator springs were tested and calibrated immediately after each trial, and all pump valves were examined and tested for leakage and found to be practically tight.



CONDENSER AND HEATER CONNECTIONS.

Indicator diagrams from all the steam cylinders were taken every hour. The indicators on all the steam cylinders of each engine were electrically connected, in such a manner that six diagrams were taken simultaneously from each engine, each of which represented the average pressure in the cylinder for one minute. The pencil friction of the indicator was prevented by a current breaker, which gave the pencil an intermittent instead of a constant contact with the paper and formed the diagram by a series of dots. At the Chestnut Hill Station the pencil made 30 revolutions on each diagram, and at the Spot Pond Station 25 revolutions, so that each diagram represents the average pressure in the cylinder for one minute.

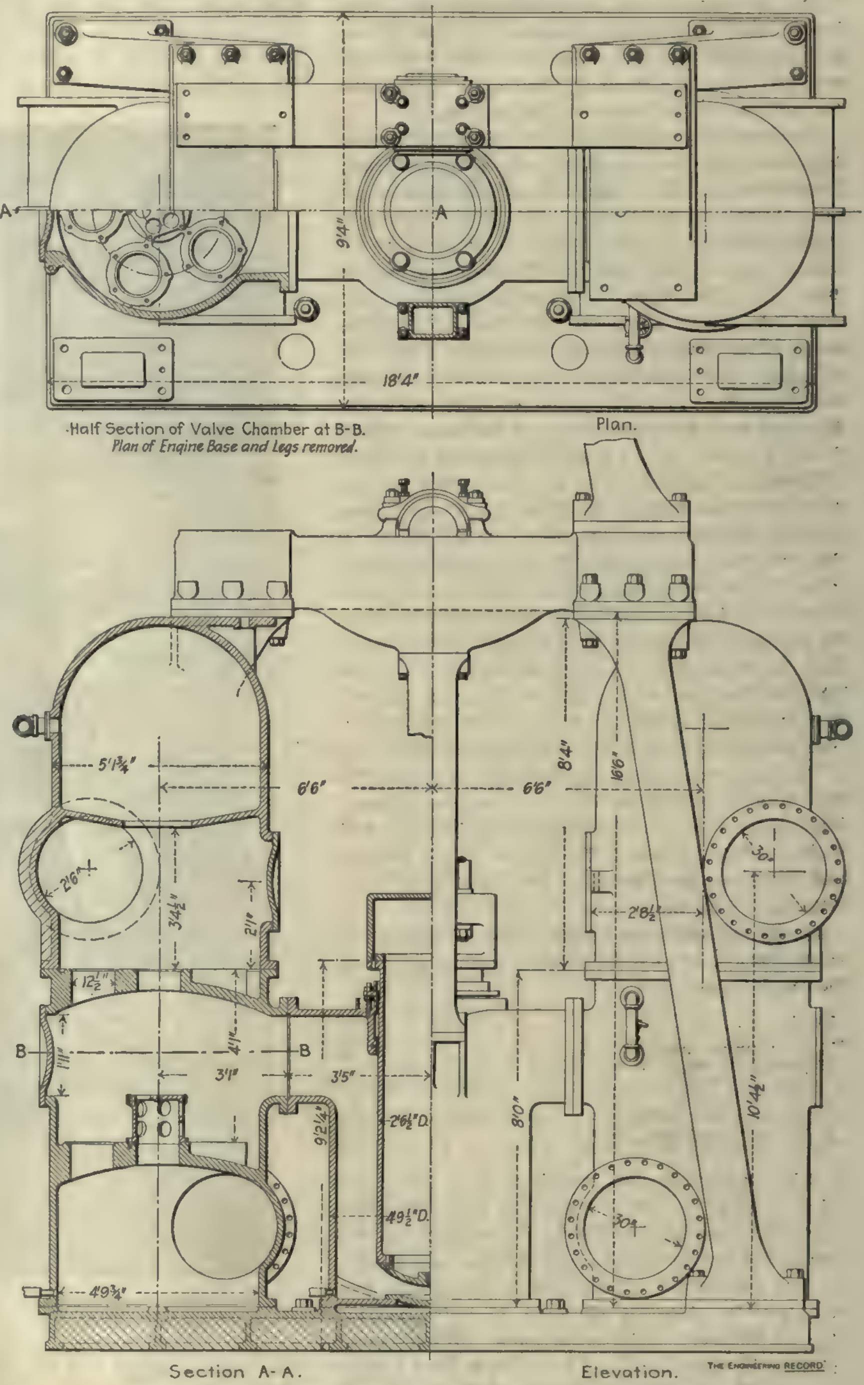
While the indicator diagrams were being taken, five-second observations were made of the pressure in the force mains, and from these observations the actual horse-power of work done by each engine while the diagrams were being made was determined.

The average friction of each engine for the 24 hours of the trial was determined from the average of the differences between indicated horse-power and the actual horse-power of work done during times while the diagrams were being taken.

Calorimeter measurements of the quality of the steam were made during both trials.

The coal used at the Chestnut Hill Station was the Loyal Hanna Sonman Shaft coal, and at the Spot Pond Station, Georges Creek Cumberland coal, in both cases the coal in regular use at the stations. The number of thermal units per pound of coal was not actually determined, and the quantities used in the report are those determined for the same kind of coal on previous tests.

In connection with the test of the engine at the Spot Pond Station a careful weir measurement was made of the water pumped. The water pumped by the engine was forced through a 36-inch pipe to a distributing reservoir, where it was delivered into a masonry chamber 20.5 feet long, 6 feet wide and 18.25 feet deep. The water entered the side of the chamber at the bottom near one end, passed through a screen, and then, after flowing 13 feet through the chamber, passed over a weir 5.991 feet long having a brass edge 0.25 of an inch wide, finished perfectly level. A temporary floor was placed in the chamber between the screen and the weir, making the channel approaching the weir 6 feet in depth. A rectangular brass plate 8 inches long by 6 inches high, with a hole $1^1/_{16}$ inches in diameter in the center, was set flush with the side of the channel, with the center of the hole 6 feet back from the weir and 0.79 foot below the crest. The hole in the center of the plate was connected by a 1-inch pipe with a can in which the water level was observed every two minutes during the entire 24 hours. The quantity delivered was determined by three different formulas and the average result used. The leakage from the force main was tested before the trial.



WATER END OF SPOT POND ENGINE, SHOWING VALVE CAGES.

At the Chestnut Hill Station no measurement of the slip of the pumps was made during the trial, but the monthly records of water pumped at the station, compared with careful current-meter measurements of the water delivered to the pumps, show that the slip does not exceed 1½ per cent.

GENERAL DATA OF TESTS.

Principal Dimensions of Engines. (The dimensions given are nominal, the actual dimensions under working conditions, given in the full report, are omitted.)

Station	Chestnut Hill Low-Service.			Spot Pond.
Engine	No. 5.	No. 6.	No. 7.	No. 9.
Diameter of cylinders.				
High-pressure, ins.	17	17	17	[illegible]
Intermediate-press., ins.	31.25	31.25	31.25	41.5
Low-pressure, ins.	48	48	48	62
Cylinder Clearances.				
High-pressure, per cent.	..	1.5	..	1
Intermediate-pressure, per cent.	..	1.3	..	0.5
Low-pressure, per cent.	..	1.1	..	0.5
General				
Diameter plungers, ins.	37	37	37	30.5
Stroke, pistons, plungers, ins.	60	60	60	60
Diam., suction and discharge pipes, ins.	[illegible]	36	[illegible]	30
Diam. flywheels (2), ft.	17	17	17	17
Weight, each wheel, lbs.	30,000	30,000	30,000	34,000
Rev. per min. for capacity	29.01	29.01	29.01	24.4
Speed per minute, ft.	290.1	290.1	290.1	244.0
Diam. main journals, ins.	14	14	14	14
Length, main journals, ins.	22	22	22	22
Diam., crank pins, ins.	8	8	8	8
Length, crank pins, ins.	8	8	8	8

Principal Dimensions of Boiler Plant.

Station	Chestnut Hill.	Spot Pond.
Boilers used in test	3	2
Boiler diameter, ft.	8.17	7.67
Boiler, length over all, ft.	29.5	29.37
Tubes in each boiler	[illegible]	256
Diam. tubes, outside, ins.	[illegible]	2.25
Length of tubes, ft.	15	15
Water-heating surface, each boiler, sq. ft.	2,107	1,645
Super-heating ditto, sq. ft.	832	[illegible]
Total heating surface, each boiler, sq. ft.	2,939	2,295
Inside area tubes, each boiler, sq. ft.	6.82	5.89
Grate area, each boiler, sq. ft.	38.48	33.18
Ratio, water heating to grate surface	56.57 to 1	49.58 to 1
Ratio, grate to tube area	5.64 to 1	5.63 to 1
Economizer heating surface, sq. ft.	1,728	1,728
Stack, height, ft.	125	125
Stack, inside diam., ft.	4.5	4.5

TRIAL DATA.

Station	Chestnut Hill Low-Service.			Spot Pond.
Engine	No. 5.	No. 6.	No. 7.	No. 9.
Trial began	10 A.M., Apr. 30, 1901.			10 A.M., June 4, 1901.
Trial lasted	24 hrs.	24 hrs.	24 hrs.	24 hrs.
Average Pressures.				
Steam at boilers, lbs.	....	153.71	....	151.03
Steam at throttle, lbs.	....	150.88	....	150.39
1st receiver, lbs.	25.01	24.48	24.79	23.41
2nd receiver, lbs.	-5.95	-4.75	-5.25	-3.58
Vacuum, ins. mercury	27.48	27.33	27.84	26.88
Barometer, ins. mer.	29.82	[illegible]	[illegible]	29.70
H.-P. jacket, lbs.	....	[illegible]	....	150.39
I.-P. jacket, lbs.	....	40.00	....	40.21
L.-P. jacket, lbs.	....	3.10	....	2.6
Draft in flue at economizer outlet, ins.	....	....	....	0.109
Draft in flue at end of boiler, economizer inlet, ins.	....	0.142	....	0.2425
Av. net head pumped against, ft.	45.093	44.972	44.00	125.275
Average Temperatures, Fahrenheit.				
Steam at throttle, due to pressure	....	366.14	....	365.87
Steam entering H.-P. cylinder	363.6	362.4	365.8	364.57
Steam entering I.-P. cylinder	268.5	266.1	268.2	266.31
Steam entering L.-P. cylinder	197.1	195.5	193.6	201.72
Water from L.-P. jacket	177.2	187.1	186.5	199.5
Water from air pump.	97.0	100.6	91.5	105.4
Water in cond'r tank	88.1	90.9	88.6	98.6
Water from 2d receiver	....	....	....	201.5
Water in L.-P. jacket tank	74.6	73.9	71.6	89.8
Water in separator tank		[illegible]		71.0
Water in 2d receiver tank		....		70.1
Water in make-up tank		50.0		59.0
Water entering economizer		85.0		92.82
Feed water from economizer		121.2		157.90
Water, condenser circulating inlet (water pumped)		48.2		58.86
Water condenser circulating outlet	66.4	69.2	65.4	79.5
Flue gases from boiler	....	412.0	....	437.0
Flue gases from economizer	....	227.3	....	230.6
Revolutions.				
Av. per minute	30.0639	30.0604	30.0625	24.853
Water fed to boiler.				
To suction tank from conden'r tank, lbs.	75,294	76,344	72,970	105,252
To suction tank from L.-P. jacket tank, lbs	10,823.5	11,511	10,970	15,886
To suction tank from 2d rec. tank, lbs.	......	......	......	355
To suction tank from separator tank, lbs.		743.5		139
To suction tank from make-up tank, lbs.		3,481		1,532
Add for suction tank, low at end of test, lbs.		2,200		1,940
Add for boiler, level low at end of test, lbs.		96		107
Add for leakage caught, lbs.		135		.....
Total feed water, lbs.		264,568		125,211
Steam out of boilers not used by engine.				
Water from separator, lbs.		829		217
Steam blown through calorim'r (weighed in tank), lbs.		352.4		647
Leakage from whole plant, exc. of engines, lbs.		4,115.7		[illegible]
Discharge from oil-pressure pipe, lbs.		1,385.4		...
Total steam from boilers not used by engines, lbs.		6,682.5		1,633
Steam chargeable to engines, lbs.		257,885.5		123,578
Steam received from engine.				
From condenser, lbs.	75,280	76,353	72,968	106,345
From leak on engine, caught and weig'd, lbs.	......	58	......	......
From L.-P. jacket, lbs.	10,806.5	11,491	10,929	16,220.5
From 2d rec'r, lbs.	......	......	......	603.5
Charged to leaks on engine	......	......	......	409
Total steam used by engines	86,086.5	87,902	83,897	123,578
Av. entrainment in steam entering engine (0.7%)	......	......	......	865
Total dry steam used by engines	......	257,885.5	......	122,713
Percentage of total steam used in jackets	12.55	13.07	13.03	13.125

HORSE-POWER FIGURES.

	No. 5.	No. 6.	No. 7.	No. 9.
Av. percentage of engine friction from 24 sets of cards	11.16	11.58	12.57	3.47
Av. H.-P. delivered	287.27	286.38	280.27	448.35
Av. ind. H.-P.; H.-P. cyl.	114.11	112.58	111.11	151.93
Ditto I.-P. cyl.	104.09	104.10	103.80	138.22
Ditto L.-P. cyl.	105.16	107.20	105.66	174.32
Total Ind. H.-P.	323.36	323.88	320.57	464.47
Av. moist steam per I. H.-P. per hour, lbs.		11.10		11.09
Av. dry steam per I. H.-P. hour, lbs.	11.08	11.31	10.92	11.01
Av. B. T. U. per I. H.-P. per minute	206.79	209.99	203.86	203.42

COAL AND RATE OF COMBUSTION AND EVAPORATION.

	Chestnut Hill	Spot Pond
Moisture in coal, per cent.	2.2	3.7
Total dry coal burned, lbs.	25,958	11,972
Total ashes, lbs.	1,648	783
Coal per sq. ft. of grate per hr., lbs.	9.58	7.806
Coal per sq. ft. heat. surf. per hour, lbs.	0.125	0.1574
Evap. per lb. coal, actual conditions, with economizer, lbs.	9.968	10.072
Evap. per lb. dry coal, same conditions, lbs.	10.192	10.459
Evap. per lb. dry coal, actual conditions, excluding economizer, lbs.	9.883	9.883
Evap. per lb. coal, from and at 212° F., including economizer, lbs.	12.042	12.270
Ditto without economizer, lbs.	11.677	11.593
Evap. per sq. ft. heat. surf. per hr., lbs.	1.736	1.586
Dry coal per I. H.-P. per hour, lbs.	1.118	1.074
Dry coal per D. H.-P. per hour, lbs.	1.267	1.112

Useful Work Performed by Engines.

Station	Chestnut Hill Low-Service.			Spot Pond.
Engine	No. 5	No. 6.	No. 7.	No. 9.
Plunger displacement, cu. ft. per revolution	112.0415	112.0066	112.0335	76.1869
Plunger displacement at 62.4125 lbs. per cu. ft. L. S. engines, and 62.373 lbs. for Sp. Pd. engine. Lbs. per revolution	6992.8	6990.6	6992.3	4752.0
Total pumpage, slip neglected, gallons	36,284,300	36,268,900	36,280,000	20,396,800
Total useful work, ft-lbs	13,651,125,000	13,608,593,750	13,318,666,670	21,305,450,000

DUTIES.

	Low-service Engines			Sp. Pd. Engine
	Number 5.	Number 6.	Number 7.	Number 9.
Duty per 1,000 lbs. steam, plunger, displ. (cont. basis). Ft.-lbs.	158,574,000	154,815,000	158,750,000	172,405,000
Duty per 1,000,000 B. T. U. Ft.-lbs	141,787,000	139,039,000	143,771,000	156,592,000
Duty per 100 lbs. moist coal. Ft.-lbs.	Average 3 engines,		152,883,000	171,376,000
Duty per 100 lbs. dry coal. Ft.-lbs.	Average 3 engines,		156,322,000	177,961,000
Duty per 1,000 lbs. dry steam	Average 3 engines,		157,349,000	173,620,000

EFFICIENCIES, IN PERCENTAGES.

	Low-service Engines			Sp. Pd. Engine
	No. 5.	No. 6.	No. 7.	No. 9.
Mechanism	88.84	88.42	87.43	96.53
Boiler and economizer, actual		82.9		84.64
Boiler alone, actual, had economizer not been used		80.4		79.97
Thermal eff. of engine.	20.50	20.22	20.80	[illegible]

Weir Measurements.

Length of wier. Ft.	5.991
Aver. depth of water on weir. Ft.	1.337
Cal. disc. over weir. Gals.	20,142,500
Leakage from force main during test. Gals.	1,120
Water drawn from force main during test. Gals.	4,080
Plunger displ. of pumps. Gals.	20,396,800
Slip. Per cent.	1.22

Average Results of Gas Analyses in Percentages by Volume.
Average of 24 Observations.

Station	Chestnut Hill.	Spot Pond.
Carbonic Acid (CO_2)	13.6	13.8
Oxygen (O)	4.7	5.1
Carbonic Oxide (CO)	.1	.3
Nitrogen by difference (N).	81.6	80.8
Total	100.	100.

New Sewage Screening Apparatus at Manchester.

In the annual report for 1900-01 of the Rivers Department of the city of Manchester, England, of which Sir B. T. Leech is chairman, there is an illustrated description of the new works recently constructed for removing detritus from the sewage of that place before it passes through the disposal works, which were described in The Engineering Record of December 2, 1899. The sewer inlets of the city being generally unprovided with traps, the sewage, especially during storms, contains large quantities of heavy detritus from the streets, together with cinders and sometimes coal from boiler houses. This was formerly removed with wheelbarrows from the chemical precipitation tanks at considerable trouble and expense. There is also much floating matter present, such as cotton waste, rags and garbage of various kinds, which would cause trouble if allowed to pass into the tanks. A system of screens and catchpits was therefore built, which has been in satisfactory operation for nearly two years.

The main sewer divides, on reaching the plant, into three branches, of which the central one is a storm overflow channel passing directly through the screening building. The branch on either side of this overflow leads first to a coarse screen, next past a concrete cut-water to fine screens, and then the sewage passes into two catchpits with hopper-shaped bottoms. Beyond these pits is another set of fine screens like the first, and beyond them are baffles past which the sewage flows into a single channel, the size of the outfall sewer, leading to other portions of the disposal works.

The first or coarse set of screens is built of 1 x 4½-inch bars with 6-inch spaces, intended to arrest all large pieces of timber and the like which may be carried down the sewer and would tend to injure the finer screens. These bars are kept cleared by hand.

The second screen extends the whole width of the chamber, 37 feet, but is built in three sections, each of which can be worked independently. It is constructed of ⅜-inch iron rods with 1¼-inch openings. It is mechanically cleaned by tines attached to channel-iron bars, fixed in turn to endless chains working on sprocket wheels at each end of the section of the screen. As the chains revolve the tines pass between the openings in the screen. The distance between the tined bars is such that two of them traverse the screen at the same time. The rate of speed of these bars is 1½ feet per second, and they carry the floating matter arrested by the screen to a point above the floor of the chamber, immediately over a wrought-iron channel.

On passing over the sprocket wheels, the tines recline to a vertical position, and any matters which tend to adhere to them are swept off by means of a brush into the channel. The brush extends the whole length of the section of screen, and is fixed on a shaft actuated by a lever and counterweight for reversing the motions. The wrought-iron channel is cleaned with a squeegee and its contents loaded into tram wagons which pass down the center of the chamber on the roadway over the storm-relief channel.

The third screen is much like the second, but it has no brush for cleaning and is built of ⅝-inch bars placed half an inch apart; it is constructed in four sections instead of three. Both the second and third screens are surrounded by headstocks carrying the necessary sprocket wheels, shafting and driving pulleys; the machines are driven by cotton belts from an overhead countershaft with fast and loose pulleys.

On either side of the storm-relief channel there are two catchpits between the second and third sets of screens, in which the heavier suspended matter is deposited. In the hopper-shaped bottoms of each there is a bucket elevator or dredger. Its buckets are attached to an endless chain actuated by a sprocket wheel in a headstock fixed some distance above the floor of the screening chamber. The buckets are formed of 5/32-inch steel plates, with semi-circular bottoms and rounded noses, and measure over all 16 x 8 inches by 8 inches deep. On the back of each bucket is riveted a steel-plate slide 4 x 20 inches in size; this keeps the bucket in place when full by working in two angle-iron guides fixed to the bottom of the pit and to the headstock. The buckets are perforated with small holes for draining the dredged matter.

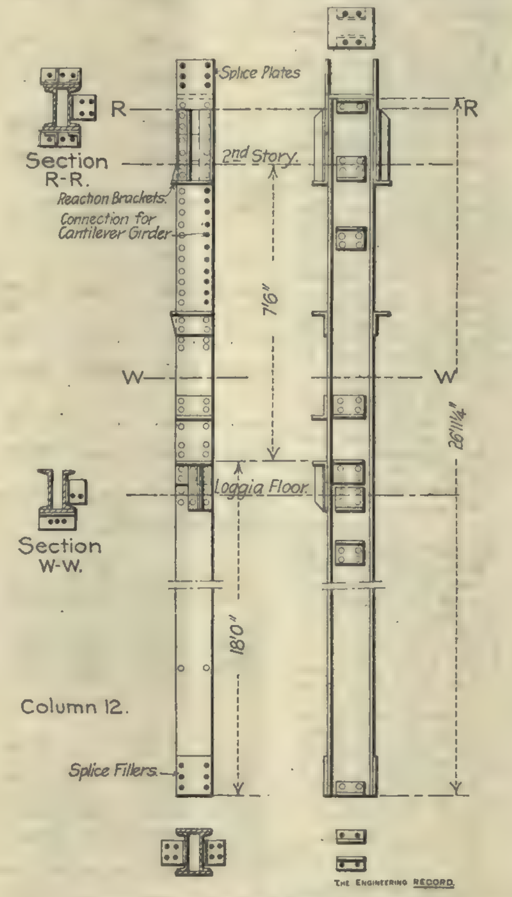
The endless detachable chain on which the buckets are fastened is kept in position at the bottom of the pit by a guide wheel and sprocket wheel fixed on stone bases. The headstocks are supported by heavy steel girders. The headstock frame is of cast-iron, with sprocket wheels 2¼ feet in diameter and steel pinion wheels. The whole is driven by a 36-inch pulley with 5-inch face, run by a cotton-webbed belt from the main shaft. There are fast and loose pulleys on all the headstocks, so as to permit working them at will. When these machines are in operation, the buckets tip on passing over the sprocket wheel at the headstock into a hopper, by which the detritus is conducted into a metal channel or conveyor. Scrapers attached to endless chains push the material along this channel to a point over the central roadway already mentioned, where a wagon is placed to receive it. These endless chains are provided with detachable and attachment links passing over sprocket wheels actuated from a shaft.

By means of this plant about 90 tons of solid matter are removed each week from the sewage during dry weather. In stormy weather as much as 50 tons has been removed in 24 hours.

An average sample of detritus was found to consist of a large proportion of sand, fine coal and cinder, a fair amount of coal in moderate-size pieces, with some gravel, clinker, small pieces of brick, wood and leaves. Altogether there was about 35 per cent. of combustible matter in the dried sample, of which about 7 per cent. was coal that could be easily picked out by hand. A rough experiment showed that this material, if mixed with garbage from the screens and allowed to drain, can be burned with about 25 per cent. additional fuel. To obtain clinker from the mineral matter will probably require a forced draft.

Heavy Girders in the Union Club House.

The house of the Union Club, New York, is a 75½ x 150-foot, five-story building with steel beams and girders supported on interior columns and on cast-iron plates in the thick masonry exterior walls. The column and wall footings are carried down to the solid rock, which is leveled up with concrete. There are 48 steel columns, more than half of which have a closed rectangular cross-section made with two 10-inch channels and two or four 12-inch plates, or of two 12-inch channels and two 14-inch plates. They have field-riveted splices, with flange cover plates and horizontal diaphragms or cap plates shop-riveted to top-flange angles. Nineteen of the lightest columns have I-shaped cross sections, made with four 3½ x 3-inch angles and an 8-inch web plate. The maximum column load is 682,420 pounds, for which there is provided a cross-sectional area of 62 square inches. The columns are bolted to square webbed cast-iron bases which have five 2-inch grouting holes through the bottom, and, for the heavier columns, are 3¼ feet square on the base and 18 inches high, with 1½ and 2-inch metal.

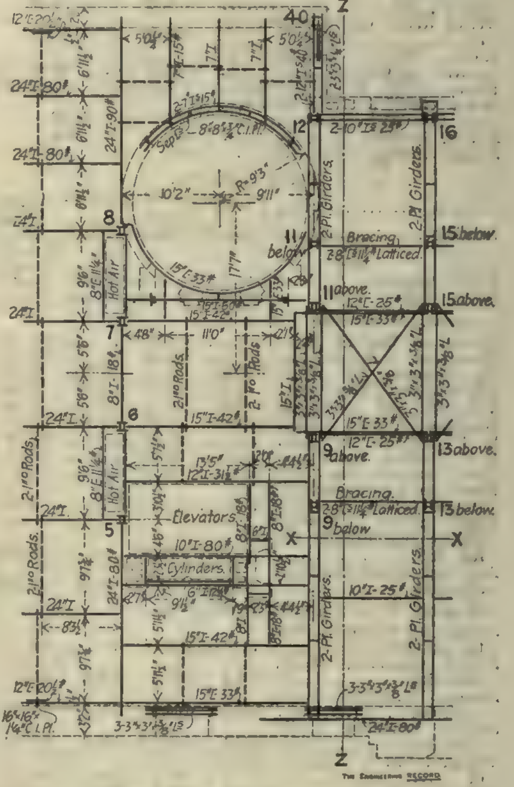


Cantilever Girder Connections.

The column rows are from 9 to 12 feet apart transversely and from 12 to 20 feet apart longitudinally, except at the ends of the building, where there is a distance of about 34 feet from the center of the last row of columns to the inner face of the wall. In the 20-foot panels the floor beams are 15-inch, 70-pound I-beams about 5 feet apart. In most of the 34-foot panels the floor beams are single, 24-inch, 80-pound I-beams, with an 8½ x ⅞-inch reinforcement plate 25 feet long riveted to each flange, and are spaced about 10 feet apart. In the 34-foot panels of the second floor, under the billiard room, there are plate girders from 8 to 11 feet apart, the heaviest of which has a 30 x ½-inch web, four 6 x 6 x ¾-inch flange angles and two full length 13 x 13/16-inch flange cover plates. Near one end of the building there is a circular stair well 18½ feet in diameter, which has a semi-circular 15-inch channel framed in the floor at each story.

The I-beam framing conforms to the Carnegie standard, with field-riveted instead of bolted connections in all principal places. There is horizontal X-bracing of 3 x 3-inch angles in three panels between the two middle longitudinal rows of columns in the second floor only.

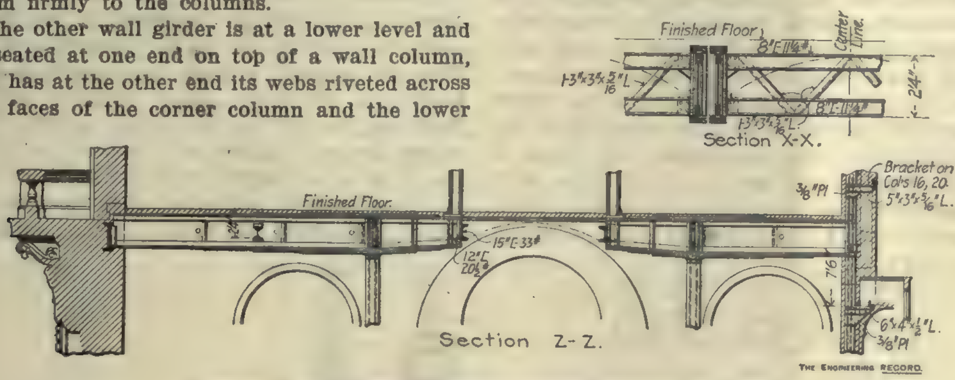
In four transverse rows of columns in the center of the building, the two interior columns in the first and basement stories are 27 feet apart and the corresponding interior columns in the upper stories are about 13 feet apart. In order to accommodate the first story ceiling arches the upper tiers of these columns are supported on the 7-foot cantilever ends of double plate girders supported on the lower sections of the interior columns and having upward reactions at the walls. The cantilever girders vary slightly in weight; the heaviest one has in each half one 32¾ x ¾-inch web, four 6 x 4 x ¾-inch flange angles, two 10 x ¾-inch flange plates 21 feet long, two 10 x ¾ x 14 feet long, and two 10 x ⅝ x 8 feet long. There are pairs of 3½ x 3-inch regular vertical web stiffener angles, and over the first-story columns there are two 4 x 3 x ⅜-inch and six 3½ x 3 x ⅜-inch web stiffener angles, all crimped. The girders are connected together by vertical transverse diaphragms bolted to intermediate web stiffener angles on the insides of the webs, and accessible through circular 4-inch hand holes in the neutral axis of the web. At the extremity of the cantilever a plate is riveted across both outside flanges at the end vertical web stiffener angles and extends up above the top flange to rivet across the side of the column and form an additional connection for it, besides the rivets through its bottom horizontal flange and base plate. On one side of the building the anchor ends of the cantilevers are riveted to horizontal I-beams built into the wall; on the opposite side they are riveted to the first-story columns between lower bracket seats which take downward thrust and dead weight during erection,



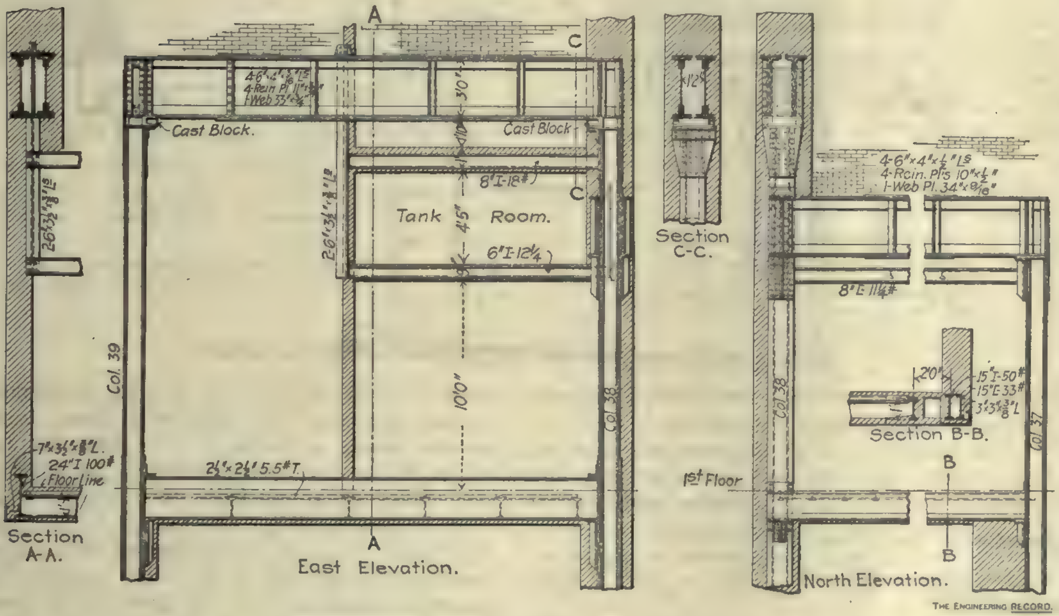
Part Plan at Cantilevers.

and reversed upper brackets which take upward reactions. The cantilevers are connected together by transverse lattice girders 30 inches deep, with single 8-inch top and bottom chord channels with their webs vertical, and single 3 x 4-inch lattice angles.

At one corner of the building the exterior walls above the first story are carried by double girders of about 22 and 23 feet clear span, which rest on the tops of three columns, terminating at the levels of the first story mezzanines. The short span girder is slightly heavier than the other one and has a 33 x ¾-inch web plate, four 3 x 4 x 13/16-inch flange angles, and four 11 x ¾-inch flange reinforcement plates. The corner column has a long, wide, vertical plate riveted across the upper part of the outer flanges so as to extend beyond the cap almost to the top of the girder, and is riveted to the flanges of its end vertical web-stiffener angles so as to hold the two parts of the girder together and connect them firmly to the columns.



Second Floor Cantilevers Supporting Columns 13 and 15.



Corner Wall Girders over First Story.

The other wall girder is at a lower level and is seated at one end on top of a wall column, and has at the other end its webs riveted across the faces of the corner column and the lower flange supported on bracket angles with their horizontal flanges reinforced by vertical angles. From it is suspended an 8-inch channel to which are framed light ceiling beams. A portion of the upper part of the first story adjacent to these girders is occupied by a very low tank room, with a floor platform suspended from the center of the heavy girder. There is only about 2 inches clearance between the flanges of the girders, so the narrow flanges of the pair of 6 x 3½-inch suspender angles were cut off at the upper end, and allow the two 6-inch flanges riveted together to pass up between the halves of the girder. Short transverse angles are riveted with their horizontal flanges down to the tops of these angles and form bearings for their support on the top flanges of the girder.

There is a driveway under the first floor, and over it the ceiling is made of concrete on expanded metal enclosing the 20-inch I-beam girders and 10-inch floorbeams. This floor consists of 2 inches of concrete on book tiles laid on 2½ x 2½-inch T-bars 18 inches apart. The T-bars rest across the top flanges of the 10-inch I-beams, 3½ feet apart, and their ends are offset about 1½ inches, so as to drop the horizontal flanges below the top flanges of the I-beams.

All the other floors in the building are made with Guastavino arches, leveled up with concrete, and proportioned for loads up to 350 pounds per square foot. They are made with three or four courses, and as each course weighs about 10 pounds per square foot the net weight of arches is only about 40 pounds per square foot for spans up to 13 or 14 feet.

Under the billiard room the skewbacks rest on courses of brick laid on the lower flanges of the deep plate girders so as to raise the arches nearer the top flanges. The arch thrust is resisted by pairs of 1-inch rods running diagonally in the same vertical plane from the upper part of the web of one girder to the lower part of the web of the next girder, thus forming a kind of transverse X-bracings 8 or 9 feet apart. All the stairways are of Guastavino construction, the main stairway being a three-story spiral about 18 feet in diameter.

Messrs. John DuFais and Cass Gilbert are the associated architects of the building, Messrs. Purdy & Henderson are the consulting engineers, and the George A. Fuller Company is the general contractor.

A Fire and Water Test on a 7-foot floor arch will be conducted at East 105th Street and Harlem River, New York, on November 21, under the supervision of the Department of Buildings. The floor is of cinder concrete with a special metal element, and is of the type made by Paul Kuhne & Co. The final series of thin partition tests will be conducted on the same day. Mr. W. W. Ewing is the Department's engineer in charge of these tests.

Ventilating and Heating the Glasgow Art Galleries.

The Glasgow Art Galleries are a group of buildings which were opened concurrently with the British international exhibition at Glasgow, forming for the time being a part of that exposition. The buildings have been equipped with a large and interesting ventilating and heating system, which comprises a plenum system of air distribution and a water-tube boiler plant for steam production. The plant includes also an air washing apparatus of noteworthy completeness. In a recent issue of "The Engineer" the plant was described, together with a test of the ventilating machinery, the latter permitting some interesting deductions to be made from the plant's operation. The arrangement of ventilation was planned by Mr. Thomas Young and the apparatus was furnished by the Sturtevant Engineering Company, Ltd.

The cold air is drawn from an inlet shaft by means of an electrically-driven enclosed-type fan, through a corrugated filter, fitted with a water flushing and spraying arrangement. It is then forced through the steam heater coils, warmed, and delivered into the main basement flues, whence it is distributed, by means of vertical ducts built in the walls, to the various rooms and passages of the building. Two complete sets of heating and ventilating apparatus thus arranged are installed, one for the east portion and one for the west portion of the galleries. The boilers for supplying steam to the heater coils are situated in the east wing in the basement, and a steam main runs from the boilers, branching to each of the heaters, the condensed steam being returned to a feed tank in boiler house, from which the feed pumps draw their supply to feed the boilers.

The boilers are of Babcock & Wilcox type, two in number, each with 1,300 square feet of heating surface, designed for a working steam pressure of 120 pounds per square inch. The two boilers are set in one battery and are provided with Vicar patent mechanical stokers, worked by eccentrics on one overhead line of shafting. An electric motor drives this shafting by means of a chain drive. There is also a Green economizer, consisting of 128 pipes, each 9 feet long by 4 9/16 inches diameter. The gearing for the self-acting scrapers is also driven by an electric motor, similar to that for driving the stokers. These motors are designed for a current of 8 amperes at 250 volts, supplied from the corporation mains. There is also a by-pass flue, whereby the gases can pass direct to chimney without passing through the economizer, and also an induced draught fan, so arranged that the gases can be diverted through the fan and thence to the chimney.

The ventilating fans and heaters are in the basement, situated east and west in the center of the building, a complete apparatus serving the east portion and a similar apparatus the west. Each fan is of the steel-plate design, three-quarter housing. It is fitted with a pulley for belt drive, and runs at 120 revolutions per minute, and at this speed delivers 5,000,000 cubic feet of air per hour. There are two discharges, one on the top serving the high ducts, so called, and one on the bottom serving the low ducts; both discharges horizontal. The electric motor for driving the fan is 30 brake horse-power, running at 670 revolutions per minute. It is of the enclosed ventilated type, and works at 500 volts.

In connection with each outlet from the fan there is a sectional base heater composed of compactly arranged steam coils. Each heater is made up of six independent sections, arranged in two groups across the path of air flow. These sections are 5 feet wide by 7 feet high, and are enclosed in a steel-plate casing, the piping involved being 10,800 feet run of 1-inch steel pipe. Steam is transmitted from the steam boilers by means of a 6-inch wrought steel steam pipe, lap welded, with steel flanges, the branches from the steam boiler to steam main being 5 inches. The 6-inch pipe divides into two 4-inch branches, one to serve the east and the other the west apparatus. The condensed steam pipes from the heaters are connected to lifting traps—two to each heater—and these return connections from traps are joined to the return main which runs to the feed tank in the boiler house.

The method of washing the cold air from the atmosphere before passing through the fans is as follows: The air enters the building at the top of a lofty tower, and is drawn down a vertical well, 10 x 5 feet in cross section. This well is lined with white enamelled brick. The well extends to the basement, where in a special chamber is fitted the air-washing apparatus. This consists of galvanized corrugated iron sheets, 10 feet x 2 feet 3 inches wide, arranged in three separate groups, bolted together and supported by T-iron framing. The sheets have a 4-inch pitch of corrugation, and are spaced about ⅞ inch apart. The three groups are about 4 feet wide, making a total area through the filters about 120 square feet. Each group is held together with six ⅞-inch bolts, the spacing between the plates being arranged by flat bars resting on these bolts. The washer on the air inlet side is fitted with five Kortings gun-metal water-spray nozzles, which wash the air before passing through the filter. There is also a perforated copper steam pipe fitted on the air inlet side for use during frosty weather. The washer is found very effective in preventing fog from passing into the building.

There are, of course, two washers as described, one for the east and one for the west side. In the well hinged valves or dampers are fitted, so that the air from outside can be completely shut off and the air drawn from the building by means of openings cut into the east and west halls. The vitiated air is withdrawn from points at the floor level, and passes up through flues to the outlets on roof.

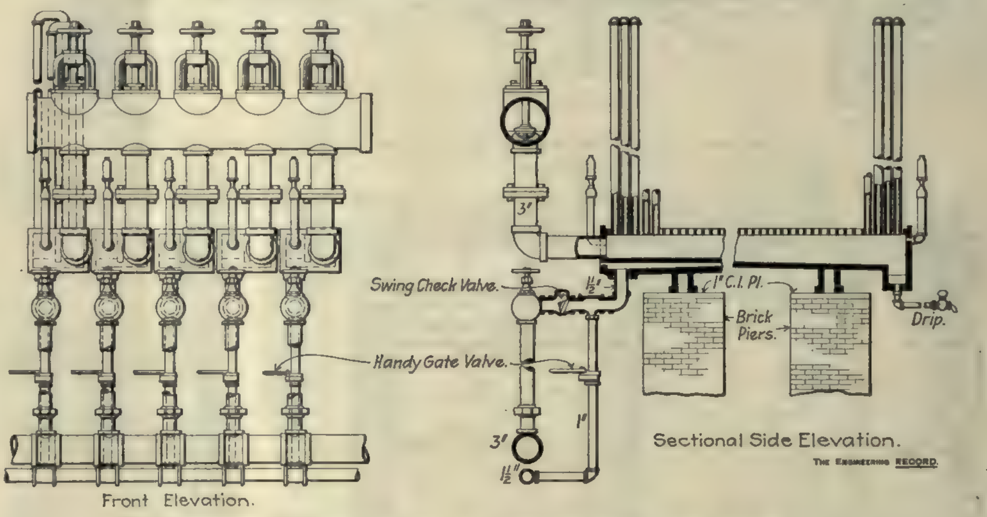
The results of the tests are shown in an accompanying table. The east section was tested on March 4th of the present year and the west section on March 7th. The fan motor was run at varying speeds and the number of amperes required under the different conditions are given in the first column. The speed of the fan to that of the motor is about 1 to 5.65, and the revolutions of the fan wheel are given in the second column. The velocity of the air at the air inlet is given in the third column, and the area of the air inlet being 54 square feet, the total volume of air received per minute is given in the fourth column. The velocities of air in the high and low ducts, no detailed method for measuring which, it may be mentioned, was stated, are given in columns 5 and 6. Their total areas being 37.92 and 42.96 square feet respectively, in the east system and 40 and 41.25 square feet, respectively, in the west system, the amount of air moved in each system may readily be calculated; the total amount of air delivered from each fan unit is given in column 7. The remaining three columns give the temperatures as stated at the column heads. Perhaps the most interesting figures are those relating to the power required to drive the air. At highest fan speed in the one case 55 amperes were required by the motor, which at 500 volts means about 37 electrical horse-power; in the other case, 43 amperes were accepted by the motor, which means about 29 electrical horse-power. It will thus be seen that based on the air received by the apparatus, 7.2 to 7.25 electrical horse-power are required per 1,000,000 cubic feet of air moved per hour, and based on the air delivered, 6 to 6.75 electrical horse-power per 1,000,000 cubic feet per hour.

Test of Ventilating and Heating Apparatus in the Glasgow Art Galleries.

Motor amperes.	Revs. per min., fan.	Inlet velocity, ft. per min.	Inlet, cu. ft. per min.	High ducts, ft. per min.	Low ducts, ft. per min.	Total delivery cu. ft. per min.	—Temperatures, deg. Fahr.— High ducts.	Low ducts	Air inlet.
East Side.									
25	80	742	42,768	...	...	......	...	...	44
33	94	1,058	57,132	877	875	68,688	110	100	44
[illegible]	104	1,272	68,688	1,025	1,279	93,833	89	94	48
46	110	1,425	76,950	1,260	1,530	113,272	100	100	[illegible]
55	120	1,588	85,752	1,364	1,442	103,507	103	102	48
West Side.									
20	74	866	46,764	970	916	76,585	105	118.5	47
26	86	880	47,720	932	670	64,918	101	124	47
[illegible]	96	1,250	67,500	1,150	516	67,285	114	126.5	47
37	104	1,268	68,472	1,171	844	81,655	113.5	121	47
43	114	1,233	66,582	1,125	635	71,194	[illegible]	108	44

Heating Apparatus in St. Louis Schools.

The accompanying illustration shows some of the details of heater coils as designed for the ventilating and heating plants of St. Louis schoolhouses. The chief point of interest lies in the construction of the steam header, which, as indicated, entirely encloses the valves commanding the branch steam pipes to each section of the heater, the valve seats being spaced along the bottom of the header and the valves themselves being in effect caps to the top of the branch pipes. The arrangement of drains is also interesting, the regular returns fitted with an angle valve as indicated with a check within the angle valve, and the drain pipes dropping from a point within the check and fitted with quick-operating handy gate valves.



DETAILS OF HEATERS FOR THE FAN SYSTEMS IN ST. LOUIS SCHOOLS.

The heaters are of the ordinary pipe-coil type, with cast-iron bases arranged for four rows of vertical pipes. A longitudinal partition extends through the base, separating the steam from the return side of the coils, and at the far end the steam and return chambers in the base are open to each other, so as to effect a circulation of steam along the entire base, and thus give the distant pipes of the coil their proportion of the steam supply.

The heating apparatus of the St. Louis schools, which is designed by Mr. Alvin D. Reed, chief engineer of the St. Louis Board of Education, was briefly described in the issue of July 20 in the record of the meeting of the American Society of Heating & Ventilating Engineers, held in Chicago that month. The schoolhouses are heated entirely by an air supply circulated on the plenum system. The air is brought downward from the roof level and passed successively through tempering coils, fan and heating coils. The heating chamber is centrally located, and the fan is of the double-discharge type driven by a direct-connected steam engine. By-pass and dampers are used with the tempering coils to maintain a temperature of 70 degrees Fahrenheit, and similarly, beyond each outlet of the fan there is a tempered and hot-air space. The air system beyond is of the type in which small ducts for the individual rooms are carried from the heating chamber to the various flues; double dampers operated by thermostats are placed at the mouths of the ducts to mix the tempered and hot-air supplies as desired.

The two discharges from the fan are one, top horizontal, and the other inclined upward, the latter bending toward the top of the fan into the horizontal in the opposite direction to the top horizontal discharge. A deflecting sheet of metal is fitted within the casing of the fan to assist in diverting the proper proportion of air from the upward inclined discharge to the top horizontal discharge. The deflector extends from the top of the fan casing at the point where the two discharges separate, and takes the form of an intermediate scroll, which may be brought nearer or farther away from the fan wheel, as desired. The elbow curving from the upward inclined discharge into the horizontal is also provided with deflectors, these being curved sheets of metal parallel with the top curve of the elbow and riveted to the sides of the elbow. They are three in number. Their office is principally to force the air to flow over the whole area of the discharge, and consequently through the heater coils immediately beyond. Deflectors are also provided in front of the by-passes under the heating coils. These are continuations of the outside scroll surface of the fan casing, and slide in angle-iron guides in the lower part of the casing. There is a damper in the by-pass to open or close that channel, and the purpose of the deflector is to equalize as much as possible the distribution over the whole area of the path of air flow.

Underground Water Supplies continue to receive the attention of the State Supreme Court of New York. In the latest case, Jager v. City of New York, 72 N. Y. Supp. 131, Judge Chester rules that where the owner of 4½ acres provided the same with ditches for market gardening, and his supply of water was shut off in 1894 by the driven-well pumping plant then introduced by the city, he could not recover $20,000 from the city for seven years' loss of crops; nor where the crops annually failed to mature was he justified in continuing to plant them. No injunction was awarded against operating the pumping plant.

The Collapse of the Fairhaven Water Tower.

The water tower forming part of the water system of Fairhaven, Mass., collapsed in the afternoon of November 9. This interesting structure was fully described in The Engineering Record of February 24, 1894. It stood three-quarters of a mile from the center of the town near the north side of the main road, which runs in a generally easterly direction through the town. The tower has attracted much attention since it was built and has served as a model for many more structures for a like purpose. The following notes concerning it are furnished by an engineer familiar with the tower since its erection was begun, and in a position to be acquainted with the facts of its condition.

The tower, the first of its size and type in the country, consisted of a cylindrical tank of steel plate resting on a base composed of twelve columns surmounted by a circular girder, and capped with a galvanized sheet-iron roof. An inverted conical bottom of steel plate carried a gland at its lowest point, which served as an expansion joint for the supply and outlet pipe.

The feet of the twelve legs rested on piers of rubble masonry built in cement mortar, which were 9 feet square at the base, 6 at the surface of the ground and 8 feet deep. These piers had coping or anchor stones 4 feet square and 1½ feet thick. Each anchor-stone was perforated for two 1½-inch bolts, passing through iron pipes built into the foundation. These bolts held the feet of the columns in position. The ground between and inside of the piers was covered by a crowning foundation of rubble and cement. The piers were 65 feet apart on centers.

The columns were built up from an 18 x ½-inch web with flanges 14 x ½ inches, riveted onto angle irons. (These dimensions differ slightly from those mentioned in the article referred to above.) The feet and caps were 20 inches square and ¾ inch thick. The columns were 100 feet in height, in five sections. At each joint there ran around the twelve posts a line of horizontal struts of 8-inch channel beams. Turnbuckle tie-rods 1¾ inches in diameter ran diagonally across each panel thus formed. The circular girder at the top of the columns was nearly 3 feet in depth. It was built of ⅝-inch plate, and 4 x 3 x ½-inch angle bars. The plate was stiffened by angle-iron ribs, both inside and outside. The segments of the girder were separated by plates so bent as to allow the passage of the eye-bolts, which secured the tank to the base, and they were riveted to the caps of the columns. (These details are entirely unlike those of the original design, published in 1894.)

The tank was 35 feet in diameter, 50 feet high, and built of ½ to ¼-inch plate. It was ten courses high, twelve plates to a course. The five lower courses were double riveted on the vertical seams, all other seams single riveted. The inverted conical base was 20 feet in depth and was described as follows by Mr. Nye, superintendent of the water-works, at a meeting of the New England Water-Works Association: "The tank differs in no way from any ordinary well-designed tank or standpipe, except in the construction of the bottom, which was made in the form of an inverted cone. This was done to avoid center supports or cross girders and transfer the strain caused by the weight of water to the outside of the tank, where it was supported by posts. The bottom plates are lapped and double riveted, and the radial seams have butt joints and are also double riveted. The outer courses of the double plates are ½ inch in thickness, as are the lower courses of the side plates, and pass under the latter and project ½ inch beyond, the angle iron which forms the connection between the sides and bottom, and are riveted to it. The courses of bottom plates decrease regularly in thickness toward the center, where the inlet and outlet pipe enters through a composition stuffing box, which allows for expansion and contraction or any movement of the pipe."

The upper section of the conical part of the tank was flanged and riveted to an angle iron on the lowest course of the cylindrical portion of the tank. Eye-bolts passing from double lugs on this bottom course through the caps of the columns served to hold the structure together. These eye-bolts were 1⅛ inches in diameter.

The galvanized sheet-iron roof was conical in shape, of No. 10 gauge. It was 48 feet in height.

The one pipe to the tank was 12 inches in diameter, of wrought iron, encased to prevent freezing. There was a grating platform around both the bottom and top of the tank, and a manhole in the bottom course on the street or south side. There was a by-pass controlled by gates, allowing water to flow directly through the main without entering the tower.

The tank held, when full, 400,000 gallons, weighing 1,600 tons. At the time of its collapse it was three-quarters full, as is usual on Saturdays after the pumping. There were two boys on a tandem wheel and one man in a wagon nearby at the time, and they were caught by the rushing waters and more or less severely injured.

Seen soon after its fall, portions of the large circular girder were in the highway. The tank lay only a little out of a north-south line, the base toward the highway and the manhole on what would have been the north side if the tank were righted. The base was ruptured, mainly along the seams, and the fracture showed signs of internal oxidation. The columns to the north and east were bent over, so that their caps pointed toward the highway, and one or two had been ruptured by twisting strains. Three anchor bases were at varying distances from their position, going to the south and east. One was removed at least 100 feet. There are no signs of rolling or sliding, and it is apparent that the bases, which weigh 3,500 pounds each, were slung by the bending and twisting columns as one would sling an apple from the end of a green withe. There is a large pothole in the cement foundation northeast of the pipe, and the appearance of the surrounding territory seems to indicate that most of the water went north and east.

Apparently the conical base ruptured near the pipe in a seam, and the rupture extended upward in an irregular line, following to a great extent the line of rivet holes. The weight of water may have split open the circular girder, and certainly did impart a rotary motion to the tank, as is shown by the displaced manhole and by the twist and direction of bending of the columns. The columns slung the anchor stones as described, and the loosened waters carried everything not firmly fastened.

The town's supply of water was crippled only while the gates were located in the by-pass, a matter of an hour. Travel on the street railway on road near the tower was hindered for about three hours. Workmen commenced cleaning away the wreck Sunday, and the management is already investigating the building of a new tower. The tower was designed by Mr. F. C. Coffin, while in the office of the late M. M. Tidd, who was engineer for the water company. Riter [illegible] Conley were the builders, the work being done in 1893; Mr. J. K. Nye supervised the work in his capacity as superintendent of the water company. He has inspected the tower carefully since at least once a month. It had lately been repainted and was apparently all right in every way.

Note on the Working of Sand Filters.

Abstract of a paper by Henry F. Rutter, published by the Institution of Civil Engineers.

The object of the following communication is to draw attention to a practical improvement in the working of slow sand filters, which has resulted in greater economy and convenience, and virtual increase of the capacity of existing plant.

A few years ago it was believed that the function of the sand in filters is quite a secondary one, that the sand is merely a porous structure for upholding the surface film, on which the efficiency of the filter actually depends. It was stated that the formation of this film on the surface of the sand should be promoted by subsidence after each cleaning of the filter; that the subsidence should be prolonged for several hours before the filter is again set to work; that the integrity of the film should be maintained with the greatest care; and that its rupture would be followed by immediate deterioration of the filtrate from a bacterioscopic point of view. In the practical working of open filters the maintenance of the surface film is impossible. In the summer months the gases generated among the low forms of vegetable life which grow on the surface of the sand float these matted growths to the surface of the water, thus frequently exposing clean patches of sand to the passage of the water. In the case of mechanical filters the supposed necessity for maintaining the integrity of the surface film is frankly ignored.

Among other observers who were dissatisfied with the surface-film theory, Mr. Clark, chief chemist to the Massachusetts Board of Health, carried out a series of tests at the experimental filter station at Lawrence, Mass., the results of which were kindly communicated to the author when he visited the station in 1899. These results seemed to prove conclusively that rupture of the film has no prejudicial effect on the filtrate. On his return to England the author ventured to suggest the systematic disturbance of the surface film in the working of a large plant of open filters, having a capacity of 25 million gallons per day, with which he is connected. This filter plant deals with river water of fair initial purity, which can, as a rule, be filtered quite easily, giving a filtrate of excellent bacterial character. In the spring of every year, however, and in some years throughout the summer months, inconvenience in the working of the filters is caused by the rapid clogging of the surface of the sand by the formation of a film, which, although of extreme tenuity, is sufficient to prevent entirely the passage of water. Filters which at other times may continue to filter efficiently for two or even three months without the necessity of cleaning them by the removal of the surface of the sand will, at the seasons mentioned, frequently be rendered entirely useless after only five or six days' work. The inconvenience caused by this behavior of the filters at the season of maximum demand is great, involving, as it must, the laying-off of the filters for cleaning at very frequent intervals, with the consequent reduction of available area and the heavy expense of washing and re-spreading considerable quantities of sand. The disturbance of the surface film by the simple means to be described later has, during the last 18 months, resulted in greatly increased facility of working and material reduction of expense, while the high character of the filtrate has been fully maintained.

Immediately the filter shows signs of clogging, by reduction in the rate of flow, the outlet of the filter is closed, and an interval of about six hours is allowed to elapse before the film is disturbed, in order to ensure that the whole body of sand below the film shall be fully charged with water. After the disturbance of the surface the filter is again allowed to stand idle for a period of six hours. The latter precaution is found in practice materially to increase the further life of the filter. The result of disturbance of the surface is often curious. A filter which shows signs of blocking up within five or six days after cleaning will, after treatment, frequently work for three or four weeks before requiring further disturbance, although the character of the water supplied to it may remain identical. In the case of the filters under consideration, it is found that disturbance can be effected two or three times before cleaning becomes necessary.

The apparatus used consists of a broad rake, composed of a thin strip of iron riveted between two light angle-bars along its upper edge. The lower edge of the strip is slightly serrated to prevent the rake from slipping over the surface of the film without breaking it up. The weight of the rake in air is 40 pounds. The rake is pulled backwards and forwards across the filter by ropes by two men, and is shifted laterally a distance equal to its own width each time it reaches the retaining wall.

The author is aware that similar methods have been in use for many years in some filter plants, but he finds that in many installations the advantages of disturbance of the film are unknown, and in cases where that treatment has been adopted it has neither been carried out systematically, nor with the precautions which he suggests.

Personal Notes.

Mr. Joseph A. Gehres has been elected surveyor of Akron, O.

Mr. E. N. Smith has been elected surveyor of Lancaster County, Lancaster, Pa.

Mr. William H. Hardcastle has been elected water superintendent of Media borough at Chester, Pa., succeeding Mr. George W. Carey.

Chief Engineer A. C. Cunningham, U. S. N., has been ordered to take charge of work in connection with the floating steel dry-dock at Algiers, La.

Mr. James E. Hewes, city engineer and superintendent of the municipal electric light plant in Hagerstown, Md., has tendered his resignation, to take effect January 1, 1902.

Lieut.-Col. David P. Heap, Corps of Engineers, U. S. A., has been assigned additional duties in an appointment as engineer officer of the Department of California, at San Francisco.

Mr. Willis F. Brown, at one time city civil engineer of Toledo, O., and Mr. Harley J. Hill, formerly with the American Municipal Supply Co., of Cleveland, have associated themselves for the practice of civil and consulting engineering at 55 Law Building, Toledo.

Major Smith S. Leach, Corps of Engineers, U. S. A., has been assigned to the command of the first battalion of engineers and his work at New London is to be undertaken by Major Charles F. Powell, who will be relieved at Pittsburg by Captain William L. Sibert. Major Ernest H. Ruffner, in addition to his present duties, will temporarily perform those of Capt. Sibert.

Mr. Maurice Fitzmaurice, the present chief engineer of the Assuan reservoir work on the Nile, who has been appointed chief engineer to the London County Council to succeed Sir Alexander Binnie, who retires at the end of the year, has had considerable experience in large engineering undertakings. He was at one time engaged on the Forth Bridge under Sir Benjamin Baker, and later was resident engineer in connection with the construction of the Blackwell Tunnel.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Grand Rapids. Mich.—The time for receiving bids for furnishing the city with a water supply has been extended from Nov. 12 to Nov. 26, as advertised in The Engineering Record.

Caruthersville, Mo.—Bids are wanted Dec. 2 for all machinery, apparatus, material and supplies for a water-works plant, as advertised in The Engineering Record.

Sioux Falls, S. D.—City Aud. E. G. Ledyard writes that on Nov. 5 a vote was taken in favor of issuing $210,000 bonds for a municipal water-works system.

Salt Lake City, Utah.—State Engr. A. J. McCuen writes that preliminary surveys have been made for a canal to cover 80,000 acres in Colorado and extend into Utah, but money has not yet been raised for construction, which it is estimated will cost $1,000,000.

Barberton, O.—Wm. S. Mitchell, Village Trustee, writes that test wells are to be drilled at once, and if a sufficient quantity of water is found to supply the village estimates will be made and submitted to a vote of the people in the spring.

Helena, Mont.—S. Fortier, Dir. of the U. S. Experiment Station at Bozeman, writes that government engineers propose to build a diversion weir on St. Mary's River just below St. Mary's Lake and divert water into Milk River by means of a long diversion canal, the capacity of which will be 1,200 ft. per second.

Mantua, O.—Consulting Engr. L. E. Chapin, of Canton, writes that bids for the construction of water-works were not opened Nov. 15, as the letting has been deferred until early spring.

Baraboo, Wis.—The proposition to issue $60,000 municipal water-works bonds is stated to have carried.

Rockville Center, L. I., N. Y.—The Village Clerk writes that on Nov. 12 it was voted to issue $10,000 bonds for the extension of water mains.

Eureka, Ill.—Press reports state that the Council proposes to extend the water mains.

Sacramento, Cal.—Local press reports state that a contract is about to be let for a 5,000,000-gal. or a 10,000,000-gal. pump.

Barrington, R. I.—The Town Council has granted a 25-year franchise to the Barrington Water Co.

Newark, N. J.—The contract for the construction of an outlet tunnel from the Cedar Grove reservoir through First Mountain has been awarded to the United Engineering & Contracting Co., of New York, for $93,735. For bids received see The Engineering Record of Oct. 26.
A resolution authorizing the construction of a pipe line to connect the new storage reservoir with the distributing main at Bloomfield and Fifth Aves. has been adopted.

Hartford, S. D.—Town Clk. Nels Haugen writes that on Nov. 5 it was voted to issue $6,000 bonds for a water system.

Southampton, Ont.—Engr. in Charge John Galt, of Toronto, writes that the contract for constructing water-works has been awarded to John McKnight, Rose Ave., Toronto, for $6,450.

High Point, N. C.—At the election held Nov. 9 $50,000 additional bonds were voted for the completion of the water-works and the installation of sewerage. J. J. Cox, Mayor.

Geneseo, Ill.—Bids are wanted Nov. 23 for furnishing material and sinking a well. L. B. Smith, City Clk.

Dover, N. J.—Bids are wanted Nov. 21 for furnishing material and constructing 2 reservoirs. D. R. Hummer, Clk. Bd. Water Commrs.

Ft. Collins, Colo.—Joel Roullard, Pres. of the Larimer & Weld Reservoir Co., writes that bids will be received in a few weeks for the construction of an irrigation canal and reservoir in Poudre Canon. Estimated cost, $125,000.

Washington, D. C.—Bids are wanted by the Commissioners D. C. until Nov. 19 for furnishing cast iron water pipe. John Biddle, Commr. D. C.

Charleston, S. C.—The Mercantile Trust Co. of Baltimore has retained Hill, Quick & Allen, of Baltimore, as consulting engineers in the matter of sinking and testing artesian wells for a water supply for the city of Charleston. The wells will be located some 10 miles from the city and it is proposed to secure a daily supply of 5,000,000 gallons.

Philadelphia, Pa.—Bids are wanted Dec. 18 for the improvement, extension and filtration of the water supply, including water filter plant at Torresdale, Oak Lane reservoir, and triplex pumps and gasoline driving engines at Upper Roxbury filter plant. Wm. C. Haddock, Dir. Dep. of Pub. Wks., Bureau of Water.

Custer, S. D.—A committee has been appointed by the City Council to make investigations and determine upon the best plan to procure an ample supply of water for both fire protection and domestic purposes.

West Windfield, N. Y.—The proposition to construct a system of water-works for fire protection is said to be under consideration.

Dickson, Tenn.—Press reports state that Chas. I. Brown, of Nashville, has been engaged to supervise the construction of municipal water-works and electric light plant.

Aurora, Ill.—A recommendation is before the Council authorizing the expenditure of $20,000 for the purchase of an air compressor. The authorities are also considering the feasibility of building a reservoir.

Winthrop, Minn.—Press reports state that $10,000 bonds have been voted for water and light plant. C. E. Larson, Village Recorder.

St. Charles, Mo.—H. C. Scott, of St. Louis, Pres. of the St. Charles Water & Improvement Co., has accepted the offer made by this city to purchase the company's water system for $20,000.

Austin, Tex.—Judge F. G. Morris, of the 53d District Court, on Nov. 7 delivered his opinion, which perpetuates the injunction restraining the City Council from purchasing the plant of the Water & Light Company.

Lexington, Miss.—Money & Money, of Carrollton, Miss., write that they have made a proposition to Lexington for the construction of a water-works plant, at a probable cost of $5,000. Water supply to be taken from artesian wells.

Norwich, Conn.—The Board of Water Commissioners has reported to the Common Council favoring Stony Brook watershed as the source of an increased water supply. The estimated cost of proposed improvement, which includes the construction of a reservoir having a capacity of 350,000,000 gallions of water, and a pipe line 5 miles long, is $297,000. General plans prepared by Chandler & Palmer.

Hendricks, Minn.—The contract for constructing water-works at Hendricks will be let Nov. 26. Plans and specifications are on file at the office of the engineer, J. J. Flather, 816 Phoenix Bldg., Minneapolis, Minn.

Chicago, Ill.—Local press reports state that improvements in the city's water supply service, costing $2,270,000, will be recommended to the City Council by Acting City Engr. John Spengler. The principal items are $2,000,000 for the construction of a land tunnel from Hyde Park crib to a new pumping station at 103d and State Sts., $200,000 for the removal of old two-mile crib and extension of tunnel to Carter H. Harrison crib, and $70,000 for new superstructure for Lake View crib.

West Salem, Wis.—Local press reports state that there is talk of constructing a system of water-works.

Oshkosh, Wis.—Press reports state that the Oshkosh Water-Works Co. proposes to make numerous extensions at once.

Dayton, O.—It is stated that bids are wanted Nov. 19 for laying water mains. G. F. Kuhns, Pres. Bd. City Affairs.

Trenton, N. J.—The Board of Water Commissioners has decided that a water main sufficient to supply Escher St. vicinity should be constructed as soon as possible, and the mains and attachments committee has been instructed to look into the question of the needs of several other localities.

Ft. Dady, Fla.—See "Government Work."

West Bay City, Mich.—The Common Council has sold $15,000 water-works bonds.

Duncansville, Pa.—The Boro. Council has passed an ordinance appropriating the waters of Blair Gap run, Gillan's run and Burgoon's run in Allegheny and Juniata townships for the establishment of a municipal water-works plant.

San Luis Obispo, Cal.—It is stated that bids are wanted by the City Engineer until Dec. 2 for water mains.

Goldsboro, N. C.—The proposition to issue $110,000 bonds for water-works, electric lights, street improvements, a city hall, etc., is stated to have carried at the recent election.

Saginaw, Mich.—Bids are wanted Nov. 21 for furnishing iron water pipe, hydrants, valves and special castings, required by the city, for one year from Jan. 1, 1902. Alfred Davies, Clk. Bd. Pub. Wks.

Tarrytown, N. Y.—At a recent special election it was voted to appropriate $5,000 for a high service filter reservoir.

New York, N. Y.—The following bids were opened Nov. 7 by the Dept. of Water Supply, for furnishing delivering and laying a water main from the Croton Aqueduct, near Gun Hill Road, through Van Cortlandt Park, Bailey Ave. and Harlem River Terrace, to Fordham Road:

Items and Quantities:	F. Thilemann, Jr.	Norton & Dalton.	Cunningham & Kearns.	C. W. Collins.	Jno. Cornwell, Jr.	F. V. Smith Contg. Co.	J. S. Rogers.	Hy. Lipps, Jr.	W. E. Welch.	J. J. McQuade.
Straight pipe, 4,200 tons	$24.00	$23.00	$25.00	$23.50	$20.00	$22.50	$23.25	$23.50	$23.00	$25.00
Special castings, 30 tons	60.00	54.00	52.00	53.50	60.00	60.00	51.00	52.00	50.00	50.00
Rock excav., 2,500 cu. yds.	2.50	3.00	2.00	.50	.01	2.50	.28	.60	.35	1.50
Earth excav., 24,000 cu. yds.	.40	.30	.35	.50	.01	.85	.28	.60	.35	.40
Filling, 22,000 cu. yds.	.25	.30	.35	.21	.01	...	.28	.60	.35	.30
Pipe laying:										
48-in., 11,600 lin. ft.	1.30	1.40	1.50	1.40	3.25	1.50	1.50	1.50	1.20	1.10
36-in., 150 lin. ft.	.90	.80	1.00	1.25	.70	1.60	.90	1.00	.80	1.00
20-in., 200 lin. ft.	.55	.50	.50	1.00	.40	.60	.60	.50	.50	.60
12-in., 200 lin. ft.	.40	.25	.35	.75	.55	.40	.25	.40	.25	.40
6-in., 350 lin. ft.	.30	.18	.30	.50	.15	.20	.18	.20	.15	.30
Stop cocks and gearings:										
5 48-in.	1,450.00	1,200.00	1,250.00	1,500.00	1,500.00	1,400.00	1,250.00	1,500.00	800.00	1,200.00
1 20-in.	350.00	300.00	350.00	350.00	400.00	350.00	320.00	340.00	300.00	250.00
Stop cocks and boxes:										
10 12-in.	55.00	55.00	70.00	65.00	150.00	65.00	60.00	77.00	60.00	50.00
6 6-in.	35.00	27.00	29.00	30.00	75.00	35.00	30.00	38.00	30.00	15.00
Dble nozzle case hydrants, 6	70.00	65.00	70.00	70.00	160.00	70.00	75.00	70.00	65.00	50.00
Blow-offs, to set, 6	20.00	20.00	15.00	10.00	20.00	10.00	15.00	20.00	15.00	30.00
Pavement & flagging relay, 50 sq. yds.	.30	.40	.50	.30	.20	.50	.70	.01	.40	.20
Macadam pavement relay, 2,500 sq. yds.	.75	.50	.70	.01	.30	.50	.50	.50	.50	1.00
Curb reset, 500 lin. ft.	.05	.10	.10	.10	.01	.10	.10	.01	.10	.20
Brick masonry, 180 cu. yds.	12.50	15.00	9.00	9.00	10.00	9.00	12.00	10.00	10.00	12.00
Con. masonry, 25 cu. yds.	5.00	5.00	5.00	7.00	6.00	4.00	2.00	3.50	8.00	4.00
Dry stone mas., 900 cu. yds.	3.00	2.00	4.00	1.50	.50	.01	1.00	2.00	3.00	3.00

Columbus, O.—Local press reports state that the proposition to connect the east and west side pumping stations is under consideration. Estimated cost, $48,000.

Walnut Ridge, Ark.—Press reports state that a water-works system and an electric light plant are to be constructed.

Pottstown, Pa.—Local press reports state that the Pottstown Gas & Water Co. has decided upon improvements estimated to cost $20,000. It is proposed to replace 6-in. pipe with 16 and 10-in. mains.

Berwick, Me.—The Berwick Water-Works Co. is said to have engaged William M. Ames to make plans for the construction of a water plant between Sanford and Shapleigh.

Sumpter, Ore.—Local press reports state that the Sumpter Water Co. is making arrangements for the building of a reserve storage reservoir.

Springfield, Ill.—It is stated that bids are wanted by Mayor Philips for furnishing 12 filters at the water-works.

Oakland, Cal.—Plans for a new water and power system, to cost about $2,500,000, are said to have been completed by Eastern people represented by R. G. Hanford, of Baltimore, Md.

Esmond, S. D.—The construction of a water works plant is said to be under consideration.

Tuscumbia, Ala.—The City Council has granted a franchise to J. M. Hughes and W. H. Dempsey, of Beaver Falls, Pa., for a system of water-works, to be followed by the construction of an electric light plant and street railway.

Jennings, La.—The question of constructing water-works and a sewerage system is under consideration.

Detroit, Mich.—The proposition to issue $38,000 bonds to extend the water mains to Hamtramck Village has carried.

Kansas City, Mo.—The Board of Public Works has decided to accept the recommendation of the experts that the second 30-in. pipe between Kaw Point and 12th and Bell Sts. be laid as the first step in the betterment of the water system.

Sydney, N. S.—W. T. Jennings, of Toronto, is stated to have recomemnded that the town's water supply be pumped from Middle Lake to a reservoir, capacity 54,000,000 gallons, thence by gravity through an 18-in. pipe to the town. Estimated cost, $200,000.

Madisonville, O.—Bonds to the amount of $25,000 are stated to have been voted for the improvement and extension of the water-works and electric light plant.

Mansfield, La.—F. J. Obern, Birmingham, Ala., is reported to have secured the contract to furnish water and electric lighting to the town, for $12,288.

Plymouth, O.—Engr. in Charge J. B. Weddell, of Mansfield, O., writes that contracts, for the construction of water-works in Plymouth, have been awarded as follows: Tower, to Chicago Bridge & Iron Co., of Chicago, at $4,600; 5 6-in. and 38 4-in. hydrants; also 4 8-in., 21 6-in. and 5 4-in. valves to Rensselaer Mfg. Co., Troy, N. Y.; pipe, to Massillon Iron & Steel Co., Massillon, O., at $26 per ton for 53 tons of 8-in., $27 per ton for 159 tons of 6-in. and $28 per ton for 88 tons of 4-in.; 4 tons of specials to Massillon Iron & Steel Co., at 2½ cts. per pound; pipe laying to J. C. Brooks & Son, of Jackson, Mich., at 17 cts., 15 cts. and 12 cts. respectively for 8, 6 and 4-in. pipe; extension to power plant to D. E. Nixen, of Plymouth, for $750.

Baker City, Ore.—The citizens have voted in favor of constructing a water-works system.

SEWERAGE AND SEWAGE DISPOSAL.

Chicago, Ill.—Bids are wanted Dec. 6 for designing, furnishing and erecting 4 pumping engines to pump sewage and storm water, as advertised in The Engineering Record.

West New York, N. J.—Town Clk. Francis F. Town writes that bids will be opened Nov. 18 for the construction of a sewer on Niles Ave., the work to include 700 ft. 24-in. brick sewer and 1,150 ft. 15 to 20-in. earthen pipe sewer. Estimated cost, $10,000. Robert Haw, 584 Spring St., West Hoboken, N. J., Engr. in charge.

Jersey City, N. J.—Bids are wanted Nov. 19 for constructing sewers in portions of 4 streets. Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

Philadelphia, Pa.—Bids are wanted Nov. 20 for constructing a branch sewer in a portion of 35th St. Wm. C. Haddock, Dir. of Pub. Wks., Bureau of Surveys.

Knoxville, Ia.—It is stated that surveys and plans are now being made for a combination sewer system. Contracts will probably be let in the spring.

Vacaville, Cal.—It is stated that a special election will be held to vote on the issue of $30,000 bonds for the construction of a sewer system.

High Point, N. C.—See "Water."

Wabash, Ind.—Bids are wanted Nov. 25 for 9,000 lin. ft. of 12-in. vitrified pipe sewer. Robt. P. Woods, City Engr.

New Philadelphia, O.—Bids are wanted Nov. 28 for constructing about ½ mile of storm water sewer, from 12 to 24 in. in diameter. Excavation to average about 8 ft. deep. R. J. W. Dodd, City Clk.; Paul R. Murray, Engr. in Charge.

Hillsboro, Ore.—Recorder B. Bowman writes that a preliminary survey has been made and there is some talk of constructing a sewerage system for the business portion of the city at an estimated cost of $7,000, but nothing definite has as yet been done.

Atlanta, Ga.—A committee, composed of city and county officers and others, has been formed to take under consideration the question of extending the sewerage system of Atlanta over the entire County of Fulton, and to make recommendation, for said improvement, to the Board of County Commissioners and to the General Council of Atlanta.

Norwich, Conn.—The Common Council has adopted a resolution authorizing the Street Committee to construct a sewer on West Thames St., running into the Thames River.

Vicksburg, Miss.—Bids are wanted Nov. 18 for constructing a brick sewer and wooden gutter, at a probable cost of $5,000. W. L. Trowbridge, Mayor.

Hartford, Conn.—The preliminary assessment for the cost of the Wilson St. system of sewers has been levied without appeal, and contracts for construction will be let in the near future. Estimated cost, $10,000. C. H. Bunce, City Engr.

Duluth, Minn.—Bids are wanted Nov. 18 for constructing sanitary sewers in portions of four streets. R. Murchison, Clk. Bd. Pub. Wks.

Washington, O.—The estimated cost of constructing the proposed trunk sewer is $15,400. Messrs. Jackson, Millikan and Pickering have been appointed a committee to engage an engineer to prepare plans, etc.

Marion, O.—The City Council has passed an ordinance providing for the construction of a sanitary sewer in a part of Sewer District No. 3. D. M. Odaffer, City Clk.

Rossville, Ill.—There is talk of issuing $8,000 bonds for the construction of a municipal sewerage system.

Moline, Ill.—It is stated that bids are wanted Nov. 18 for constructing an 8 and 12-in. sewer in 3 streets, and a 6-in. water main in 3 streets. Henry C. Paddock, Sec'y Bd. Local Improvements.

Bradford, Pa.—City Clk. Edward C. Charlton writes that on Nov. 5 it was voted to issue $25,000 bonds for the repaving and sewering of Main and Congress Sts.

Whitinsville, Mass.—The contract for preparing plans for a system of sewerage is stated to have been awarded to McClintock & Woodfall, of Boston.

Lexington, Ky.—President Lowry, of the Board of Aldermen, is urging the construction of a sewerage system.

Winchester, Ind.—It is stated that bids are wanted Nov. 22 for constructing lateral sewers, with manholes, flush tanks, etc., in 4th and Main Sts. C. C. Yunker, City Engr.

Atchison, Kan.—The City Engineer has been instructed to prepare plans for a sewer in District P, Northwest Atchison.

Ridgefield, Conn.—L. L. Beckwith, of Ridgefield, is stated to have received the contract for constructing sewers at his bid of $39,000 (the borough to furnish pipe, brick and other materials).

Fond du Lac, Wis.—It is stated that bids are wanted Nov. 18 for $40,000 sewer bonds. F. A. Bartlett, City Clk.

Erie, Pa.—The Common Council has adopted an amendment, to the ordinance providing for an issue of bonds for the abatement of Mill Creek nuisance, which reduces the amount of appropriation to $50,000.

Ithaca, N. Y.—The Board of Health has sent a communication to the Sewer Commission suggesting that the city sewer system be extended in certain sections.

Alexandria, Ind.—Local press reports state that the City Engineer will receive bids until Nov. 23 for constructing Central Sewer extension No. 2.

McKeesport, Pa.—Local press reports state that this city has engaged Alexander Potter of New York City to prepare plans, etc., for the proposed sewerage system for Crooked Run District.

Kansas City, Mo.—The Board of Public Works has approved a plan showing the proposed district sewer in district 114.

Glenville, O.—The Glenville Council has passed an ordinance granting Cleveland the right to construct a sewer in Lake View Avenue.

Jennings, La.—See "Water."

Syracuse, N. Y.—Local press reports state that contracts are about to be let for the construction of intercepting sewers, estimated to cost $210,000.

Pittsburg, Pa.—Bids are wanted Nov. 23 for constructing a 36-in. brick sewer on a portion of Center Ave. Edw. M. Bigelow, Dir. Dept. Pub. Wks.

Milwaukee, Wis.—Bids are wanted Nov. 19 for furnishing material and constructing the uncompleted portion of section No. 2 of the Kinnickinnic River Flushing Works tunnel, in the 17th Ward. Chas. J. Poetsch, City Engr.

Pittsfield, Mass.—Bids are wanted Nov. 26 for constructing a sewage pumping station and screen house. J. L. Bacon, Chmn. Bd. Pub. Wks.

Batavia, N. Y.—J. W. and Glenn D. Holmes have made a report to the Board of Sewer Commissioners showing the estimated cost of three different methods of disposing of city sewage. Approximate estimate, $252,000.

Beaumont, Tex.—The following bids were opened Nov. 5 for the construction of sewers: Merritt W. Yeater, Engr. in Charge: Irwin Bros., Greenville, O., $92,570 (awarded); Kelley & Kelley, Beaumont, $96,935; T. J. Shea, Houston, Tex., $100,468; H. Shuter, Houston, $108,046.

New Philadelphia, O.—Engr. in Charge Paul R. Murray writes that the following bids were opened Oct. 31 for sewer work, to include 20,140 ft. of 5 to 20-in. pipe sewer, 28 manholes and 10 flush tanks: Irwin Bros., Greenville, O., $13,285; Ohio Engineering Co., Lorain, O., $12,728; S. T. Knight, Columbus, O., $12,318; O. R. Hines, Scio, O., $11,120; Adams Bros., Zanesville, O., $10,164. Average depth of trench to be 9 ft., excavated in sand and gravel.

Morristown, N. J.—The approximate cost of the proposed trunk sewer has been placed at $200,000 by the Executive Committee of the Trunk Sewerage Commission.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that the contract for constructing sewers in District No. 197 has been awarded to Michael Walsh, of Kansas City, as follows: Sewer pipe—27-in., $2.90; 24-in., $1.85; 21-in., $1.50; 18-in., $1; 15-in., 95 cts.; 12-in., 60 cts.; 8-in., 52 cts.; 12-in. pipe for catch-basins, 50 cts.; ½-in. water pipe, 30 cts.; manholes, $30; catch basins, $20; flush tanks, $60; rock excavation, $2.50. Total, approximately, $12,354.

Bartonville, Ill.—The Asylum Board has voted an additional $197,000 to complete the sewer system and 9 cottages.

Olyphant, Pa.—The citizens, on Nov. 5, voted to appropriate $3,000 toward the construction of a sewer.

Topeka, Kan.—Local press reports state that it is proposed to build a sewer to include Washburn College District. Estimated cost, $10,000.

Canon City, Colo.—City Engr. L. C. Hall writes that the following bids were opened Nov. 11 for sewer construction, the work to include 70,000 ft. of 6 to 24-in. pipe sewer, 129 manholes and 29 flush-tanks; average depth of excavation, 9.3 ft.: A, Rees & Killian, Florence, Colo., $48,400; B, Geo. M. Steinmetz, Denver, Colo., $50,524; C, Doyle & Schwartz, Colorado Springs, Colo., $52,333; D, Fox & Condon, Canon City, Colo., $49,164; E, Piper Bros., Pueblo, Colo, $59,686; F, C. R. Quinlin, Colorado Springs, Colo., $50,777; G, Thos. Ord, Colorado Springs, $60,806; H, L. M. Hovey, Florence, Colo., $44,795 (awarded). For detail bids on pipe see accompanying table:

Bidders.	24-in.	21-in.	18-in.	15-in.	12-in.	10-in.	8-in.	6-in.
A.........	$1.80	$1.65	$1.30	$.95	$.75	$.67	$.52	$.44
B.........	1.90	1.65	1.20	.90	.75	.65	.55	.48
C.........	2.10	1.75	1.50	1.00	.76	.73	.58	.49
D.........	2.10	1.70	1.25	1.00	.77	.67	.62	.40
E.........	2.20	1.85	1.50	1.20	.90	.80	.62	.54
F.........	1.70	1.43	1.15	.90	.77	.70	.60	.50
G.........	2.10	1.90	1.45	1.16	1.07	.92	.65	.56
H.........	2.25	1.75	1.25	1.00	.80	.70	.50	.35

BRIDGES.

Victoria, B. C.—Bids are wanted Jan. 8, 1902, for the substructure and the superstructure of Fraser River bridge, as advertised in The Engineering Record.

Little Falls, Minn.—The County Commissioners have appointed as a committee Messrs. Jacobson, Gross and Sullivan to confer with a committee appointed by the City Council, composed of Aldermen Peterson, Lane and Vertin, to obtain estimates as to the cost of bridges of different designs.

Holyoke, Mass.—The question of constructing a bridge at Sargeant St. has been referred to the Board of Public Works, the Finance Committee and the City Engineer, to consider plans for an entire new structure and to report at the next meeting of the Board of Aldermen.

East Weare, N. H.—The construction of an iron bridge near Black's Crossing, to replace present structure, is contemplated.

Sanatoga, Pa.—It is reported that a movement is on foot to construct a bridge across Schuylkill River, near Sanatoga.

Sheboygan, Wis.—Press reports state that the Chicago & Northwestern Ry. Co. intends to construct a double track steel bridge across Sheboygan River, on the Princeton division. E. C. Carter, Ch. Engr., Chicago, Ill.

Bridgeport, Conn.—Press reports state that the Yellow Mill bridge is to be constructed, at a probable cost of $165,000.

Columbus, O.—The proposition to construct Hayden's Falls bridge and 2 bridges on David Taylor Road carried at the recent election. John W. McCafferty, Clk. of Courts.

Glendon, Pa.—Judge Scott has appointed viewers (Horace J. Miller, of Upper Mt. Bethel, being among them) to report on the construction of a county bridge across Lehigh River, at Glendon.

Marquette, Mich.—It is proposed to build a 50-ft. span steel highway bridge.

Philadelphia, Pa.—Bids are wanted Nov. 20 for constructing a bridge at 52d St., over West Chester & Philadelphia R. R. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Surveys.

Lafayette, Ind.—Wallace Marshall and Melville W. Miller are preparing plans for a steel bridge to take the place of Brown St. bridge, recently damaged by fire. The stonework is not damaged, and it may only be necessary to raise the piers a little. The plans are to be for a bridge having 5 spans, a total length of 582 ft., and a driveway 20 ft. wide, to be either of brick or asphalt, but no sidewalks. As soon as plans have been approved and appropriations made it is stated that bids for construction will be asked.

Glassport, Pa.—The West Elizabeth & Dravosburg Bridge Co. has applied for a charter to construct a bridge across Monongahela River, at Glassport. Incorporators: J. A. Pierce, Chas. H. Kline, R. H. Jackson and others, all of McKeesport.

East Haven, Conn.—The construction of a drawbridge, to replace structure recently destroyed between East Haven and Branford, is contemplated.

Donora, Pa.—The construction of a bridge, connecting Donora and Webster, is said to be contemplated. Probable cost, $500,000.

Kenosha, Wis.—Press reports state that the Kenosha Street Ry. Co. has awarded the contract for constructing a steel bridge at Main St. to the Wisconsin Bridge Co., at $18,300.

Brewer, Me.—A correspondent writes that the City Council of Brewer has voted to employ an engineer to make plans, specifications and estimates for the proposed steel bridge, to be placed on present piers and abutments, between the cities of Bangor and Brewer. This is only preliminary work and the bridge is not to be built at once.

Cincinnati, O.—Bids are wanted Dec. 7 for constructing a wrought iron bridge across Muddy Creek, in Delhi Township. Eugene L. Lewis, Co. Aud.

Clay, W. Va.—Clay County Sheriff J. A. Sizemore writes that on Oct. 26 it was voted to issue $27,000 bonds for the construction of a bridge across Elk River.

Cincinnati, O.—See "Railroads."

Pittsburg, Pa.—Bids are wanted Nov. 23 for constructing a foot-bridge at Melancthon St. Estimated cost $3,000. Edw. M. Bigelow, Dir. Pub. Wks.

Kansas City, Mo.—The lowest bid received by the Park Board, Nov. 6, for constructing the superstructure of the Benton Boulevard bridge is reported to have been from the Modern Steel Structural Co., Waukesha, Wis., at $14,842. The Parker-Washington Co. is stated to have submitted the lowest bid for the substructure, at $14,814.

Buffalo, N. Y.—The Owego Bridge Co., Owego, N. Y., is stated to have submitted the lowest bid on Nov. 11 for constructing the superstructure of Van Rensselaer St. viaduct, at $67,300.

Duluth, Minn.—Press reports state that Hugo & Tims, of Duluth, have secured the contract for constructing the substructure of the aerial bridge across Duluth Ship Canal; contract price said to be about $8,000.

Worcester, Mass.—A petition is being circulated asking for the construction of a steel bridge across Lake Quinsigamond.

St. Cloud, Minn.—The construction of a steel bridge across Sauk River is contemplated.

Kenosha, Wis.—Bids are wanted Nov. 18 for furnishing material and constructing the center pier and approaches to the proposed Middle St. bridge. Gus. Jacob, City Clk.

Greenfield, Ind.—Bids are wanted Dec. 7 for constructing several small county bridges. R. G. Wilson, Co. Commr.

Kokomo, Ind.—The City Engineer has been directed to prepare an estimate of the cost of constructing a bridge at Quincy St.

Lexington, Ky.—The construction of an iron bridge, at a probable cost of $8,000, is contemplated.

Manassas, Va.—It is stated that bids are wanted by the County Commissioners until Nov. 28 for constructing a wrought iron or steel high truss bridge, 110 ft. long, with masonry and approaches, at Milford Mills.

Frederick, Md.—It is stated that bids are wanted by the County Commissioners until Nov. 19 for constructing an iron and steel bridge, 300 ft. long, with a 14-ft. roadway across Monocacy River, at Crist's Ford.

Boise, Idaho.—Local press reports state that bids will be received by the County Commissioners until Dec. 16 for constructing Eagle Island bridge.

PAVING AND ROADMAKING.

Woodlynne, N. J.—A correspondent writes that ordinances are being prepared providing for the curbing and paving with gravel and macadam, of the streets of this borough.

Odon, Ind.—W. H. McCarter, Pres. Washington Township Board, writes that the contract for 33 miles of gravel road has been awarded to Clark & Wood, of Bedford, Ind., for $70,560.

Albert Lea, Minn.—The City Clerk writes that specifications will be on file Jan. 1, 1902, for contemplated paving work.

Kansas City, Mo.—City Engr. Robt. W. Waddell writes that the contract for paving Main St., 3,872 sq. yds., with Pittsburg brick, has been awarded to A. R. Mense, of Kansas City, at $1.60 per sq. yd.; total, $6,195.

Wilson, N. C.—Surveys are now being made with a view to paving the business streets of the town, also those leading from the passenger and freight depots; the citizens having recently voted $25,000 for this purpose.

Sullivan, Ind.—Bids are wanted Dec. 5 for constructing about 14 miles of gravel roads in Turman township. J. M. Lang, Co. Aud.

Yellowstone National Park, Wyo.—Press reports state that the U. S. Government will expand $250,000 next year in acadamizing the roads in Yellowstone National Park.

Granite, Ill.—The citizens have voted in favor of issuing bonds for street improvements.

Marquette, Mich.—It is proposed to lay 1,920 sq. yds. of asphalt block or granite and 5,700 sq. yds. of brick pavement. Chas. Cummings, City Engr.

Oneonta, N. Y.—The State Engineer estimates the cost of macadamizing about 1½ miles of road in Oneonta, at $12,150.

St. Augustine, Fla.—The City Council has decided to pave Treasury St. with vitrified brick.

Upper Alton, Ill.—Wolf, Maupin & Curdie are reported to have received the contract for about 15,000 sq. yds. of Alton brick pavement and 6,000 lin. ft. of Alton limestone curbing on College St., at $1.06 per sq. yd. and 46 cts. per lin. ft. respectively. Total bid reported to be about $19,000.

St. Paul, Minn.—The lowest bid received for macadamizing Arcade St. is stated to have been submitted by James Forrestal, at $18,900.

Lowell, Mass.—The City Council has adopted an order providing for the macadamizing of Agawam, Pleasant and a part of Stevens Sts., at a total cost of $13,000.

Ashtabula, O.—The City and Street Committee is said to be arranging to purchase a steam street roller.

Washington, D. C.—In the annual report of the engineer department of the District government the recommendation was renewed that all granite-block pavements in the city be replaced as rapidly as possible with sheet asphalt or asphalt block.

Evanston, O.—Bids are wanted Dec. 11 for $27,999 bonds to be used to improve Duck Creek road. A. J. Chambers, Clk. of Council.

Cincinnati, O.—Bids are wanted Dec. 6 for grading, macadamizing, curbing, etc., on a portion of Imperial St. Geo. F. Holmes, Clk. Bd. Pub. Service.

Syracuse, N. Y.—Bids will be received by Edward A. Bond, State Engr. & Surveyor, at the office of the Division Engineer, Weighlock Bldg., Syracuse, until Nov. 20, for improving 1 mile of road in Skaneateles and 2 miles in Fabius, Onondaga County.

Bradford, Pa.—See "Sewerage and Sewage Disposal."

Farmington, Conn.—Bids are wanted Nov. 18 for constructing a macadam road in the town. Rich'd H. Condon, 1st Selectman.

Portland, Ind.—It is stated that bids are wanted Nov. 23 for constructing about 8 miles of gravel roads. Jay Griffith, Co. Surv.

Goldsboro, N. C.—See "Water."

Brooksville, Fla.—An election is to be held on Dec. 31 to vote on the question of issuing $30,000 bonds for good roads.

Brooklyn, N. Y.—The Board of Aldermen has adopted a resolution to pave Third Ave., from 60th St. to the Shore Road, at a probable cost of $260,000.

College Point, L. I., N. Y.—The paving of 13th St. with asphalt is contemplated.

Wellsville, O.—Local press reports state that bids were opened Nov. 8 for 11,000 sq. yds. vitrified brick pavement on Clark Ave., the lowest bid received being from H. S. Rinehart, East Liverpool, O., at $1.30 per sq. yd.

Pittsburg, Pa.—Bids are wanted Nov. 23 for grading, paving and curbing a portion of Moultrie St. Edw. M. Bigelow, Dir. Dept. of Pub. Wks.

Toledo, O.—The contract for paving Lincoln Ave. has been awarded to Jas. Sheehan, of Toledo, at $1.08 per sq. yd. for Massillon block on sand, with Berea curb. Total, $10,291.

Newport News, Va.—Local press reports state that contracts are about to be let for street paving, to cost $100,000.

San Francisco, Cal.—The repaving of a portion of Valencia St., at a cost of $28,320, has been ordered.

Chicago, Ill.—The construction of a boulevard connecting the West and South Side park systems is contemplated.

Kansas City, Mo.—Bids are wanted Nov. 19 for constructing brick pavement on several alleys. Robt. W. Waddell, City Engr.

Trenton, N. J.—Bids are wanted Dec. 3 for paving with sheet asphaltum on portions of 2 streets, and with brick on a portion of another street. C. Edw. Murray, City Clk.

Muskegon, Mich.—City Engr. C. S. Gamble writes that contracts have been awarded as follows: Houston Ave., 12,250 yds. of brick with 7,889 lin. ft. cement curb and gutter, on sand foundation, to Geo. W. Kneal, of Lansing, Mich., for $19,855. Myrtle St., 4,337 yds. of brick with 2,450 lin. ft. cement curb and gutter, sand foundation, to Schoenberg & Dodge, Muskegon, for $6,846. Amity St., 5,541 yds. of brick with 2,536 lin. ft. cement curb and gutter, to Schoenberg & Dodge, for $8,926. Contracts will soon be let for paving Western Ave. with brick, 42 ft. wide and about ¾ of a mile long, but work will not be done until April.

Cleveland, O.—The following bids were opened Nov. 6 by the Board of County Commissioners for improving Noble Road with brick or macadam: Bidders (all of Cleveland): A, M. F. Bramley & Co., $53,540; B, Wm. S. Hadley, $43,910; C, Wm. H. Ford & Geo. Davis, $59,010; D, Burr & Doolittle $57,550; E, C. D. Klock, $47,765; F, B. P. Burnett, $49,887; G, W. C. Bayer, $49,025. For detail bids see accompanying table:

Bidders.	45,000 cu. yds. grading.	Sewer pipe.			50 cu. yds. concrete.	100 cu. yds. blk. st. mas.	100 trees.	25,000 lin. ft. 3 x 15 curbing	2,000 cu. yds. br. stone.	17,000 sq. ft. 4-in. brick.
		25,000 ft. 4-in.	500 ft. 24-in.	500 ft. 30-in.						
A......	$.38	$.07	$.95	$2.10	$5.50	$10.00	$4.00	$.18	$1.40	$1.42
B......	.20	.05	1.00	1.55	3.50	6.50	2.00	.22	1.20	1.28
C......	.38	.07	.95	2.00	4.50	9.00	1.50	.22	2.61	1.56
D......	.40	.06	.85	2.25	6.00	8.00	3.00	.18	1.40	1.60
E......	.37	.07	.95	1.40	5.00	9.00	4.00	.19	1.50	1.17
F......	.37	.05	.95	1.40	5.00	6.50	2.85	.16	1.50	1.33
G......	.30	.05	.85	2.60	5.00	8.00	4.00	.20	1.25	1.30

POWER PLANTS, GAS AND ELECTRICITY.

York, Pa.—The Select Council has passed an ordinance granting permission to the York Steam Htg. Co. to extend its lines.

Sullivan, Ill.—S. D. Stocks and Dr. S. W. Johnson, of Sullivan, are reported interested in the construction of an electric light plant.

Des Moines, Ia.—The Iowa Town Lighting & Fuel Co. has been incorporated, with a capital of $25,000, to furnish light and heat in Iowa towns. John S. Emery, Pres.

St. Charles, Mo.—J. H. Wolsey, of St. Louis, has petitioned the Council for a franchise to construct and maintain a hot-water and steam-heating system in St. Charles.

Sonyea, N. Y.—Martin L. Bauer, of Owego, is stated to have secured the contract for the electrical work, building conduits and for new arc lights and wires at the Craig Colony, for $4,000.

Columbus, O.—It is reported that the Indianola Heating & Lighting Co. proposes constructing a plant on McMillen Ave. W. H. Sharp, Pres.

Tuscumbia, Ala.—See "Water."

Darby, Pa.—The Council is stated to have passed on first reading an ordinance granting permission to the Delaware County Subway Co. to construct a conduit system in the borough.

Racine, Wis.—The electric light plant of the Milwaukee Electric Ry. Co. at Racine is reported to have been seriously damaged on Nov. 4.

Amite, La.—W. B. Senter, of Amite, proposes to construct a $6,000 electric light plant.

Chicago, Ill.—Commissioner Kennedy, of the Lincoln Park Board, is stated to have been authorized to draw up plans for a new power house for Lincoln Park.

Barron, Wis.—The citizens are stated to have voted on Nov. 5 to borrow $10,500 from the State with which to purchase and improve the water power now owned by Soderberg & Gillette.

Walnut Ridge, Ark.—See "Water."

Oelwein, Ia.—City Clk. H. V. Hoyer writes that on Nov. 5 it was voted to grant a franchise for a gas plant to John G. Homes.

Mansfield, La.—See "Water."

St. Albans, Vt.—Bids are wanted Nov. 18 for lighting the streets and city buildings with electricity. O. L. Hinds, Mayor.

Winthrop, Minn.—See "Water."

Toledo, O.—The State Board of Public Works is stated to have granted A. K. Detwiler, of Toledo, permission to construct a line of poles.

Marlboro, N. Y.—The Newburgh Heat, Light & Power Co. is stated to have petitioned the Town Board for permission to extend its system through the town.

Sheldon, Ill.—The Sheldon Electric Light Co., of Sheldon, has been incorporated; capital, $10,000. Incorporators: Horace Gibson, Jos. Nagele and Jas. W. Watkins.

Goldsboro, N. C.—See "Water."

West New Brighton, N. Y.—Bids are wanted Nov. 25 for installing electric wiring, fixtures and electric gong system in school No. 18, W. New Brighton, Boro. of Richmond. Rich'd H. Adams, Chmn. Com. on Bldgs., Dept. of Educ., N. Y. City.

Orange, N. J.—The Council on Nov. 11 is stated to have awarded the contract for lighting the streets for 5 years, to the United Electric Co. of New Jersey, at $85 per lamp per year.

Castile, N. Y.—The Castile Electric Light & Power Co. of Castile has been incorporated. Directors: G. S. Vangorder, Pike; M. H. Olin, Perry, and J. H. Duncan, Silver Springs.

Muskegon Heights, Mich.—The village of Muskegon Heights is reported to have granted the Grand Rapids, Grand Haven & Muskegon Interurban Ry. Co. a 30-year lighting franchise. It will erect a sub-power station in the village which will also be utilized as the lighting plant. T. F. Carroll, Vice-Pres., Grand Rapids.

Dickson, Tenn.—See "Water."

La Crosse, Wis.—The Council is stated to have granted the Central Electric Light Co. a franchise to construct lighting plants and conduct a general lighting business for a period of 20 years.

Madisonville, O.—See "Water."

Grayling, Mich.—It is reported that the M. B. Wheeler Co., of Grand Rapids, will construct an electric light plant at Grayling.

ELECTRIC RAILWAYS.

Rochester, N. Y.—The Rochester, Syracuse & Eastern R. R. Co. has been incorporated, with a capital of $3,500,000, to operate a street surface electric line between Syracuse and Rochester, a distance of 100 miles. Directors: Ferdinand W. Roebling, of Trenton, N. J.; Clarence W. Seamans, of New York City; Chas. A. Lux, of Clyde, and others.

Colorado Springs, Colo.—The North American Ry. Construction Co., Chicago, Ill., is stated to have received the contract for constructing a trolley line from Colorado Springs to Cheyenne Canyon, a distance of about 6 miles.

South Framingham, Mass.—The Selectmen are stated to have granted a franchise to the Boston & Worcester St. Ry. Co. from the Natick town line to the junction of Eastern Ave. and Concord St., near the State camp grounds.

Ottumwa, Ia.—It is reported that the Ottumwa Traction & Light Co, will construct and equip 5 miles of street railway next spring. Under the terms of the franchise granted in July, 1901, the company is required to have 2½ miles built by Jan. 1, 1902.

Muncie, Ind.—Wm. H. Wood, one of the incorporators of the Muncie, Middletown & Greenfield Ry., writes that surveys are being pushed to completion from Muncie south.

East St. Louis, Ill.—The East St. Louis Electric St. R. R. Co. has petitioned the Council for permission to extend its line.

Cleveland, O.—The Cleveland Traction Co. has been incorporated, with a capital of $1,000, to construct one electric railway on the west side of the river and three on the east side. Incorporators: Frank De Haas Robison, Frank F. Gentsch, and others.

Galesburg, Ill.—The Galesburg Electric Motor & Power Co. is about to petition the City Council for a franchise to construct a railway on N. Prairie St.

Topeka, Kan.—The Topeka & Vinewood Park Ry. Co. is reported to have under consideration the construction of a $100,000 electric line between Topeka and Vinewood Park.

Murfreesboro, Tenn.—C. F. Franklin, of Toledo, O., is reported interested in the construction of an electric railway between Murfreesboro and Eagleville, a distance of about 18 miles.

Vailsburg, N. J.—Francis M. Eppley, of West Orange, representing the Essex Cross Ry. Co., is stated to have petitioned the Council for a franchise.

Granville, Vt.—The Granville & Poultney Electric Ry. Co. has been organized, and it is reported that it will at once commence surveying for the proposed line, which will connect Granville and Poultney with Lake St. Catherine. Wm. Nathaniel, Pres., Poultney, Vt.

Elmhurst, Cal.—A press report states that two 125-H.-P. boilers in the Elmhurst power station of the Oakland, San Leandro & Haywards Electric Ry. were wrecked by an explosion Nov. 3. C. H. Johnson, Ch. Engr., Oakland.

Kennedy, O.—The Council is stated to have granted a franchise to the Rapid Ry. Co. This road is to be constructed from Cincinnati to Lebanon and Dayton. G. R. Scrugham, Pres., Union Trust Bldg., Cincinnati.

Fairport, N. Y.—The Village Trustees are stated to have granted a franchise to the Fairport & Eastern Ry. Co.

Lexington, Ky.—A company has been formed here, with a capital of $7,000,000, to construct an electric railway in Central Kentucky. Geo. D. Davis, of Detroit, Mich.; C. D. Knapp, Jr., of New York, N. Y., and Judge M. C. Alford, of Lexington, are among the incorporators.

Richmond, Va.—The Council has granted a franchise to the Citizens' Rapid Transit Co.

Bridgeton, N. J.—The Bridgeton & Millville Traction Co. is considering the question of extending its lines from Bridgeton through Shiloh and Roadstown.

Ludlow, Mass.—Chas. F. Howard and A. H. Bartlett, of Ludlow, are reported interested in the construction of an electric railway about 3½ miles long, between Ludlow and Chicopee.

Berwyn, Md.—A charter is stated to have been granted to the Berwyn & Laurel Electric Ry. Co. to construct a line from Berwyn to Laurel, a distance of 10 miles; capital, $500,000. Incorporators: Frank Gosnell and Ernest S. McElroy, of Baltimore, and others.

Depew, N. Y.—The Town Board is stated to have granted permission to the Buffalo & Depew R. R. Co. to extend its road through the town. E. M. Alexander, Supt., Depew.

Salt Lake City, Utah.—A. R. Lundy, of Chicago, Ill., is reported to have been engaged to prepare plans for a power plant to be erected on the banks of the Jordan, near First South St., for the Consolidated Ry. & Power Co., to cost about $250,000. W. P. Read, Gen. Supt., Salt Lake City.

Falmouth, Mass.—It is stated that the Middleboro, Wareham & Buzzards Bay St. Ry. Co. is to extend its line to Falmouth. Chas. H. Cox, Ch. Engr., Middleboro.

Ft. Smith, Ark.—The Ft. Smith Rapid Transit Co. is stated to have been incorporated, with a capital of $2,000,000, to construct and operate electric interurban roads in Sebastian, Crawford and Franklin Counties. T. L. Cannon, Pres.; Frank Parke, Sec.

Marion, Ind.—Geo. T. Whittaker, of Dunkirk, representing the Eastern Indiana Traction Co., is stated to have petitioned the Grant County Commissioners for a franchise.

Philippi, W. Va.—A press report states that the electric railway company, of which John A. Howard, of Wheeling, is Pres., intends extending its line and doubling the electric capacity of its electric light plant here. Contract for the power house, to cost about $50,000, will soon be let.

Apollo, Pa.—A charter is stated to have been granted to the Apollo, Vandegrift & Leechburg St. Ry. Co., to construct a line 8 miles long; capital, $50,000.

Lead, S. D.—The Burlington R. R. Co. (E. J. Blake, Consulting Engr., Chicago, Ill.) is stated to have secured a franchise to construct and operate an electric road through Main St. It will connect with the Deadwood Central road between Deadwood and this city and will continue to the west part of the town. The Deadwood Central line will be converted into an electric road immediately.

Altoona, Ia.—The citizens are stated to have voted on Nov. 8 to grant a franchise and levy a tax to aid in the construction of the Des Moines, Colfax & Eastern Ry. The promoters of the road contemplate extending the line to Marshalltown by way of Altoona and Mitchellville. Mrs. M. A. Butler, of Cleveland, O., is reported to be the chief promoter.

Kenosha, Wis.—The Wisconsin Inter-Lakes Electric Ry. Co. has been incorporated, with a capital of $25,000, to construct electric lines to connect the various lake regions of Wisconsin. The first line to be constructed will be from Kenosha to Lake Geneva. Gerald R. McDowell is one of the incorporators.

Bloomfield, Ind.—D. J. Terhune, Linton; Harvey Laughlin, Lyons; O. W. Shryer, Bloomfield, and others are stated to have secured from the Commissioners of Greene County a franchise to construct an electric railway to connect Bloomfield, Elliston, Worthington, Switz City, Lyons, Linton, Jasonville and Midland.

South Deerfield, Mass.—The Greenfield, Deerfield & Northampton St. Ry. Co. has been incorporated, with a capital of $20,000, to construct an electric railway from South Deerfield through Whately to Hatfield. Directors: Jas. B. Bridges, South Deerfield; Walter W. Sanderson, Whately; W. H. Belden, Hatfield, and others.

Vandegrift, Pa.—The Vandegrift & New Kensington St. Ry. Co., of Vandegrift, has been incorporated, with a capital of $15,000, to construct a line about 2½ miles in length.

Oskaloosa, Ia.—Robt. A. Hall and James E. Blake, of Cedar Rapids, Ia., are reported interested in the construction of an electric line between Tama and to Button, via Oskaloosa, a total distance of about 95 miles.

Danville, Ill.—The City Council is stated to have granted Chas. M. Cole a franchise in Danville for an electric railway, which he proposes constructing between Covington, Ind., and Danville, Ill.

RAILROADS

Philadelphia, Pa.—Bids are wanted by the Pennsylvania R. R. Co. until Nov. 25 for furnishing labor and material necessary to complete the excavation and masonry for a single track tunnel, 3,600 ft. long, through Allegheny Mountain, together with 1,200 lin. ft. of approach, as advertised in The Engineering Record.

Fitzgerald, Ga.—A charter is stated to have been granted the Fitzgerald, Ocmulgee & Red Bluff Ry. Co. to construct a railroad about 50 miles long from Fitzgerald to Helena and McRae in Telfair County, and into Montgomery County. Thos. Wilson and T. D. Ross, of Fitzgerald, are among the incorporators.

Carson City, Nev.—The California Midland R. R. Co. is reported incorporated to construct a railway from San Francisco to and through the San Joaquin valley to Dead Man's Pass, thence into the State of Nevada and on a direct line for Tonopah. W. H. H. Hart, of San Francisco, Cal., is one of the incorporators.

Woodbury, Tenn.—The citizens of Cannon County are stated to have voted on Nov. 9 to subscribe $138,000 to the Woodbury & Nashville R. R. The intention of the promoters is to connect the Tennessee Central through Cannon County with the Nashville, Chattanooga & St. Louis near Bellbuckle.

Newark, N. J.—At the Council meeting Nov. 7 track elevation bonds to the amount of $500,000 were ordered to be offered for sale.

Kansas City, Mo.—A charter is stated to have been granted to the Kansas City, Peoria & Chicago R. R. Co. of Kansas City, with a capital of $3,945,000. The road is to be 263 miles long and will extend from Kansas City, Mo., to Gower in Buchanan County, and from Kansas City to Quincy, Ill.

Pittsburg, Pa.—The Eastern Rapid Transit St. Ry. Co. of Pittsburg, which is reported to have planned to tunnel Mt. Washington on the south side and connect with the Pittsburg & Knoxville R. R., is reported to have received a charter; capital, $6,000. Directors: Addison F. Holliday, Crafton; Fredk. C. Leslie, Washington, and John S. Weller, Bedford.

Cincinnati, O.—The proposition to issue $2,500,000 bonds to provide terminal facilities for the Cincinnati & Southern Ry. is reported to have carried at the election in Hamilton County, Nov. 5. It is also reported that the company will expend large sums in building new bridges and cutting down grades.

Memphis, Tenn.—The Memphis, Helena & Louisiana Ry. Co. has been incorporated, with a capital of $3,000,000, to construct a railroad from a point on the Memphis branch of the Iron Mountain R. R. in a southerly direction through the counties of Crittenden, St. Francis, Lee, Phillips, Arkansas, Desha and Chicot, to a point on the line between Arkansas and Louisiana, a distance of 187½ miles. Directors: Geo. J. Gould, Lakewood, N. J.; B. S. Johnson, Little Rock, Ark.; Edw. S. Ready, Helena, Mont., and others.

Kingfisher, Okla. Ter.—The Oklahoma, Texas & Gulf Ry. Co. has been incorporated, to construct a railroad from Kingfisher, via Oklahoma City and Coalgate, Ind. Ter., to Paris, Tex., a distance of about 180 miles. Alfred T. Yerkes, of Chicago, and Harold Berry, of New York, N. Y., are among the incorporators.

Taloga, Okla. Ter.—A charter is stated to have been granted to the Taloga & Eastern R. R. Co., with a capital of $200,000, to construct a standard gauge road from Taloga through the counties of Dewey, Custer, Blaine and Woods, to where it will intersect the Orient R. R. Directors; John E. Culver, Elmira, N. Y.; W. C. Edwards, Kansas City, Mo., and Frank Rhinehart, Guthrie.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Des Moines, Ia.—Bids are wanted Dec. 20 for the erection and completion of the mason work and cut stone for the Polk County Court House, as advertised in The Engineering Record.

Cantrall, Ill.—Bids are wanted Nov. 18 for erecting a village prison. G. T. Sayles, Chmn. Bldg. Com.

Concord, N. H.—The City Council has voted to erect a new city building, at a cost of $150,000.

Charlotte, Mich.—Claire Allen, of Jackson, is stated to have prepared plans for a church for the Methodist Episcopal Society of Charlotte; to cost about $25,000.

Lufkin, Tex.—The citizens of Angelina County are stated to have voted to issue $40,000 bonds for a brick court house.

Burlington, Ia.—County Aud. W. P. Sharts writes that on Nov. 5 it was voted to rebuild the county poor house and asylum, at a cost of $40,000.

Brooklyn, N. Y.—Plans prepared by W. E. Stone, 55 B'way, N. Y. City, for the Norwegian Deaconesses' Home and Hospital, to be erected on 4th Ave. and 46th St., are stated to have been accepted by the Board of Directors; cost to be about $100,000.

Albia, Ia.—The citizens of Monroe County are stated to have voted to erect a court house.

Montreal, Que.—The Board of Directresses of the Montreal Maternity Hospital are stated to have decided to erect a hospital on Durocher St., to cost about $30,000. Mrs. H. C. Holt, Secy.

Augusta, Ark.—Rickon & Thompson, of Little Rock, are reported to be preparing plans for enlarging and repairing the Woodruff County court house at Augusta, at a cost of about $25,000; also preparing plans for a $10,000 court house to be erected at Cotton Plant in the same county.

Williamson, W. Va.—Bids are wanted Nov. 30 for erecting a court house. Jas. Damron, Clk. Co. Court; Frank P. Millburn, Archt., Columbia, S. C.

Pensacola, Fla.—Press reports state that the Episcopal Church is about to let contracts for the erection of a $20,000 building.

Guelph, Ont.—Andrew Carnegie is stated to have offered this city $20,000 for a public library.

Bangor, Me.—W. N. Sawyer, of Bangor, is stated to have secured the contract for erecting the Central Congregational Church, to cost about $50,000. E. R. Burpee, Chmn. Bldg. Com.

Poughkeepsie, N. Y.—W. J. Beardsley, of Poughkeepsie, is reported to have prepared plans for a court house and jail, to cost about $200,000.

Bradford, Pa.—The City Hall is reported to have been destroyed by fire on Nov. 8.

Spokane, Wash.—Preusse & Zittel, Jameson Bldg., are stated to have prepared plans for a $60,000 edifice for the R. C. Church of Our Lady of Lourdes, to be erected on Madison St. and Riverside Ave.

South Bend, Ind.—City Engr. A. J. Hammond writes that bids are wanted Dec. 31 for the construction of Central Fire Station. Estimated cost, $13,000. Freyermuth & Maurer, Architects.

Washington, Ga.—A press report states that the Commissioners of Wilkes County will receive plans until Nov. 26 for the erection of a $40,000 court house.

Yellow Springs, O.—The Trustees of the Methodist Home for the Aged at Yellow Springs are reported to have under consideration plans for the construction of a $25,000 building.

Benton, Ark.—The Saline County Board is reported to have appropriated $20,000 for a court house.

Galveston, Tex.—The Directors of the Rosenberg Library Association are stated to have accepted the plans of Eames & Young, Lincoln Trust Bldg., St. Louis, Mo., for a library to be erected on Tremont St. and Sealy Ave., to cost about $100,000.

Vicksburg, Miss.—The Presbyterian Congregation here has decided to build a new church.

San Jose, Cal.—The plans of Wm. Binder, Porter Bldg., are stated to have been accepted for a $50,000 Carnegie Library.

Springfield, Ill.—The plans of Sam'l A. Bullard, 208 S. 6th St., are stated to have been accepted for the Springfield State Arsenal, to cost about $200,000.

Newton, Tex.—Co. Clk. John M. Horger writes that it was voted Nov. 2 to issue $25,000 bonds for a court house.

Parker, S. D.—Clk. of Courts Frank B. Stevens writes that on Nov. 5 it was voted to issue $20,000 bonds for the erection of a court house.

Elkpoint, S. D.—Co. Aud. H. M. Dodd writes that on Nov. 5 a vote was taken in favor of issuing $20,000 bonds for an addition to the court house.

Aberdeen, S. D.—Co. Aud. Chas. Eygabrood writes that at the recent election it was voted to issue $65,000 bonds for a court house.

Sibley, Ia.—J. P. Hawxhurst, Clk. of the District Court, writes that at the recent election it was voted to issue $50,000 bonds for a court house and jail.

Ottawa, Ont.—Bids are wanted Nov. 27 for erecting an observatory building at the Central Experimental Farm, Ottawa. Fred. Gelinas, Sec'y Dept. of Pub. Wks.

Houston, Tex.—It is stated that bids are wanted Dec. 2 for erecting a Carnegie Library. S. H. Brashear, Pres. Houston Lyceum & Carnegie Library Assoc., Mason Blk.

Bloomington, Ill.—All bids recently received, for a central engine house, two fire stations and a patrol barn, have been rejected and new bids will be asked. Estimated cost, $28,000. Elmer Folsom, City Engr.

Livingston, Ala.—The County Court will convene on Nov. 25 to decide on plans for rebuilding the county court house, which was burned recently. A building committee and engineer will probably be appointed when decision is made as above.

Goldsboro, N. C.—See "Water."

Richford, Vt.—It is stated that bids are wanted Dec. 3 for erecting All Saints Catholic Church. N. O. Dorion, P. P.; L. L. Gauthier, Archt., 180 St. James St., Montreal, Que.

Ivanhoe, Minn.—Plans and specifications will be received by the County Commissioners until Nov. 18 for a court house, to cost about $30,000. Henry Potter, Co. Aud.

Natchitoches, La.—Bids are wanted Nov. 25 for erecting a jail. S. H. Hill, Clk. Police Jury.

Bartonville, Ill.—See "Sewerage and Sewage Disposal."

Trenton, N. J.—Bids will be received by the County Board of Chosen Freeholders until Nov. 22 for $25,000 armory bonds. Thos. H. Thropp, Co. Collector.

Philadelphia, Pa.—The following bids were opened Nov. 8 by the Bureau of Charities and Correction for 3 buildings adjoining the Philadelphia Hospital: Bidders all of Philadelphia:

Hospital for contagious diseases, $35,000 available.

Bidders.	Building.	Htg. and el. plant.	Time.
Harry Kuemmerle	$30,457	$36,857	140 days
Penn Erecting Co.	33,067	39,787	6 mos.
Hiram A. Miller	29,400	35,950	160 days
Henderson & Co.	27,400	33,900	131 days
M. P. Wells & Co.	33,493	40,795	5 mos.
J. H. Jordan	26,775	33,175	175 days
Maguire & Emery	30,243	36,830	4 mos.
Children's Hospital, $35,000 available.			
Penn Erecting Co.	$27,948	$32,438	7 mos.
H. A. Miller	27,295	31,745	160 days
H. Kuemmerle	33,890	37,940	140 days
J. H. Jordan	29,375	33,275	175 days
Maguire & Emery	27,621	32,112	4 mos.
Henderson & Co.	24,945	29,043	130 days
M. P. Wells & Co.	32,723	37,520	
Maternity House, $10,000 available.			
Harry Kuemmerle	$8,148	$8,793	3 mos.
Maguire & Emery	9,727	10,106	3 mos.
Henderson & Co.	8,997	9,497	100 days
H. A. Miller	9,685	10,235	120 days
M. P. Wells & Co.	9,485	10,135	4 mos.
Penn Erecting Co.	9,473	9,848	4 mos.
J. H. Jordan	8,930	9,500	125 days

BUSINESS BUILDINGS.

Birmingham, Ala.—The contract for erecting a building for the Southern Club, at 5th Ave. and 20th St., is stated to have been awarded to A. J. Krebs & Co., of Birmingham, for $30,000.

Pittsburg, Pa.—The Geo. A. Fuller Co. is stated to have secured the contract for erecting a 22-story office building for the Farmers' Deposit Nat'l Bank on Wood St. and 5th Ave.; cost, about $1,500,000.

Boston, Mass.—Plans have been filed by Architect Arthur H. Bowditch, 112 Water St., for an 11-story steel-frame fireproof office building, to be erected at 81 Summer St. Builder, The Geo. A. Fuller Co., 27 State St. Owners, The Municipal Real Estate Trust, Pemberton Sq.

Jackson, Mich.—A press report states that Geo. B. Swift, 188 Madison St., Chicago, Ill., has received the contract for constructing new shops at the junction for the Michigan Central Ry. Co., to include an electric power house, to cost in all about $400,000.

Austin, Tex.—The Houston & Texas R. R. Co. has acquired property and will shortly begin the construction of a brick passenger depot. G. A. Quinlan, Gen. Mgr., Houston.

It is reported that Hogg & Robertson propose erecting a 7-story office building on Congress Ave.

Spokane, Wash.—E. G. Bacon is about to erect a $12,000 block on Riverside Ave. A. B. Saunders, Granite Blk., Architect.

Shamokin, Pa.—The Shamokin Inn Co. has been formed, with A. G. Marr as Pres., its purpose being the construction of a fireproof hotel to be located at 9th and Independence Sts. Estimated cost, $75,000. Architect, W. U. Jury.

Racine, Wis.—Hugh R. Edwards, of Racine, is stated to have received the contract for erecting the proposed $50,000 depot at Racine, for the Chicago & Northwestern R. R.

Beaumont, Tex.—The Y. M. C. A. is reported to have under consideration the erection of a $50,000 building. Geo. W. Carroll, Chmn. Bldg. Com.

Cleveland, O.—It is stated that the Salvation Army is to erect a $30,000 building on Erie and Eagle Sts.

John Hartness Brown will erect a hotel on Euclid Ave. and Muirson St., to cost about $1,500,000.

Washington, D. C.—Appleton P. Clark, Jr., 605 F St. N. W., is stated to have prepared plans for a 6-story building to be erected on the N. E. cor. of Massachusetts Ave. and 7th St., for the Home Savings Bank. B. F. Saul, Pres.

Norfolk, Va.—The plans of J. K. Peebles, Columbia Bldg., are stated to have been accepted for a $75,000 building for the Business Men's Association, to be erected on Plume and Atlantic Sts. H. S. Herman, Chmn. Bldg Com.

Bridgeport, Conn.—J. B. Elpatrick & Son are stated to have prepared plans for a theater to be erected here by Clinton B. Seeley and Wilson Marshall, for their manager, Edw. C. Smith. It will replace the present Smith Theater and have a seating capacity of 2,212.

New Castle, Pa.—The plant of the Lawrence Ice & Storage Co. is reported to have been destroyed by fire Nov. 10. E. M. Dupont, Pres., Johnstown, Pa.

Jennings, La.—T. C. Mahaffey is reported to have engaged an architect to prepare plans for a $25,000 hotel to be erected here at once.

West Superior, Wis.—The Lake Superior Terminal & Transfer R. R. Co. is stated to have decided to build a new roundhouse between Oakes Ave. and the R. R. tracks, to cost about $20,000.

San Francisco, Cal.—Edw. J. Vogel, Claus Spreckels Bldg., is stated to have prepared plans for a 6-story brick building to be erected on Geary and William Sts., to cost about $70,000.

Winsted, Conn.—The Winsted Opera House on Main and Elm Sts., was burned Nov. 12th.

Grand Rapids, Mich.—The Powers' Theater is reported to have been destroyed by fire Nov. 13.

Richmond, Va.—Hodges & Leach, of Baltimore, Md., are stated to have completed plans and are now ready to receive bids for a $250,000 fireproof hotel to be erected at 9th and Grace Sts.

The Southern Bell Telephone Co. has purchased a site on Grace St. near 8th St., and will erect a building, estimated to cost $30,000. Hunt Chipley, Local Supt.

The office building of the Va. Electric Railway & Development Co. and the Traction Co., and of the Tower-Binford Electric Co. was destroyed by fire Nov. 9. Loss on building, $35,000. It is likely the building will be replaced by a fireproof structure. Chas. T. Davis & Dr. Jud. B. Wood are the owners.

Boston, Mass.—The 7-story building on Broad and Franklin Sts., occupied by the Murphy Varnish Co., was burned Nov. 12.

Architect M. B. Safford, 274 A St., South Boston, has filed plans for a $300,000 building, to be erected on Summer St. near Melcher St., to be occupied by the New England Confectionery Co. It will be 5 and 6 stories, 296 x 100 ft., mill construction. Owners, Boston Wharf Co. Contract for construction not awarded.

Wheelwright & Haven, 1001 Colonial Bldg., have filed plans for an Out Patients' Hospital, 4 stories, 205 x 52 ft., at 81 Fruit St. It will be steel and masonry construction. Owners, The Massachusetts General Hospital. Builders, The Thompson-Starratt Co., 183 Essex St.

Permits have been granted as follows: To build an 11-story building for stores and offices on Beacon St. and Tremont Pl. Builder, L. P. Soule & Son, 166 Devonshire St. And an 8-story brick and stone warehouse on Summer St. near Dorchester Ave. Builder, L. P. Soule & Son. There will be 5 sections, the whole being 95 x 149 ft.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

Hudson & Chambers Sts, office & store bldg; c, $30,000; o, Fredk Gerken; a. Horgan & Slattery.

11 E 32d St, br & stone hotel; c, $80,000; o, Mitchell A Cass Levy; a, Oscar Lowinson.

5th Ave & 34th St, marble, terra cotta & stone office bldg; c, $450,000; o, The Knickerbocker Trust Co.; a, McKim, Mead & White.

Park Ave, 41st and 42d Sts, br & stone hotel; c, $2,500,000; o, The Subway Realty Co.; a, Warren, Wetmore & Morgan; masons, Marc Eidlitz & Sons.

Union Ave & 168th St, br stores & flat; c, $35,000; o, Thos I Smith; a, Paul C Hunter.

DWELLINGS.

Milwaukee, Wis.—Fred'k Graf, 307 Grand Ave., is stated to have completed plans for a flat to be erected by E. Eldred Magee, at 496 Marshall St., to cost about $30,000.

Kansas City, Mo.—J. R. Kelley is about to build a $12,000 stone dwelling at Hunter Ave. and Main St.

Chicago, Ill.—Chas. A. Strandel, 82 La Salle St., is stated to have prepared plans for a 3-story apartment house to be erected on Center and N. Halsted Sts., to cost $35,000.

Detroit, Mich.—Malcomson & Higginbotham, Moffat Bldg., have prepared plans for a 4-story brick flat (hot water heating and modern plumbing), to be located on Trumbull Ave. Cost, $25,000.

Philadelphia, Pa.—John W. De Long is reported to have had plans prepared by Fred'k Fox for a 6-story apartment house, 40 x 135 ft., to be known as the St. Alban's, and to be erected in Germantown.

St. Louis, Mo.—Chas. K. Ramsey, 105 N. 7th St., is stated to have prepared plans for a $60,000 apartment house, to be erected on Cabanne Ave. and Belt St.

Baltimore, Md.—Geo. Archer, Central Savings Bank Bldg., is stated to be preparing plans for a 12-story apartment house to be erected on Mt. Royal Ave. and McMechen St., to cost about $350,000.

SCHOOLS.

Detroit, Mich.—Malcomson & Higginbotham, Moffat Bldg., have prepared plans for Pingree School, to be built of pressed brick, and have hot water heating and all modern improvements. Cost, $45,000.

Kenosha, Wis.—John Belting, of Kenosha, is stated to have secured the contract for erecting the 6th Ward School for $15,800, and Peter B. Bogard, of Milwaukee, for heating same, at $2,750.

New Haven, Conn.—G. T. Hewlett, Clk. Bd. of Educ., writes that contracts for work in the High School have been awarded as follows: Ventilating and heating, to the National Steam Economizer Co., of Springfield, Mass., for $22,798, and electrical work to W. W. Gale & Co., of New Haven, for $4,146.

Austin, Tex.—The sum of $50,000 has been appropriated for a Woman's Building at the State University. W. L. Prather, Pres.

Waynesboro, Pa.—The citizens on Nov. 5 are stated to have voted to issue $20,000 bonds for the erection of the Snyder Ave. School.

Emporia, Kan.—Mauran, Russell & Garden, Chemical Bldg., St. Louis, Mo., are stated to have prepared plans for a $60,000 library to be erected at Emporia for the Kansas State Normal School.

Camden, N. J.—The Board of Public Instruction has employed Thos. Stevens, of Camden, to prepare plans for 3 schools.

Seymour, Tex.—It is stated that $20,000 bonds have been issued for a new school.

Indianapolis, Ind.—Mr. and Mrs. E. C. Thompson, of Indianapolis, are reported to have added $20,000 to the $10,000 previously given by them to Butler College in that city, for the construction of the Bona Thompson Library, as a memorial to their daughter.

Cincinnati, O.—Bids are wanted Dec. 2 for $25,000 school bonds. Wm. Grautman, Clk. Bd. Educ.

Washington, D. C.—Bids are wanted Nov. 30 for erecting a Manual Training School on 7th and G Sts., S. E. John Biddle, Commr. D. C.

Dickinson, N. D.—Bids are wanted Dec. 1 for erecting a school. Jos. Oukrop, Clk. School Bd.

Peekskill, N. Y.—Bids are wanted Nov. 26 for erecting a school at Smith and Franklin Sts., including plumbing and heating. Edw. G. Halsey, Clk. Bd. Educ., 902 South St.

Woonsocket, R. I.—Bids are wanted Nov. 18 for erecting a brick school at Social and East School Sts. P. J. Fleurant, Chmn. Bldg. Com.

Swainsboro, Ga.—The citizens are stated to have voted to issue $12,000 bonds for a school.

Chicago, Ill.—The authorities of the University of Chicago are stated to have taken out a building permit on Nov. 12 for the new gymnasium, to be erected on the campus during the next year. It will cost $200,000.

Marquette, Mich.—It is stated that bids are wanted Nov. 30 for erecting schools. Geo. Barnes, Sec'y School Bd.

Waco, Tex.—It is stated that bids are wanted Nov. 30 for erecting the F. L. Carroll Chapel and Library for the Baylor University. E. R. Nash, Chmn.

Chelsea, Mass.—Orders have been signed by the Mayor for a $138,000 high school and a $40,000 grammar school. Wm. Hart Taylor, 6 Beacon St., Boston, has been selected as the architect. The contracts will probably be let this year, but work will not commence until next spring. Alfred L. Maggi, City Engr.

Chicago, Ill.—Bids are wanted Nov. 22 for improvements in the W. K. Sullivan school, including heating, plumbing, gasfitting, etc. W. B. Mindie, Archt., Rm. 1117, Schiller Bldg.

Brooklyn, N. Y.—The following bids were opened Nov. 11 by the Committee on Buildings, Bd. of Educ., New York City, for additions to and alterations in Public School 92, Boro. of Brooklyn: Tolmie & Kerr, $53,891; Alfred Nugent & Son, $51,932; Geo. Hildebrand, $51,647; Chris. J. Kenny, $49,998; Peter Cleary, 195 Bainbridge St., $48,875 (awarded); Thos. Cockerill & Son, $57,000; John Thatcher & Son, $53,600; Chas. O. Johnson, $50,800; Chas. H. Peckworth, $54,328; Wm. & Thos. Lamb, $53,729.

STREET CLEANING AND GARBAGE DISPOSAL.

Jersey City, N. J.—Bids are wanted Nov. 19 for sweeping, cleaning and removing all dirt, ashes and garbage from the streets for the year beginning Dec. 1, 1901. Geo. T. Bouton, Clk., Bd. Street & Water Commrs.

South Bend, Ind.—City Engr. Alonzo J. Hammond writes that the following bids for a crematory plant (city to furnish building and stack), were opened Nov. 1 by Board of Public Works: Dixon Garbage Crematory Co., Toledo, O., $5,988; Davis Garbage Furnace Co., Lancaster, Pa., $6,000; La Chapell & Pearce, Ottawa, Ill., $6,000.

Cincinnati, O.—The Committee on Health of the Board of Legislation has prepared specifications for a new garbage contract.

Fresno, Cal.—The Special Committee has reported in favor of the construction of a crematory for the disposal of garbage, and City Engineer Teilman is preparing plans, estimates, etc.

Scranton, Pa.—Bids are wanted Nov. 18 for repairing the garbage crematory. F. L. Wormser, Dir. Dept. of Pub. Safety.

Boston, Mass.—The New England Sanitary Product Co. and the city of Boston have entered into a new 10-year contract for the disposition of the city's garbage. The new plant will be placed on Spectaele Island, where the company has leased a site. Construction will be started as soon as the contract is awarded. This action was taken under the order of the City Council appropriating $140,000 for the removal of the garbage plant from Cow Pasture.

GOVERNMENT WORK.

Ft. Ethan Allen, Vt.—Bids are wanted Nov. 26 for the construction of an addition to and furnishing and installing additional pumping machinery and connections in boiler and pump house, as advertised in The Engineering Record.

Omaha, Neb.—Bids are wanted Nov. 20 for furnishing and setting a pump and boiler, in connection with the water-works at Ft. Robinson, Neb. J. W. Pullman, Ch. Q. M.

San Francisco, Cal.—Bids are wanted Nov. 29 for erecting a life saving station at Arena Cove, Cal. S. I. Kimball, Gen. Supt., U. S. Life Saving Service, Treas. Dept., Washington, D. C.

Watertown, Mass.—Bids are wanted Dec. 2 for erecting a barrack building at Watertown Arsenal, including heating, plumbing and gas fitting. Lieut.-Col. John G. Butler, Ord. Dept., U. S. A., Comdg.

Washington, D. C.—A site has been purchased on Pierce Mill road, about ¼ mile west of Connecticut Ave., for the new government bureau of standards. Cost of site $25,000. Buildings authorized to be constructed are a laboratory and power house, to cost about $250,000.

Mobile, Ala.—Bids are wanted Dec. 12 for furnishing material and constructing a beacon, at or near the former site of Half-Moon Shoal Light House, Galveston Bay, Tex. Lieut.-Col. A. N. Damrell, Corps Engrs., U. S. A.

Salem, Ore.—Bids will be received by the Supervising Architect, Treasury Dept., Washington, D. C., until Jan. 7 for the installation of a conduit and wiring system in the U. S. Post Office at Salem, as advertised in The Engineering Record.

Ft. Dady, Fla.—Bids are wanted Nov. 30 for constructing a water system at Ft. Dade, consisting of a pump and boiler house, pumping machinery, wooden tank and trestle, distributing and well systems and suction pipes. C. L. J. Frohwitter, A. Q. M.

Washington, D. C.—Bids are wanted Nov. 25 for furnishing the signal corps with deep sea and underground cables. A. W. Greely, Ch. Signal Officer, War Dept.

MISCELLANEOUS.

Bridgeport, Conn.—Gen. Mgr. J. E. Sewell writes that the Connecticut Railway & Lighting Co. proposes to construct a dam in Far Mill River, estimated cost $5,000. D. S. Brinsmade, of Derby, Conn., Engr. in Charge.

Portsmouth, O.—The proposition to issue $35,000 bonds for flood defenses is stated to have carried at the recent election. R. A. Bryan, City Engr.

New Orleans, La.—Plans and specifications are now being prepared by Coleman & Malochee, 319 Carondelet St., for a wharf 500 x 100, to be built by the Dock Commissioners, at the head of Montegut St. Estimated cost, $20,000.

Abbeville, La.—The East Side Canal Co. has been organized with a capital stock of $250,000. The object of this company is to build canals, rice mills, etc. Officers: Dr. C. J. Edwards, Pres.; Sevevin LeBlanc, Vice-Pres.; D. L. McPherson, Secy. and Treas., and R. A. Broussard, Mgr.

Philadelphia, Pa.—The Common Council has voted to take 22½ acres of land adjoining the park at Robert's Hollow for a park, to be under the care of the Commissioners of Fairmount Park.

Des Moines, Ia.—Local press reports state that the Board of Park Commissioners has decided to place an additional dam across the Des Moines River below Court Ave. bridge.

Detroit, Mich.—Bonds to the amount of $81,000 for Clark and Atkinson Parks were sold recently.

Worcester, Mass.—The joint special committee on parks of the City Council has voted to recommend to the City Council the purchase of land for park purposes at an aggregate cost of $112,000.

Norfolk, Va.—The lowest bid opened Nov. 4 for constructing a wharf at Fort Wool, Va., was from Richard Parrott, of Newburg, N. Y., at $7,450.

Findlay, O.—The Sanitary Commitee has reported that it is necessary for the health of the city that a dam be erected across the river at Liberty St., above the sewer outlets, and recommended that the engineer prepare plans.

Norfolk, Va.—The Norfolk Shipyard & Dry Dock Co. has been formally organized with a capital of from $3,000,000 to $5,000,000, and will erect a shipbuilding plant in the vicinity of Norfolk, presumably at Sewell's Point, where the company holds an option on a plot of 1,000 acres, including riparian rights to an extensive water front. Officers: Pres., George W. Atkinson, of Charleston, W. Va.; Vice-Pres., George Blackstone, of Baltimore; Sec., W. H. Anderson, of Wheeling, W. Va.; Treas., Caldwell Hardy, of Norfolk.

NEW INDUSTRIAL PLANTS.

The Jacob Dold Packing Co., Buffalo, N. Y., will rebuild its plant, recently burned, as quickly as possible.

The West Coast Asphalt Co., Waukegan, Ill., is erecting a 135 x 110-ft. building to replace that recently burned. Electric motors are used to run the plant.

The Geo. A. Williams Co., 268 Washington St., Jersey City, N. J., will receive bids about Dec. 1 for a water distilling plant, contract to be let in conjunction with a 25-ton ice plant to be erected by them for the Consumers' Light, Heat & Ice Co., Newport News, Va. Estimated cost, $55,000.

The American Hulled Bean Co., Ltd., Battle Creek, Mich., expects to erect a 3-story, 200 x 60-ft. building and install a 125-H.-P. Corliss engine and two 125-H.-P. boilers.

The Hibbard-Rodman-Ely Safe Co., 253 Broadway, New York, is building an 80 x 160-ft. addition to its Plainfield, N. J., factory, and will install a 75-K.-W. direct-connected generator in the power house.

The Capital City Dairy Co., Columbus, O., expects to increase its cold-storage capacity.

The Arkansas City, Kan., Ice & Cold-Storage Co. intends to erect a 75-ton ice plant, but details have not been arranged.

Chas. W. Clark, Butte, Mont., is interested in the erection of a smelter, to have a daily capacity of 2,000 tons.

The Los Angeles, Cal., Ry. Co. will erect the following buildings, 100 ft. wide: A 200-ft. machine shop, a 75-ft. blacksmith shop, a 100-ft. storeroom, a 280-ft. carpenter shop, a 280-ft. car repair shop, an 80-ft. armature room, a 300-ft. paint shop, a 120 x 175-ft. addition to the boiler and engine rooms, and a 600 x 120-ft. car house. Four 400-H.-P. boilers, a 2,000-H.-P. cross-compound engine direct-connected to a direct-current generator, and a 2,500-H.-P. cross-compound engine direct-connected to an alternating-current generator will be installed. Epes Randolph, Gen. Mgr.

The Stevens Arms & Tool Co., Chicopee Falls, Mass., will build a 5-story, 30 x 50-ft. addition to its plant.

The Fred. Macy Co., Grand Rapids, Mich., will erect two 3-story buildings, 432 x 68 and 200 x 60 ft., respectively, three 1-story buildings, 50 x 110, 80 x 100 and 15 ft. square, and a 125 ft. chimney. Four 16-ft. fire-tube boilers of 72 in. diameter, a 400-H.-P. slow-speed engine, and a 125-K.-W. dynamo will probably be installed. Field & Hinchman, Detroit, engineers.

BUSINESS NOTES.

The Lane Bridge Co., Painted Post, N. Y., has been incorporated, with a capital of $50,000. The directors are: D. F. Lane, A. E. Lane, and C. W. Smith, of Painted Post.

The Ball Engine Co., Erie, Pa., is building two 300-H.-P. tandem compound engines direct connected to alternating generators, which will run in parallel, for the Kilbourne & Jacobs Mfg. Co., Columbus, O., and installing a 125-H.-P. engine for the Janesville, Wis., Electric Co.; an additional engine for the Baltimore Hotel, Kansas City, Mo., and an 80-H.-P. engine for Jas. S. Kirk & Co., Chicago.

The Frank C. McLain Co., New York, has removed its offices and salesrooms for boilers, radiators, pipe and fittings, pipe to sketch, valves, etc., to corner 38th St. and 11th Ave.

The A. Leschen & Sons Rope Co. has just moved its Chicago office to 137 Lake St., where it will have a large warehouse and carry a complete stock of wire, manila and sisal rope, packing, waste, pulley blocks, sheaves, wire fittings, and various kinds of supplies. The company now has branch offices and warehouses at Chicago, 92 Center St., New York, and 85 Fremont St., San Francisco.

The Cambridge, Mass., Electric Light Co. has placed another order with the Green Fuel Economizer Co., which doubles the size of the economizer under the former contract.

The Standard Traction Brake Co., of 120 Liberty St., New York, has recently received a large order for axle and motor-driven brake equipments for the Massachusetts Construction Co., 60 State St., Boston.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Nov. 19.	Washington, D. C	Nov. 16
Nov. 19	Dayton O	Nov. 16
Nov. 20.	Scammon, Kan	Oct. 26
	Adv., Eng. Record, Oct. 26.	
Nov. 20.	Meters, Cleveland, O	Nov. 2
Nov. 21.	Boston Mass	Nov. 2
	Adv., Eng. Record, Nov. 2 to 16.	
Nov. 21.	Dover, N. J	Nov. 16
Nov. 21.	Saginaw, Mich	Nov. 16
Nov. 23.	Geneseo, Ill	Nov. 16
Nov. 26.	Grand Rapids, Mich	Nov. 16
	Adv., Eng. Record, Nov. 16.	
Nov. 28.	Hendricks Minn	Nov. 16
Nov. 30.	Ft. Dady Fla	Nov. 16
Nov. —.	West Lebanon Ind	Oct. 19
Nov. —.	Farmersville, Tex	Oct. 12
Dec. 1.	Bement, Ill	Nov. 9
Dec. 2.	Fayette, Miss	Nov. 9
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 2.	Caruthersville, Mo	Nov. 16
	Adv., Eng. Record, Nov. 16.	
Dec. 2.	San Luis Obispo, Cal	Nov. 16
Dec. 4.	Sale of pumping works Chicago, Ill	Oct. 12
	Adv., Eng. Record, Oct. 12.	
Dec. 10.	Wilmington, O	Nov. 9
Dec 17.	New York, N. Y	Oct. 19
Dec. 18.	Philadelphia, Pa	Nov. 16
Dec. —.	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. —.	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
——	Johnson City, Tenn	Nov. 2
——	Ft. Collins, Colo	Nov. 16
——	Springfield, Ill	Nov. 16
	SEWERAGE AND SEWAGE DISPOSAL.	
Nov. 18.	Providence, R. I	Nov. 9
	Adv., Eng. Record, Nov. 9, 16.	
Nov. 18.	West New York, N. J	Nov. 16
Nov. 18.	Duluth, Minn	Nov. 16
Nov. 18.	Vicksburg, Miss	Nov. 16
Nov. 18.	Moline, Ill	Nov. 16
Nov 19.	Auburn, Ind	Nov. 2
Nov. 19.	Jersey City, N. J	Nov 16
Nov. 19.	Milwaukee, Wis	Nov. 16
Nov. 20.	Philadelphia, Pa	Nov. 16
Nov. 20.	Durham, N. C	Nov. 2
	Adv., Eng. Record, Nov. 2 to 16.	
Nov. 22.	Winchester, Ind	Nov. 16
Nov. 23.	Alexandria, Ind	Nov 16
Nov. 23.	Canton, O	Nov. 9
Nov. 23.	Pittsburg, Pa	Nov. 16
Nov. 25.	Wabash Ind	Nov. 16
Nov. 26.	Pittsfield, Mass	Nov. 16
Nov. 28.	New Philadelphia, O	Nov. 16
Nov. 29.	Binghamton, N. Y	Nov. 9
Nov. 29.	Glenville, O	Nov. 9
Dec. 1.	Pasadena, Cal	Nov. 9
Dec. 6.	Chicago, Ill	Nov. 16
	Adv., Eng. Record, Nov. 16.	
——	Washington, Ia	Nov. 2
——	Pomona, Cal	Nov. 9
	BRIDGES.	
Nov. 18.	Kenosha, Wis	Nov. 16
Nov. 19.	Frederick, Md	Nov. 16
Nov. 20.	Bennington St. bridge, Boston, Mass	Nov. 9
Nov. 20.	Brooks St. bridge, Boston, Mass	Nov. 9
Nov. 20.	Philadelphia, Pa	Nov. 16
Nov. 23.	Pittsburg, Pa	Nov. 16
Nov. 25.	Maxtown, O	Nov. 9
Nov. 28.	Manassas, Va	Nov. 16
Nov. 30.	Cincinnati, O	Nov. 9
Dec. 7.	Greenfield, Ind	Nov. 16
Dec. 7.	Cincinnati, O	Nov. 16
Dec. 12.	Saginaw, Mich	Nov. 9
Dec. 14.	Melan arch bridge Des Moines, Ia	Nov. 9
	Adv., Eng. Record, Nov. 9, 16.	
Dec. 14.	Steel bridge Des Moines, Ia	Nov. 9
	Adv., Eng. Record, Nov. 9, 16.	
Dec. 16.	Boise, Idaho	Nov. 16
Jan. 8.	Victoria, B. C	Nov. 16
	Adv., Eng. Record, Nov. 16.	
Feb 28.	Sidney, N. S. W	June 22
	Adv., Eng. Record, June 22 to July 13.	
Sept. '02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Nov. 18.	Farmington, Conn	Nov. 16
Nov. 19.	East Chicago, Ind	Nov. 9
Nov. 19.	Kansas City, Mo	Nov. 16
Nov. 20.	Syracuse, N. Y	Nov. 16
Nov. 23.	Pittsburg, Pa	Nov. 16
Nov. 23.	Washington D. C	Nov. 9
	Adv., Eng. Record, Nov. 9.	
Nov. 23.	Portland, Ind	Nov. 16
Dec. 2.	Toledo, O	Nov. 9
Dec. 3.	Jeffersonville, Ind	Nov. 2
Dec. 3.	Trenton, N. J	Nov. 16
Dec. 5.	Sullivan, Ind	Nov. 16
Dec. 6.	Cincinnati, O	Nov. 16
	POWER, GAS AND ELECTRICITY.	
Nov. 18.	St. Albans, Vt	Nov. 16
Nov. 20.	Wiring post office, Kansas City, Mo	Nov. 2
	Adv., Eng. Record, Nov. 2.	
Nov. 20.	Columbia, S. C	Nov. 9
Nov 21.	Philadelphia, Pa	Nov. 9
Nov. 23	Zion City, Ill	Nov. 2
Nov. 25.	Wiring school, W. New Brighton, N. Y	Nov. 19
Nov. 26.	Lancaster, Pa	Nov. 9
Dec. 2.	Lemoore Cal	Nov. 2
Dec. 2.	Franchise, Whittier, Cal	Nov. 9
Dec. 10.	Wilmington, O	Nov. 9
Jan. 1.	Mt Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
——	Gas plant, Boonton, N. J	Nov. 9
	GOVERNMENT WORK.	
Nov. 18.	Boston, Mass	Nov. 2
Nov. 19.	Ft. Terry, N. Y	Oct. 19
	Adv., Eng. Record, Oct. 19 to Nov. 16.	
Nov. 20.	Ft. MacKenzie, Wyo	Oct. 26
Nov 20.	Wiring, Kansas City, Kan	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Nov. 20.	Bake house, Ft. Adams, R. I	Nov 9
Nov. 20.	Omaha, Neb	Nov 16
Nov. 21.	Savannah, Ga	Oct. 26
Nov. 21.	Mobile, Ala	Oct. 26
Nov. 22.	Sullivans Island, S. C	Oct. 26
Nov. 23.	San Francisco, Cal	Oct. 26
Nov. 23	Htg bldg., Philadelphia, Pa	Nov. 9
Nov. 23.	Ft Barrancas, Fla	Nov. 9
Nov. 25.	Cable, Washington, D C	Nov. 16
Nov. 26.	Ft. Ethan Allen, Vt	Nov. 16
	Adv., Eng Record, Nov. 16.	
Nov. 26.	Pawhuska, Okla. Ter	Nov. 9
Nov. 27.	Annapolis, Md	Oct. 26
Nov 28.	Ft. Sill, Okla. Ter	Nov. 9
Nov. 29.	Htg. and vent., Kansas City, Kan	Nov. 9
	Adv Eng. Record, Nov. 9, 16.	
Nov. 29.	San Francisco, Cal	Nov. 16
Nov. 30.	Slips, Norfolk, Va	Nov. 9
Nov 30.	Bldg., New York, N. Y	Nov. 9
Nov. 30.	San Francisco, Cal	Oct. 12
Nov. 30.	Ft Dady, Fla	Nov. 16
Dec. 2.	Htg. apparatus, Clinton, Ia	Oct. 19
	Adv., Eng. Record, Oct. 19, 26.	
Dec. 2.	Watertown, Mass	Nov. 16
Dec. 3.	Wiring, etc., Clinton, Ia	Oct. 19
	Adv., Eng. Record, Oct. 19 26.	
Dec. 3	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
Dec. 4.	Tampa, Fla	Nov. 9
Dec. 7.	Quay wall, San Francisco Cal	Nov 9
Dec 11.	Milwaukee, Wis	Nov. 2
	Adv., Eng. Record, Nov. 2, 9.	
Dec. 12.	Mobile, Ala	Nov. 16
Dec. 17.	Creston Ia	Nov. 9
	Adv., Eng. Record, Nov. 9, 16.	
Dec. 21.	Washington, D. C	Nov 9
Jan. 7.	Salem, Ore	Nov. 16
	Adv., Eng. Record, Nov. 16.	
	BUILDINGS.	
Nov. 18.	Court house plans, Ivanhoe, Minn	Nov. 16
Nov. 18.	School, Woonsocket, R. I	Nov. 16
Nov. 18.	Prison, Cantrall, Ill	Nov. 16
Nov 20.	Court house, Asheville, N. C	Nov. 2
Nov. 20.	Pub bldg., Toronto, Ont	Nov. 9
Nov. 21.	Excav. at library New York, N. Y	Nov. 9
Nov. 22.	Court house, Greenville, Ga	Oct 12
Nov. 22.	School improv., Chicago, Ill	Nov. 16
Nov. 25.	Jail, Natchitoches, La	Nov 16
Nov. 25.	School, Peekskill, N Y	Nov. 16
Nov. 26.	Court house plans, Washington, Ga	Nov. 16
Nov. 27.	Pub. bldgs., Ottawa, Ont	Nov 16
Nov 30.	Court house, Williamson, W. Va	Nov. 16
Nov. 30.	School, Washington, D. C	Nov. 16
Nov. 30.	Capitol plans, Harrisburg, Pa	Aug. 31
Nov. 30.	School plans, Oshkosh, Wis	Nov. 9
Nov. 30.	School chapel, Waco, Tex	Nov. 16
Nov. 30	School, Marquette, Mich	Nov. 16
Dec. 1.	School, Dickinson, N. D	Nov. 16
Dec. 1.	Library plans, Fresno, Cal	Oct. 26
Dec. 1.	Bus. bldg., Mobile, Ala	Nov. 9
Dec. 2.	Jail, Crockett, Cal	Nov. 9
Dec. 2.	Court House, Hazelhurst, Miss	Oct. 19
Dec. 2.	Library, Houston, Tex	Nov. 16
Dec. 3.	Church, Richford, Vt	Nov. 16
Dec. 20.	Court house, Des Moines, Ia	Nov. 16
	Adv., Eng. Record, Nov. 16	
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
——	Htg., etc., bank bldg., Saltillo, Mex	Nov. 9
	MISCELLANEOUS.	
Nov. 18.	Repairing garb crematory, Scranton, Pa	Nov. 16
Nov. 19.	Shed, New Orleans, La	Oct. 26
	Adv., Eng. Record, Oct. 26 to Nov. 16	
Nov. 19.	Garb., etc., removal, Jersey City, N. J.	Nov. 16
Nov. 25.	R. R tunnel, Philadelphia, Pa	Nov. 16
	Adv., Eng. Record, Nov. 16.	
Nov. 25.	El. Ry. power house, Tribes Hill, N. Y.	Nov. 9
Nov. 26.	El. Ry., Celina, O	Nov. 9
Dec. 31	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 9

THE ENGINEERING RECORD.

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Administration of Public Works in New York.

It has rarely happened that such an excellent opportunity is afforded for clean municipal government as was recently voted to Seth Low by the citizens of New York. In an election in which no party lines can be truthfully said to have been in any way prominent, he was chosen by an unexpectedly large majority. The overwhelming vote was an indication of the desire of the people for good government and of their confidence in the ability of Mr. Low and his associates to give it to them. Political themes are wholly outside the field of The Engineering Record, and its only purpose in referring to this municipal election is to point out that the men just chosen by such majorities are expected to accomplish works which only the highest ability can achieve. Mr. Low is experienced in the administration of public affairs, but he will find the mayoralty of Greater New York a much more difficult office than that of the city of Brooklyn, which he filled satisfactorily some years ago. The problems presented are far larger, much more numerous, and oftentimes the subject of conflicting claims by important interests. No one man can, by any possibility, personally grasp the details of administration of this great city. The mayor must depend on his advisers, and on his skill in selecting them hangs in no small measure the fate of his term of office.

Under the new charter which goes into force with the beginning of next year, the mayor will appoint commissioners of water supply, bridges, street cleaning, parks, police and fire. The streets, sewers and buildings will be under the borough presidents, officers elected by the people at the same time as the mayor, the old departments having charge of these works being abolished. Certain of these offices cannot be properly administered except by men of engineering ability. A railroad company which entrusted its bridges to a carpet dealer, its water supply to a butcher and the landscape work about its stations to a brewer, would be considered ripe for a receivership. Yet, by some queer mental kink or bias, the voters of a municipality are entirely content to see incompetent men placed in charge of the public works their money has built and for the maintenance of which they pay taxes. This is not only wrong as a waste of money, but it is wrong as interposing between the mayor and his real advisers a translucent screen in the shape of a man not really fitted to give advice.

The attention of Mr. Low is called to the fact that only when the water-works of New York were under commissioners of eminent engineering standing were there real improvements effected in the management of that department. Allan Campbell and John Newton were the two men who administered the water department best since the time of Tweed, and both were engineers. It can be shown by a diagram based on official figures, as was done by Mr. J. J. R. Croes in The Engineering Record of November 11, 1899, that the administration of the water department has been most satisfactory when most in accord with business principles, and the fundamental business principle is to put the management in the hands of a broad-gauge engineer. The street cleaning department of the city also needs a good executive engineer at its head, a man of the Waring type, with strong military instincts to bring the brigade of employees into an efficient and cheerful state. Here again, if Mr. Low will take the trouble to examine the records, he will find that the best results were attained by an engineer. If he will turn to the matter of bridges, a different condition will be noticed. Owing to the lack of engineering information by the commissioners in charge of the New York and Brooklyn Bridge, the inspection of that structure has been a farce, of a nature that would result in the immediate dismissal of the negligent official were the structure the property of a railway corporation. Because it belongs to a city, however, nothing is done, because the bridge commissioner knows nothing about bridges, and we may even expect shortly a statement that the management is all right because the bridge is still standing and is acknowledged by engineering critics to be as strong as ever. Such senile argument may pass with the public, but the commissioner the people of New York ought to have in charge of their bridges should be able to see the fallacy of such a plea.

There is an impression prevalent among business men that an engineer is not a business man and should not be entrusted with the supreme direction of affairs, such as falls to the lot of a commissioner of a great New York department. The experience of the city is to the contrary effect, as briefly mentioned above, and railway and manufacturing corporations are rapidly adopting this view. It is to be hoped that Mr. Low will come to a like opinion and appoint at least two engineers as heads of municipal departments, thus inaugurating on a small scale a policy which, if carried out with careful attention to the ability of the appointees, will mean a distinct advance in the administration of American municipal affairs.

The Exceeding Danger of allowing the public any option in the engineering features of municipal works was clearly indicated by the result of a recent special election in Sacramento. There were two suitable methods of obtaining a good supply—filtration or artesian wells. The authorities could not decide which was the better, and, after discussing the subject for a while, determined to allow the people to settle it. At the eleventh hour, in order to avoid any possible appearance of partiality one way or the other, it was foolishly resolved to let the people also vote on retaining the present river supply, full of polluting substances from the size of dead animals down. The usual result is recorded: 1,304 votes for filters, 1,568 for wells, and 1,872 for the river.

The Steam and Electrical Plant of the North American Building, Philadelphia.

The North American, the oldest paper published without intermission in the United States, was founded in 1771. In May, 1899, the publication was acquired by the present owner, and on that date it entered upon a new journalistic career demanding increased facilities, which resulted in the erection of the present building. The new structure of the North American is a typical modern office building twenty-one stories in height, with two stories of basements below grade line. The total height from foundation to roof is 296 feet, above grade line 256 feet, and the ground area covered is 76 x 104 feet. The reception rooms, the advertising and circulation departments and business offices of the paper are on the sixteenth floor; on the seventeenth, the editorial and art rooms of the Sunday edition and the library; on the eighteenth, the editorial and art departments of the daily; on the nineteenth, the composing room; on the twentieth, the engraving, plate making and electrotyping departments. Below the sixteenth floor are suites of offices, and in the basements are the press room, and the boilers, engines, dynamos and pumps.

The excavation for the foundations were carried to a depth of 40 feet below grade, a good gravel bottom having been found at about the level of low tide in the Delaware River. The entire ground space is overlaid with concrete from 5 to 15 feet in thickness, which was interlaced with heavy structural steel grillage under all walls and columns. All foundations for the engines are independent of the foundations for the walls and columns.

The limited ground area upon which the building has been erected made the problem of arranging the steam and electric apparatus somewhat difficult, and special work in the design of the foundations was required to prevent damage to the tall office building of the Real Estate & Trust Company on the adjoining property. Heavy arched brick foundation walls to support the Hoe sextuple presses, located in the basement above the engine room, were considered necessary by the press manufacturers, thus reducing the available floor area and head room and increasing the difficulties in the plant installation. The flywheels on the large engines clear the press supports by 1½ inches. The building is of the skeleton steel construction with floors composed of brick arches overlaid with concrete. The exterior facing is of brown Hummelsville sandstone, selected by the owner of the building.

The heating is derived from the exhaust steam of the engines and pumps. Circulation is maintained at low pressure by the Warren-Webster vacuum system, and the radiators are controlled automatically by thermostatic valves. Ventilation is secured where necessary by motor-driven fans. Cold air is forced into the engine room, which is located in the sub-basement.

The electrical plant was designed and now furnishes current for the following purposes:

(1) Power for distribution to various parts of the building to motors used to operate the Hoe presses, form hoist, coal conveyor, ash hoist, ventilation fans, refrigerating apparatus, linotype machines, boiler feed pumps and other machinery used in and about the printing offices. There are at present a total of 62 motors, requiring about 372 horse-power. Three more presses are contemplated in the future, which will increase the total motive power equipment to fully 520 horse-power.

(2) To supply 3,100 16-candle-power incandescent lights and 30 enclosed arc lamps for lighting and the photographic and etching process, and 2,240 8-candle-power incandescent

lamps for the electric sign erected on the roof of the building.

Steam is supplied to drive the elevator pumps, which operate five passenger elevators, one freight elevator, one sidewalk lift, one form hoist and two lifts for electrotypes.

Steam is also supplied to operate two Westinghouse air pumps used to furnish compressed air for the pneumatic tube service, operating elevator doors, pumping oil and printers' ink, and for cleaning generators, printing presses and other machinery.

The total maximum output at the generators required, should all the lights and motors in the building be used at one time, would be, at present, about 700 kilowatts, divided as follows: Motors, 342 kilowatts; incandescent lighting, 250; electric sign, 93, and arc lamps, 15 kilowatts. There are installed at present three generators giving a total output of 500 kilowatts or about 71 per cent. of the maximum. Eventually the total output required will be about 825 kilowatts, and provision is made for the installation of a new 200-kilowatt unit.

The present total horse-power of the engine is 750, or 559 kilowatts, with provision for an additional engine of 300 horse-power.

The boilers, which are of the water-tube type, were furnished by the Edge Moor Iron Works, and their capacity equals 1,200 horse-power, divided into four units, rated at 300 horse-power each, and set in two batteries. Each unit contains 121 4-inch tubes 16 feet long, laid eleven high and eleven wide. There are two 36-inch steam drums on each boiler, and the heating surface per unit is 2,800 square feet or 9 1/3 square feet per rated horse-power.

The dimensions of the space available, within which the boilers were required to be erected, are 20 feet 5 inches width, by 66 feet length by 19 feet height. Provision for fire room, flue connections, and passageways at rear and sides of boilers for cleaning, had to be made, so it is readily seen the boilers had necessarily to be limited in their dimensions.

The ratio of grate area to heating surface specified was forty-six, somewhat higher than is usual with the fuel employed, which is chestnut anthracite, the object being to obtain extra evaporation when necessary and also to provide against poor quality of coal. McClave shaking grates are used. The settings are built of No. 1 red brick with 20-inch external and 24-inch division walls. The furnace walls are lined with fire-brick walls 9 inches thick to a point 3 feet in the rear of the bridge wall and 4 feet above the grate base line. The remaining space in the combustion chamber is lined with a 4-inch fire-brick wall. Extra precautions were taken to reduce the temperature of the boiler-room. The 20-inch external walls are laid up as follows: First, the fire-brick lining; second, a 4-inch wall of No. 1 hard brick, hollow; third, 1 inch of asbestos cement; fourth, an outside facing of No. 1 hard brick stretchers, hollow. All the red brick are tied through the asbestos cement by galvanized wire ties laid in alternate courses. The walls are carried up from the floor to the ceiling and the fronts are also lined with asbestos to reduce the temperature. The steam drums are also covered with asbestos 1½ inches thick. The boilers are fitted with double 2½-inch blow-off valves of the Fairbanks pattern, the 3-inch blow-off piping leading to a blow-off tank, constructed of ⅜-inch boiler plates, 12 feet long and 5 feet wide, which is located beneath the boilers. This tank was tested to 225 pounds hydrostatic pressure before setting. It is drained into the bilge tank under the engine room by means of a 3½-inch syphon and is fitted with a 4-inch vent pipe carried to the roof line. The boilers are designed to carry 135 pounds steam pressure, and the builders were required to furnish a certificate from the Hartford Steam Boiler Inspection & Insurance Company that the boilers would work safely at 150 pounds. The boilers are operated under natural draft and are hand fired. The main flue is below the boiler room floor, parallel with the length of the boilers for the length of the fire room, thence making a right angle turn at an easy curve and following a varying grade to avoid obstructions of foundations. The full area is maintained by varying the rectangular dimensions to the base of the chimney. The chimney is of steel plate lined with brick; the internal diameter is 5 feet 9 inches and the height 300 feet. The draft is controlled by an automatic damper regulator, operating a large damper in the main flue. The ash pits are suspended hoppers of heavy steel plates, lined with fire brick and having a vizor gate opened by segment gears for discharging the contents to substantial ash cans. These receptacles are lifted to the sidewalk on an electric ash hoist; the work is done quickly and economically.

The coal storage space is limited, but a bin capacity of about 75 tons has been realized, or sufficient for about five days' supply. The coal conveying and ash handling machinery was installed by the Link Belt Engineering Company. The coal is dumped from the sidewalk into a storage hopper, located under the sidewalk, from there is conveyed to a bin above, and also to a hopper on the boiler room floor by a spiral coal carrier, and then shoveled to the boilers.

The water supply of the building is derived from the city mains through two 4½-inch pipes and thence through two Loomis-Manning filters to a pressure tank. The boiler feed is taken from the pressure tanks, passes through a Webster vacuum heater and is pumped to the boilers at a temperature of 210 degrees Fahr. There are three boiler feed pumps, each capable of delivering at normal speed 2,000 gallons per hour. One pump is of the Worthington duplex pattern, with cylinders 7½ and 4½ by 10 inches; two are of the Worthington vertical triplex type with cylinders 5 inches in diameter and of 6 inches stroke, driven by two Crocker-Wheeler motors. The pumps are fitted with bronze plungers and bronze-lined cylinders and glands.

Flanged wrought iron steam piping is used for all sizes over 2½ inches, and the piping was tested for 225 pounds pressure. Gate valves are used on all pipe over 2½ inches in diameter, and globe valves on the smaller sizes, and all valves were required to stand an hydraulic test of 250 pounds per square inch. All steam valves of 6 inches and over are by-passed. The main steam pipes leading to the engines are laid in brick troughs below the engine room floor and are protected against radiation and condensation by an extra heavy non-conducting covering. Combined separators and receivers are provided for each engine and by means of the necessary valves any or all the boilers may be used for any engine. Copper bends are used in main steam pipe and exhaust pipe, and all piping is carried on expansion rollers or iron hangers with adjustable suspension clamps. The live steam condensation from each separator is discharged to the heater by an independent trap for each separator. A complete system of drip piping is installed and drips are connected from all T's, crosses, valves, bends and dead ends where pockets are liable to occur. The live steam drips are separated from the exhaust drips and are discharged into the heater by an automatic pump and receiver of 35 gallons capacity through the main drip pipes to which the subsidiary drips are attached. The exhaust drips are drained to a bilge tank located under the engine room floor. This tank is 5 x 9 feet, inside dimensions, and constructed of ⅜-inch boiler plate with head and bottom of ½-inch plate. This tank is fitted for connecting drips, drain vent and discharge pipes, with manhole to admit for cleaning out. As before mentioned, the water from the blow-off tank is syphoned to the bilge tank, and as the bilge tank is below the level of the sewer, its contents are pumped to the sewer by a Worthington duplex pump with a capacity of 75 gallons per minute. A duplicate bilge pump is also installed for use in the event of injury to the first pump. Both pumps are brass fitted. The exhaust from all engines and pumps is conveyed through a line of piping laid below the floor to the Webster heater. During warm weather the exhaust steam is discharged to the atmosphere through a vertical spiral riveted exhaust pipe, leading to the roof, and during the cold season the exhaust steam is used for heating the building as described. The back pressure valve is located at the top of the exhaust piping. The piping is by-passed around heater, so that all or any portion of the steam may be used for heating feed water.

The engines, constructed by the Southwark Foundry & Machine Company, are of the well-known Porter-Allen side-crank, single-cylinder, flywheel type. A sub-base extension is provided, fitted to receive direct-connected, direct-current, slow-speed generators. The engines are equipped with oil guards and have Porter-Allen governors. The engines are all rated at one-quarter cut-off, with dry steam delivered at 120 pounds and an estimated back pressure of 5 pounds per square inch. There are at present installed three engines as previously stated. The two 300-horse-power units have cylinders 18 inches in diameter and 30 inches stroke, and operate at 174 revolutions per minute. The 150-horse-power unit has a cylinder of 15 inches diameter and 16 inches stroke, and a speed of 250 revolutions per minute. The balance wheels are designed with a factor of safety of ten when speeded to 50 per cent. in excess of their normal velocity. The engines are required to govern within 1½ per cent. between no load and maximum overload with a variation of 10 pounds below or 10 pounds above the normal steam pressure of 120 pounds. The generators are of the multipolar type, manufactured by the Crocker-Wheeler Company. As before mentioned, there are two units of 200 kilowatts capacity, each direct-connected to one of the 300-horse-power engines and one 100-kilowatt machine connected to the 150-horse-power engine. The generators operate at 220 volts and have the field windings over-compounded for automatic regulation, to compensate for the loss in the system of distribution; they are connected to work independently or in multiple, as required. The field frame for each generator is fitted and mounted on the extension base of the engine, and, because of the limited head room, is divided vertically to open on a horizontal plane at right angles to the shaft, giving convenient access for repairs to the field coils and armature windings. The armatures are of the iron-clad type and the insulation of all windings of field and armature was tested with an alternating current ten times the voltage of the normal current at overload.

The following sections are taken from the generator specifications:

> The area of brush contact must be ample to carry full load 24 hours and overload as specified, without excessive tension on pressure springs and absolutely without spark or glow at the commutator under any variation of load or E.M.F.
>
> Commutators shall be constructed from the best quality of hard rolled and forged copper, built up with mica spacings and insulation throughout.
>
> The commutators shall be of ample diameter and width to allow ample area for brush contact and use of carbon brushes. The commutators must work without spark or glow at the brushes under

any change of load or E.M.F. required by these specifications.

Rheostats.—Each generator shall be furnished with a Carpenter enamel or any other equally compact and efficient rheostat, arranged and fitted for mounting on the rear side of 1½-inch marble panel, only the handle and dial being visible from the front. Exposed portions to be nickel plated. Each shall be capable of reducing the volts of its generator by steps of one-half volt or less, under any condition of load between no load and maximum overload under the conditions stated in these specifications.

The maximum rise of temperature of any portion of the rheostats under any conditions of commercial operation shall not exceed 60 degrees C. above surrounding atmosphere.

Cables and Electrical Connections.—The contractor shall furnish and install through conduits below the floor all cable and connecting lugs, to make complete all connections to deliver the current of each generator to the switchboard, also all cables and connecting lugs between rheostats and fields of generators. The cables must be stranded, very flexible, have rubber insulation and lead covering, best Lake copper 98 per cent. conductivity, the sectional area to be 1,200 cir. mils per ampere at maximum overload.

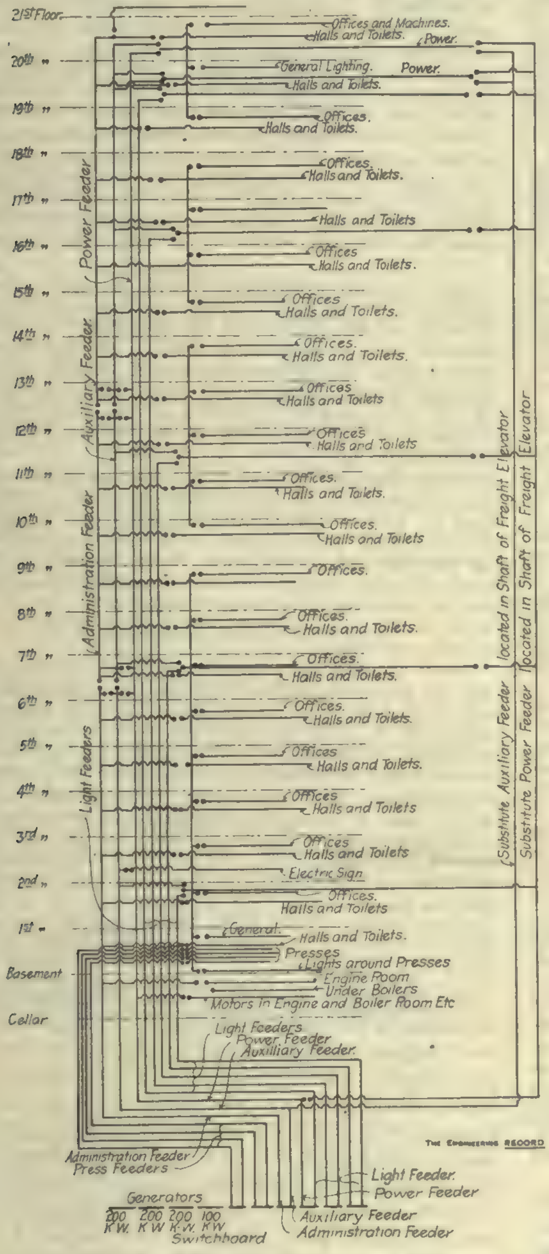


DIAGRAM OF LIGHTING AND POWER FEEDERS.

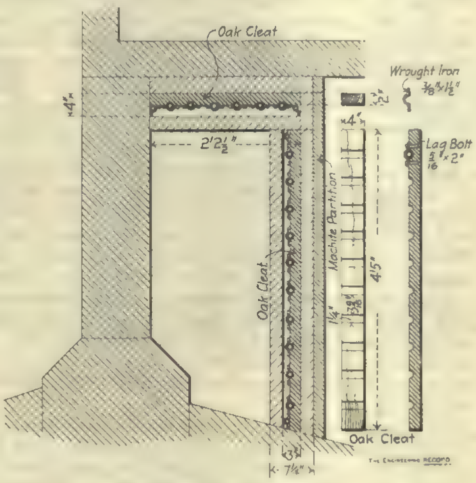
The lugs must be of best composition metal, high conductivity, large size, cables to be soldered in socket; contact surfaces to be extra large, accurately faced and double bolted. There must be no heating at any point of this work.

Non-sparking.—Each generator must run absolutely non-sparking at the brushes and commutator under any variation of voltage and under any condition of load or overload and without shifting of the brushes; the carbon brushes must not glow in the slightest degree.

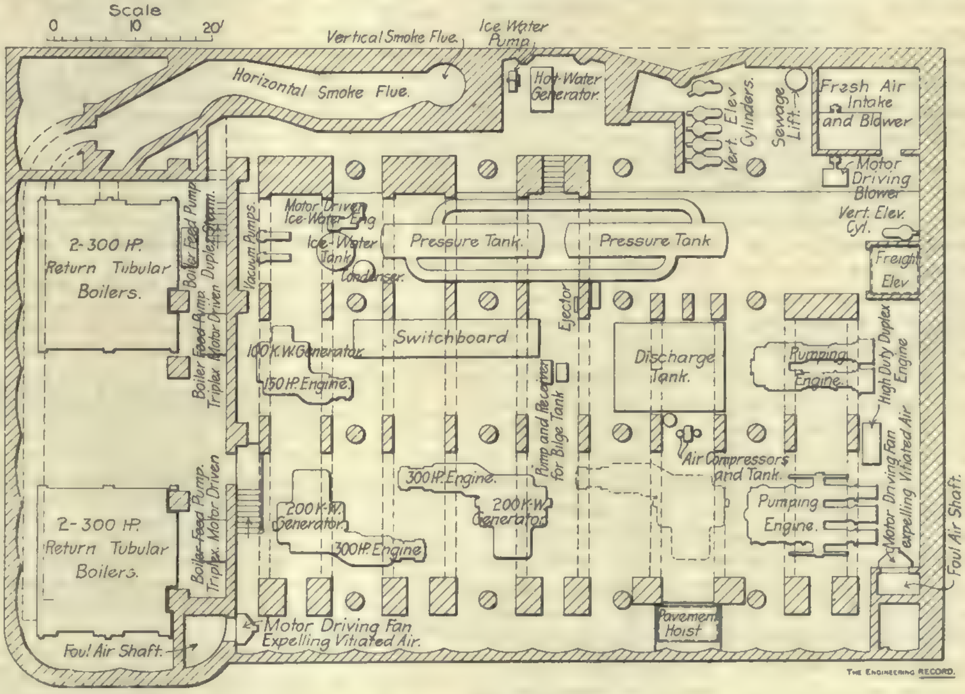
Capacity.—Each generator shall in every respect be constructed for and guaranteed to carry its full rated load for continuous runs of 24 hours per day, and the rise of temperature on armature or fields of any machine shall not exceed 40 degrees C. after a continuous run of 12 hours at full rated current, voltage and speed, and immediately succeeding this 12 hours' test each machine must be capable of carrying 25 per cent overload for 2 hours and during this latter overload test shall not on armature or fields show a rise in temperature exceeding 45 degrees C. above the surrounding atmosphere, and allowance of 10 degrees extra will be made for commutator temperature.

Each generator shall be capable of carrying an overload of 50 per cent for 30 minutes and a momentary overload of 75 per cent. at any time during its 24 hours' use under conditions of regular service; the rise of temperature under either of these overload conditions shall not exceed 50 degrees C. above surrounding atmosphere, allowing 10 degrees C. excess for commutator temperature.

Regulation.—These generators shall be fitted with compound field winding for automatic regulation, the shunt coils and series coils to be wound on separate spools. The machines to be over compounded to compensate for loss in the system of distribution, the series fields being adjustable, and when the machines are started to be adjusted for a loss of 3 per cent. at a maximum load.



PLAN OF WIRE WELL.



PLAN OF ENGINE AND BOILER ROOMS.

The regulation shall compensate to maintain a uniform E.M.F. at the lamps under any and all variations in load from ¼ load to 25 per cent. overload. All generators shall successfully operate in multiple arc with each other under all loads and overloads for variations thereof as may be required by the daily service from this installation.

Guarantee of Efficiency.—When the contractor submits his proposal he shall state therein the commercial efficiency which he guarantees on each generator and which shall not be less than the following, viz.:

Percentage of efficiency.

Loading	¼	½	¾	full	25% over
100 Kw.	84	90	92	93	92
200 Kw.	85	92	93	93½	93

The commercial efficiency shall be based upon a mechanical efficiency of 100 per cent., excluding air losses and friction.

Testing.—Guarantees of efficiency, regulation, heating and insulation shall be proven by tests under the following conditions:

All tests to be made in the presence of the engineers of the purchaser and the contractor, and in the shops of the contractor as far as practicable, but final tests to be made after the plant is erected on the premises of the purchaser.

All instruments required for the test shall be furnished and set up by the contractor (without extra cost to the purchaser) and shall be correctly calibrated to agree with accepted standards.

The purchaser shall provide the load and motive power for test on his premises.

The electric energy generated at the dynamos is conducted to the switchboard by lead-covered, rubber-insulated copper cables laid in vitrified conduits below the engine-room floor. The switchboard is erected within convenient working distance of the generators. The switchboard frame is of structural steel angles and channels bolted and riveted together. The panels of the switchboard are of Vermont marble slabs, 1½ inches in thickness, and having a ⅜-inch bevel around the face corners, polished on both sides and all edges and bevels. There are four generator panels, and six feeder panels, the instruments for two feeders being mounted on each panel. The rear of the switchboard is protected by a substantial iron frame and grille work, with a door at each end affording convenient access to the rear passage, 5½ feet wide, for inspection and cleaning of the electrical conductors, connections and apparatus. Each generator panel is fitted with a pilot lamp, a Thomson recording wattmeter and General Electric astatic voltmeter and ammeter; a double-pole, quick-break, double-throw, knife-blade switch and automatic circuit breaker; rheostat and enclosed safety fuses. Each feeder panel is fitted with an ammeter, recording wattmeter, double-pole, automatic circuit breaker, double-pole, double-throw, quick-break switch, and double-pole, enclosed safety fuses. In an installation for this kind of service the circuit breaker on each feeder is found very useful and satisfactory by the operatives. The switchboard is equipped with a double set of bus-bars for the generators, a bus for motive power feeders, and one for lighting feeders, the double-throw switches previously mentioned making it convenient to use one or more generators for the motive power or for lighting independent of each other. The arrangement for recording watt-meters affords facilities for keeping an accurate record of the electric energy manufactured by each generator; also to separate the accounts of current used for lighting and for motive power. The switchboard was installed by the General Incandescent Arc Light Company, which also furnished all flush push-button switches, receptacles, outlet boxes, panel boards and distribution panels.

A unique feature is the signal board in the office of the superintendent of the building in the third story. This is similar in construction to the usual switchboards. The panels are Vermont marble. On this are located the following indicating instruments with wires or pipes connecting between the several initial sources and the instruments: Glass water column indicators to show the position of each elevator; mercury columns to show water pressure for moving elevators; mechanical counters to indicate the number of trips made by each elevator; glass water column indicators to show the water in storage tanks; mercury column steam gauges to indicate steam pressure, and recording steam gauges to show variations of pressure of live steam, and steam heating systems; recording ammeters to show amounts and variations of current used and recording volt-meters to indicate electromotive force. A thermometer indicates the temperature of the drinking water, which is purified, refrigerated and circulated as described later.

The wiring of the building is for 220 volts on the two-wire system. The height of the building and the large amount of current required to supply the several departments with current for lighting and motive power, demanded an effort to exercise an unusual economy in copper as well as to obtain a system of electrical distribution possessing such subdivisions as would readily give the essential elements of flexibility of manipulation and reliability of service. The feeder system consists of a motive power feeder from the switchboard to the twentieth floor; five feeders for the lighting system to offices; one feeder for lighting of halls, corridors, stairs, toilets; five feeders, one to each of the printing presses; also two auxiliary feeders from switchboard to twentieth floor, these paralleling each of the previously mentioned feeders; by the use of double-pole, double-throw switches at branch-off connections, either of these auxiliary feeders may be utilized as a substitute for either of the lighting feeders, for the motive-power feeder, or may reinforce any or all of the feeders as occasion requires. The floors are grouped on five sets of vertical mains for electric lighting. Each vertical main is supplied with current by the feeder leading from the respective feeder panel on the switchboard, and through the wire shaft to the center of distribution of the vertical main. At the switchboard panel there is a double-pole, quick-break switch, an automatic circuit-breaker and a pair of enclosed safety fuses, and at the extreme end of the feeder, a double-throw, quick-break switch is provided so that in the event of its feeder being out of order the load of this section of the building can be quickly transferred to the auxiliary feeder. The electrical distribution for each floor is obtained by a system of enameled iron conduits, through which are drawn stranded copper conductors furnished by the Standard Underground Cable Company, each conductor being insulated with rubber insulation protected by heavy braiding. On each floor there are located at convenient points distributing panels of Vermont marble, each enclosed in a heavy sheet steel box, with the sides, top and bottom lined with Vermont marble. A bevel plate glass front in a metal door frame, with lock and key, protects the panel. All of the switches and conductors in the panel boxes are of highly polished copper insulated with Sterling transparent varnish, excepting at the contact parts, where the metal has a carefully faced contact surface.

The different offices are fitted with electroliers, side brackets and numerous receptacles for attaching desk lamps. The electroliers are controlled by push button switches set flush with the surface of the wall.

Extracts from the wiring specifications follow:

Feeders and vertical mains with insulation double coated vulcanized red core rubber, heavily braided and waxed. For all secondary mains and lateral branches the insulation shall be red core double coated vulcanized rubber, heavily braided and waxed. All rubber insulated conductors shall be tinned.

Copper.—The copper wire shall be soft drawn exactly to gauge from the best Lake Superior bars having a guaranteed conductivity of 98 per cent. of that of the chemically pure copper, according to Dr. Mattiesson's standard, and where rubber insulation is used wire shall be tinned. All conductors shall be stranded where the sizes exceed 15,000 cir. mils.

Contractors shall submit for the architect's inspection and selection samples of insulated wire properly labeled for identification.

Splicing and Connections.—All conductors must be in continuous lengths from box to box without splicing. Tinned copper or composition sleeves with branch-off shall be used for all connections on large cables and MacIntire joints on smaller conductors, every joint must be thoroughly soldered and thoroughly sweated and all surplus solder and fluid must be wiped off clean and dry. Terminals of stranded conductors must be soldered. The insulation must be restored by the best grade of rubber tape put on warm and pressed firmly around the conductor.

The conduit system must be continuous from one junction box to another and to fixtures, and the conduit tube must be properly screwed into all fittings; also must be first installed as a complete conduit system, without the conductors.

A galvanized pulling wire shall be drawn through each duct as laid, of sufficient strength to draw in the copper conductor.

After conductors are introduced the conduits must have all outlets plugged with special wood or fibrous plugs, made in parts, and the outlet then sealed with approved compound. Joints must be made air tight and moisture proof.

The metal of the conduit shall be permanently and effectually grounded. All elbows, fittings, pulling in and junction boxes, couplings, etc., necessary for the complete installation of the conduit system must be such as are designed specially for this purpose.

All conduit tubes shall be securely held in place by substantial wrought iron staples, or heavy iron straps, and shall throughout the system be as securely fastened as gas and water pipes would be.

Insulation Test.—Each individual length of each feeder, main, lateral branch or top line from connection to connection on panel board and without interposition of fuses and switches shall show under test between parallel conductors and between each conductor and ground an insulation resistance of 500,000 ohms. The total insulation resistance of the entire system fully and completely connected up shall not be less than 100,000 ohms. The tests to be made by accurately calibrated instruments in the presence of the architect or his representative.

The electrical conductors leading to the motors on the numerous machines are fully protected by flexible armored conduit, which admirably serves the purpose, its flexibility permitting of close fitting to the frames of the machines. In most instances the starting and regulating devices to control the individual motors are attached to the machines at a convenient point. The peculiar requirements of each class of machine were necessarily worked out to obtain the successful individual application of the motor and its method of regulation.

The chief parts of the motor specifications follow:

Motor Capacities.—Each motor furnished by the contractor must be capable of carrying the full rated load for 24 hours and an overload of 25 per cent. for 1 hour at the end of the 24 hours' run at full load, and at any time during the 24 hours' run at full load an overload of 40 per cent. for a half hour. During any of these tests, each and every motor must work absolutely sparkless at the brushes and commutator, and at the end of any test shall not show a rise of temperature exceeding 45 degrees C. above the surrounding atmosphere.

Mechanical Characteristics.—All parts of similar size machines to be made to standard gauges, and interchangeable for repairs and renewals.

The motors must work silently, and be of compact and neat design, strong rigid construction, all to be of the partially enclosed type fully protected from mechanical injury, but with ample ventilation. Laminated pole pieces, laminated and slotted armature, stout shafts, liberal bearings, self-oiling and self-aligning.

The best of materials and first class workmanship and finish throughout.

Electrical Characteristics.—Field and armature windings to be machine formed and wound coils as far as practicable; insulation must withstand ten times the working E.M.F. when tested hot after 12 hours' run at full load. Copper-coated carbon brushes with cable terminals for each carbon; brush holders large, strong and substantial, and of ample conductivity; commutators of large size for ample brush area and contact and made of best quality hard forged copper, mica insulation throughout. Commutators must operate without spark under all variations of load without shifting brushes, from no load to maximum overload and without glowing at the carbon brushes.

The motors shall be arranged for such variations of speed and such continued service at different speeds as the character of the work may require from the different machines to which they are connected.

Tests of Motors.—Tests required to prove the fulfillment of the contract and specifications shall be made at the request of the purchaser in the presence of an engineer appointed by the purchaser; also an engineer appointed by the contractor. All instruments and connections required for the tests shall be furnished by the contractor, calibrated to standards and to the satisfaction of both parties.

Motors shall be rejected which do not fulfill all the requirements of commercial operating conditions as well as the specified requirements of capacity, heating limits under load, sparkless working brushes and commutator, silent operation, or which in any respect prove unsatisfactory, and such rejected motors must be replaced at the expense of the contractor by other motors selected by the purchaser.

Motors for Linotype Machines.—There will be 20 linotype machines, each of which shall be furnished and fitted with a motor of about 1/3 horse-power connected to drive the machine by a worm gear reduction. Each motor to be substantially secured to the frame of the machine and must have speed controllers so arranged to set at eight different speeds from 60 to 85 and locked at any set speed, so operator cannot change it. Also regular starting box to start and stop the machines to successfully meet all requirements and conditions of the service.

Each motor must be made to operate in a perfectly satisfactory manner in every particular before it is accepted.

The passenger elevators were furnished by McAdams & Cartwright, of New York, and have steel frames which travel at a speed of 800 feet per minute. The hydraulic power for the elevators is supplied by two duplex pumping engines, one of the Laidlaw-Dunn-Gordon make, size of cylinders 20 x 8⅝ x 24 inches, and one of the Worthington compound duplex type 30 x 17½ x 24 inches, each capable of carrying the entire elevator load. There is also installed a Worthington compound duplex high-pressure pump for lifting heavy loads on the freight elevator. The cylinders of the elevators are of the vertical type. The pressure and discharge tanks are in the cellar. A pair of hydraulic elevators serve to convey the electrotypes between the press room in the basement and the electrotype room on the twentieth floor. About eight tons of electrotype metal are transferred daily in this manner. These elevators have a speed of 600 feet per minute.

There are also installed two single-acting sewer pumps with cylinders 8 and 10 by 12 inches, one Worthington duplex house service pump with cylinders 12 and 8½ by 12 inches, a fire pump of 750 gallons capacity at a pressure of 120 pounds, two oil pumps of the Worthington duplex type, size 3 and 2 by 3 inches, and the ink pumps.

The water storage tanks located on the twenty-first floor have a capacity of 75,000 gallons. All water for house supply is pumped to these tanks. Because of the basement being some fifteen feet below the sewers, the house drainage system is divided; that part above the sewer line is connected direct to the street sewers and the part below the sewer discharges into a tank which is emptied by an Adams sewage lift discharging into city sewers.

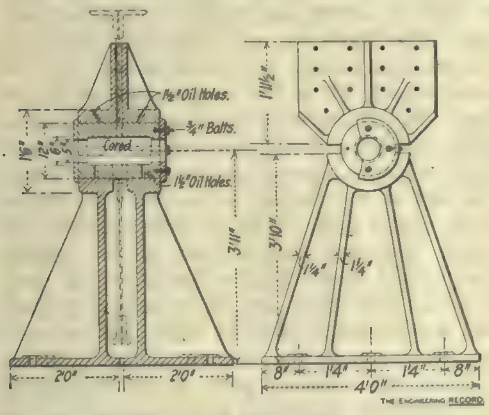
The drinking water is first filtered and then refrigerated by the use of a small ammonia tank and Remington ice machine driven by an electric motor, through which the water can be reduced to and maintained at a temperature between 25 and 50 degrees Fahr. After refrigeration the water is maintained in constant circulation through a separate system of piping by a small pump in series with the circulating pipes. Cold water faucets are located over each wash basin in the offices on each floor. This system is economical and saves the great annoyances caused by the use of individual water coolers and the daily supply of ice to individual tenants of offices.

The temperature of the fresh and refrigerated water is indicated by thermometers at suitable points.

Mr. James H. Windrim was the architect of the building, and the builders were Messrs. Doyle & Doak. The engineers were Mr. J. H. Vail for the steam, electrical and mechanical equipments, and Mr. Henry Adams for heating and ventilation. The steam, electrical and mechanical equipment was erected under the supervision of Mr. B. B. Hough, superintendent of the building.

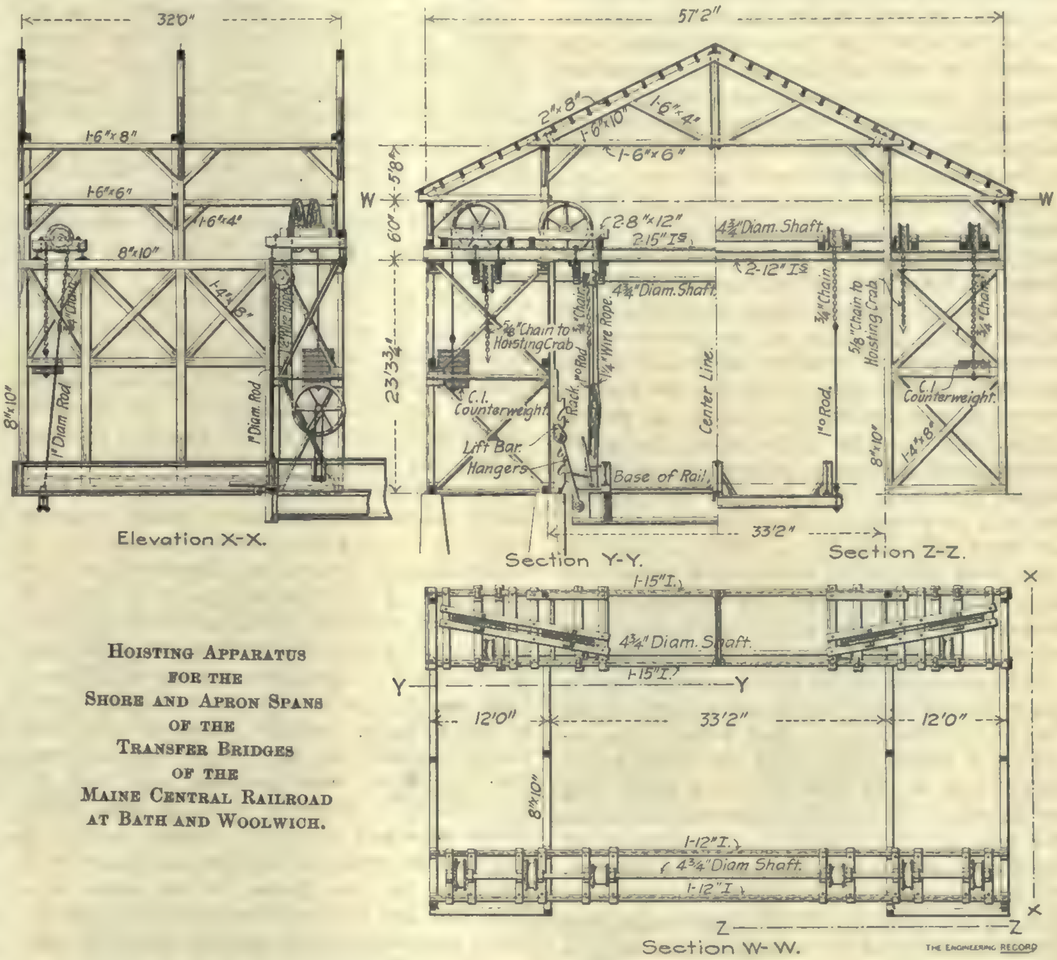
A Railroad Ferry Transfer.

The transfer bridge and ferry slips of the Maine Central Railroad provide for ferrying trains across the Kennebec River, between Bath and Woolwich. As the height of the tides at this point is about 9 feet, the total extreme rise and fall, after allowing for variation of draught of the boats, is 11 feet. Both landings are in exposed situations, where the depth of water is 30 to 40 feet at high tide at the ends of the slips, and subject to heavy ice floes. Where the bottom was of such a character that piles could be used, the ordinary methods were used for the racks and fenders, but for most of the work the bottom was of rock or material unsuitable for piling, and the slips were made by cribwork.

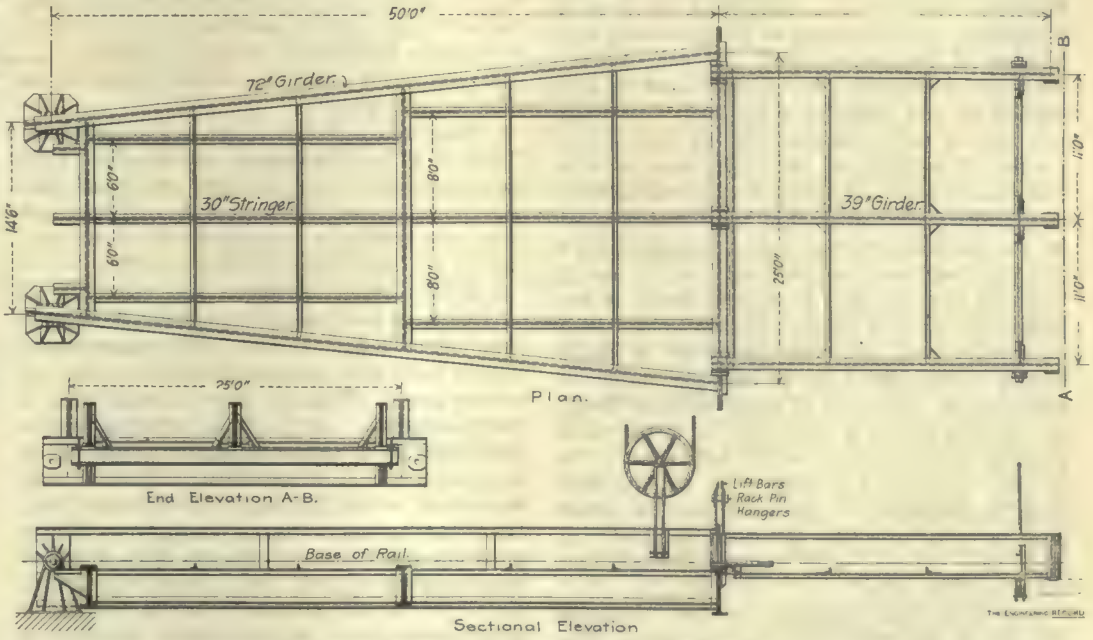


Pedestal of Shore Span.

On the slip side of these cribs a flexible fender rack, to take the impact of the boats, was built out beyond the line of the cribs. These fender racks were formed of vertical round timbers, longitudinal string pieces and vertical planking, similar to the ordinary pile rack. The lower ends of the vertical timbers were fitted into timber sockets formed by projecting three rows of the cross timbers beyond the face of the cribs and bolting longitudinal timbers to them. The ends of the vertical sticks were slightly tapered, so that in case of breaking or becoming worn they could be pulled out and renewed. About mean-tide level, where the guards would strike the racks, a series of longitudinal timbers, made "spring" fashion, was placed between the rack and the crib. At the top the racks were braced by sloping timbers, as shown. It was considered best at the time to make the cribs of squared timber.



Hoisting Apparatus for the Shore and Apron Spans of the Transfer Bridges of the Maine Central Railroad at Bath and Woolwich.



Transfer Bridge of Maine Central Railroad.

The transfer bridges are each formed of a shore span 50 feet long, hinged at the inner end, and an apron span, 25 feet long, hinged at the outer end of the longer span. As the boats were fitted for two tracks, and the trains would move on to the boats from a single track, it was decided to save weight by making the shore spans tapering. Each span is suspended at the outer ends and counterweighted. Before any load is run on the bridge the heavier shore span is hooked up by means of heavy links engaging the toothed racks at the sides. There are four positions in which this span can be rigidly sustained, leaving the slighter changes of the tide to be cared for by the apron span. The changes of the longer span are readily made between the trips of the boats.

The tracks are laid between the main girders and below their top chords in both spans. In the long span the ties are laid on the top flanges of three lines of longitudinal stringers, which are web-connected to the three transverse girders, and are seen in the sectional elevation in front of the main girder, with their lower chords just above its bottom flange. In the short span there are no cross girders, and the three longitudinal ones are braced together by transverse angles and the 15-inch carrying beam under the outer end. The lower-chord angles of these girders are reversed, and their horizontal flanges are used as shelves to receive the ends of the ties. The 50-foot girders each have a 72 x ⅜-inch web and four 6 x 6 x ⅞-inch chord angles. The two shorter cross girders have 36 x ⅜-inch webs, and the long one has a 42 x ⅜-inch web, all of them having 6 x 6-inch chord angles. The short-span main girders each have a 39 x ⅜-inch web and four 5 x 3½ x ⅝-inch chord angles. The shore ends of the 25-foot girders are made with a 10½-inch drop and are seated directly on top of the end cross girder of the long span. They are attached to it by two horizontal 1-inch bolts through its web and through the outstanding flanges of short vertical angles, riveted to their webs at the shoulder. These bolts prevent longitudinal displacement and permit the revolution of the girders through a small arc.

Each of the 50-foot girders is hinged at the shore end to a cast-iron pedestal about 4 feet high, which is made in two separate pieces, as shown in the detail, so as to receive the end of the girder between them, as indicated by dotted lines. The tops of the pedestals are concave to receive the hollow 12-inch pivot pin, the upper side of which takes the two bearing pieces which are riveted to the web of the girder.

The different parts of the hinge are locked together, and the pin is secured against longitudinal movement by a shoulder cast on one end, and by a corresponding disk tap-bolted to the other end. The pin is prevented from revolving on its axis by two ½-inch radial stud bolts, which project from its surface in the clearance between the girder bearing and the top of the pedestal.

The suspension of the girders and the mechanism for adjusting them are shown in the plan and sections of the dock house. The apparatus is symmetrical about the center longitudinal line of the plan, and half views only are shown of the plan and transverse sections. The plan at WW shows the arrangement of the shafts, drums, and counterweight sheaves. The elevation at ZZ shows the main suspension, that for the outer end of the 50-foot span, and the arrangement of the counterweight and adjustment drums on the shaft from which it is suspended. The elevation at YY shows the suspension of the 50-foot span. At each end of its outer cross-girder, the 50-foot span is suspended by two parts of a 1¼-inch wire rope, one end of which is fixed to the head-house beams. The bight of the rope engages a 5-foot sheave which is yoked to the cross-girder, and the free end passes over two 5-foot sheaves in the head-house roof and is attached to a cast-iron sectional counterweight which nearly balances the bridge. A ¾-inch chain is attached to the end of each girder by a 1-inch connecting rod, and the other end is made fast to a drum keyed to the hoisting shaft. At each end of this shaft is keyed another drum, on which is wound a chain leading to the main hoisting drum, which raises and lowers the 50-foot span. The 25-foot span can be lowered to the deck of the ferry boat or lifted clear of it by operating the hand windlasses at each side, the chains of which are made fast to the middle drum.

The work was designed by Mr. Theodore Cooper, M. Am. Soc. C. E., for the Maine Central Railroad Company, which built the ferry houses and slips. The transfer bridges and hoisting apparatus were built by the Passaic Rolling Mill Company, Mr. G. H. Blakely, M. Am. Soc. C. E., chief engineer.

Lehigh University will offer a new and extended course in electro-metallurgy next fall, which is believed to be the first of its kind established in the country.

An Austrian Investigation of Masonry Piers.

In 1897 the Austrian Society of Engineers and Architects appointed a committee of its prominent members to test the compressive resistance of masonry in large blocks and also to determine the strength of various floors. The tests on the compressive resistance of masonry have been completed, and the full report on them has been recently published. The following is an abstract of its technical part:

The famous tests on arches, made on an extensive scale by the Austrian Society, the report on which was published in 1895, have shown that the design and computation of masonry arches should be based on the theory of the elastic arch. But the second essential requirement of a correct design was still unfulfilled; namely, definite data as to the compressive resistance of masonry made up of stone and mortar. Only by the aid of these data are we enabled to determine the degree of safety a structure will have under given conditions. Owing to the scope of the tests under review and the great variety of materials employed in them the problem will be solved but very incompletely, but this investigation will certainly extend our knowledge in this direction and may become the incentive for further tests.

It was decided to test the following materials: Single granite and sandstone blocks; masonry blocks built of quarry-stones (sandstone), of ashlar masonry (granite and sandstone), of concrete, and of concrete reinforced by steel, of pier-bricks, ordinary bricks, and finally, of hollow bricks. Several proportions of mortar and of concrete were proposed for tests at different ages, and tests were to be made under central as well as under eccentric pressures. For each kind of masonry and each proportion of mortar two test prisms were proposed, and their dimensions were generally fixed at about 20x20 inches base and about 40 inches height. It was thought desirable to approach practice in preparing the test pieces in sets made with great care and sets made with less care, but the small number of tests and the practical difficulty of the proposition for comparatively small blocks did not favor it, and the tests were made on masonry supposed to be built carefully.

In Figures 1 to 5 are shown types of the different specimens:

1. Single block, Figure 1, and ashlar masonry, Figure 2, of hard sandstone and granite. Both horizontal sides were polished to planes parallel to each other. The joints were ¾ inch and filled with mortar in the proportion of one volume of Portland cement to two of sand.

2. Broken stone masonry was made up of sandstone laid on its bed in mortar in proportions of 1 : 2 and 1 : 3½. The specimens of type A were built in strong wooden boxes, all in one piece. Those of type B were built in two operations. First, three artificial blocks were made up of stones in smaller boxes, using the above mortar proportions. These blocks were then left to harden for a month's time. After that period the three blocks were laid to make up specimens of type B. The joints of this composite block were again filled with mortar of the proportion 1 : 2. The series of tests characteristic of type B was intended to show the behavior of artificial blocks as they have been prepared for long-span arches in the report on arches. In making up the specimen blocks the wooden boxes were first leveled up carefully on a layer of sand and set vertically, and the laying of stones was begun with a good mortar bed. The stones were set against the walls, and the top was leveled off with a layer of cement. Any open spaces between the masonry and the walls were filled with a grouting of mortar. To prevent the adhesion of the masonry to the wood the latter was covered with a layer of linseed oil before the laying of the stones began. For the blocks of ashlar, quarry-stone masonry and bricks, a slow setting Portland cement was used exclusively.

3. The concrete blocks were made of Danube sand, gravel and Portland cement in the proportions of 1 : 2 : 3, 1 : 3 : 5 and 1 : 4 : 6. As above, types A and B were made.

4. The concrete-steel blocks, Figures 4 and 5, were made of 1 : 3½ concrete. The arrangement of the round iron rods is different in type A from that in type B, as can be seen in the figures. In type A the vertical main-rods have a diameter of ½ inch, and extend from plane of pressure to plane of pressure. They are connected by means of horizontal rings, 9/32 inch in diameter. In type B the main sets are laid parallel to the planes of pressure.

5. Brick masonry was made of common bricks as well as of pier and hollow bricks. It was laid in mortar of proportions 1 : 2 and 1 : 3½. The same method of laying the bricks was used as for the stone masonry. The hollow bricks were laid with their holes vertical and filled with sand, except where unintentionally they were filled with mortar.

A hydraulic press capable of furnishing a slowly increasing pressure up to 1,320 tons was used for the tests. The press belonged to a steel works, which used it to compress steel blocks. A careful standardization of the press was made by the committee. The blocks were brought by a crane to the press and then were cleared of the mortar facing so that the cross dimensions could be measured at three different places; the height of the specimen was then measured. To level any remaining uneven spots in the two planes of pressure thin cardboard covers were used as a rule. In the case of more considerable differences a thin layer of fine sand, passed through a sieve, was used, so that in both cases a practically uniform distribution of the pressure was obtained. Most of the tests were made with central pressures, in opposition to the first intentions. This was due to two distinct causes. As will be seen below, no correct conclusion could be made on the compressive resistance of the specimens under eccentric pressures. Again, the longer time required for these tests, due to the required interchange of rams, made them objectionable as interfering too much with the operation of the steel works.

According to the material of the specimen the test was begun with a moderate pressure, which was then increased gradually up to the first sign of failure and finally to complete collapse. The beginning of failure was noticeable by a cracking sound, and could be seen by fine flakes peeling off of the surface and off of the edges. The characteristics of the first signs of failure cannot, however, be considered as completely reliable, because no precise fixing of the time and of the amount of pressure at which failure begins could be made with sufficient accuracy. But they, nevertheless, fix the instant at which the elastic limit of the body has been exceeded, and while not representing the full truth will be found to be of value. On the contrary, the instant and the amount of pressure at which the breaking down of the specimens took place was completely fixed, and the reading of the greatest pressure on the gauge could be recorded exactly.

Table 1 gives the detailed record of the tests. The tests of single stones of 1 foot square base show that the prevailing idea that granite must be considerably stronger than sandstone does not hold true in this case, as the limits within which the collapse took place were the same for both materials. The sandstone blocks showed, however, quite early the first signs of failure, while the granite completely failed and collapsed simultaneously with the first cracks, accompanied by an explosive sound and a breaking into small parts.

Table I, Details of Tests of Blocks, all Loaded Centrally except Nos. 5, 6 and 12:

No.	Description.	Proportion of mortar or concrete.	Age, mo's.	Pressures, lbs. per sq. in. 1st signs of failure.	Pressures, lbs. per sq. in. Break down.
	Single Stones, Fig. 1, 1 ft. square, 15¾ ins. high.				
1.	Granite, Note A...	...	...	10,866	10,910
2.	Granite	...	...	8,130	8,550
3.	Hard sandstone....	...	...	5,460	10,380
4.	Hard sandstone....	...	...	5,500	8,780
	Ashlar Masonry, Fig. 2:				
5.	Granite, Fig. 11 shows loading..	1:2	5	....	8,110
6.	Granite, Fig. 11 shows loading...	1:2	5	....	8,310
7.	Sandstone	1:2	5	Note B	....
	Quarrystone Masonry.				
8.	Hard sandstone in layers, Fig. 3a...	1:2	3½	2,760	3,220
9.	Ditto	1:2	3½	2,810	3,870
10.	Ditto	1:3½	3½	2,290	2,730
11.	Ditto	1:3½	3½	2,360	2,820
12.	Hard artificial sandstone in layers, Fig. 3b......	1:2	6	....	3,540
13.	Ditto; Note C......	1:2	6	2,580	3,510
14.	Ditto; Note D......	1:3½	6	2,240	2,390
15.	Ditto	1:3½	6	1,860	2,190
	Concrete.				
16.	Made in one block,	1:2:3	3½	1,690	1,780
17.	Ditto	1:2:3	3½	1,450	1,850
18.	Ditto	1:3:5	3½	....	839
19.	Ditto	1:3:5	3½	655	977
20.	Ditto	1:4:6	3½	....	655
21.	Ditto	1:4:6	3½	....	668
22.	Made in 3 blocks..	1:2:3	6	1,350	1,780
23.	Ditto	1:3:5	6	1,180	1,180
24.	Ditto	1:4:6	6	796	868
	Concrete Steel Blocks.				
25.	Made in 1 block, Note E............	1:3½	2	2,140	2,200
26.	Ditto	1:3½	2	2,090	2,930
27.	Ditto	1:3½	3½	2,420	3,780
28.	Ditto	1:3½	3½	2,530	3,910
29.	Ditto	1:3½	3½	1,980	3,800
30.	Ditto	1:3½	3½	2,110	4,220
31.	Ditto	1:3½	[illegible]	1,860	3,360
32.	Ditto	1:3½	6	1,990	3,340
33.	Ditto	1:3½	6	2,390	4,180
34.	Made in 3 blocks..	1:3½	4½	1,640	1,850
35.	Ditto	1:3½	4½	2,120	2,260
36.	Ditto	1:3½	6	1,540	1,950
37.	Ditto	1:3½	6	1,650	2,450
	Brick Masonry.				
38.	Paving brick.......	1:2	3½	2,520	3,770
39.	Ditto	1:2	3½	2,840	3,820
40.	Ditto	1:3½	3½	2,640	4,210
41.	Ditto	1:3½	3½	2,840	3,820
42.	Paving brick laid in 3 blocks........	1:2	6	2,400	3,370
43.	Ditto	1:2	6	2,380	2,660
44.	Hollow brick.......	1:2	3½	2,250	3,140
45.	Ditto	1:2	3½	2,360	3,630
46.	Ditto	1:3½	3½	1,910	2,290
47.	Ditto	1:3½	3½	1,930	2,380
48.	Hollow brick laid in 3 blocks........	1:2	6	2,310	2,500
49.	Ditto	1:2	[illegible]	1,920	2,450
50.	Pier brick laid in 3 blocks...........	1:2	6	1,360	2,280
51.	Ditto	1:2	6	....	2,100
52.	Common brick.....	1:2	3½	555	1,450
53.	Ditto	1:2	3½	1,010	1,850
54.	Ditto	1:3½	3½	981	1,520
55.	Ditto	1:3½	3½	1,170	1,580
56.	Common brick laid in 3 blocks.......	1:2	6	1,540	1,850
57.	Ditto	1:2	6	1,350	1,440

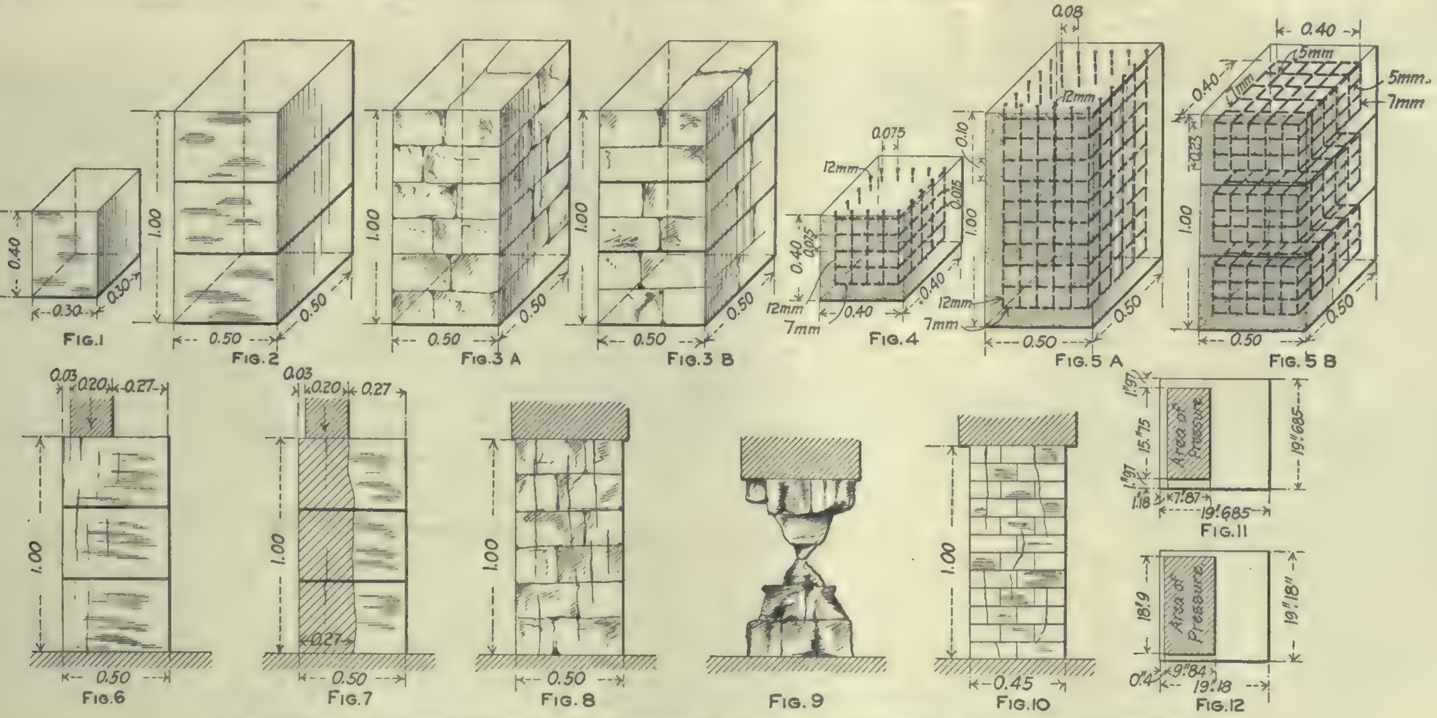
Note A.—Nos. 1, 2, 5 and 6 showed very coarse fractures.

Note B.—Test 7 could not be completed. At a pressure of 4,300 lbs. per sq. in., no signs of failure were noticeable.

Note C.—In the case of Nos. 12 and 13, the upper block became separated during transportation and only the remaining prisms of the specimens were tested.

Note D.—The mortar for binding together the three artificial blocks into one prism was mixed 1:2 for Nos. 12 to 14 inclusive, 22 to 24, 34 to 37, 42 and 43, 48 to 51, 56 and 57. These joints were four months old in the case of Nos. 34 and 35, and five months in all other cases.

Note E.—Nos. 25 to 28 were cubes measuring about 16 inches on each side.



DIAGRAMS ILLUSTRATING THE AUSTRIAN REPORT ON TESTS OF PIER MASONRY.
(Dimensions are in meters except in case of Figures 11 and 12.)

Laboratory tests made by Building Councillor Hanisch on some sandstone cubes of the same quarry, 2.4 inches on each side, gave an average breaking resistance of 10,900 pounds per square inch, while analogous tests made on granite gave completely different results. The latter tests gave the average breaking resistance of granite as 19,400 pounds per square inch. But it must be stated that the granite used in the laboratory tests was very fine grained. The specific weight of the sandstone was found to be 2.55 and that of the granite 2.57.

The ashlar masonry of granite was tested under an eccentric pressure. These tests of No. 5 and 6, as well as the analogous test of quarrystone piers, No. 12, proved to be of great interest. It is commonly assumed that according to the distribution of pressures the body fails either through the crushing of the edges or the opening of the joints, somewhat in the manner indicated in Figure 6. This did not take place at all. Failure occurred more in the manner characterized by Figure 7, and the opening of joints took place only in case of No. 6. No. 12 did not show even a flaking off of the mortar finish.

It hence follows that the failure of the masonry took place by a simultaneous shearing and crushing of the shaded area, and that in order to determine the breaking resistance the area on which the pressure was exerted directly must be taken in account. The results obtained in this way are very satisfactory; the tests, No. 12 especially, well agree with the values determined for central pressures. The behavior of masonry under eccentric pressure shows that while at small pressures the common theory of distribution of pressures in the joints and the values deduced from it for the computation of arches seem to be correct, the conditions are totally changed at the time of failure, and that the eccentric pressure is then uniformly distributed over the immediate area of contact. The remaining portion of the masonry exerts then no longer any influence, as otherwise the joints would undoubtedly have opened in all the cases tested, and failure of the mortar by tension would have taken place. Interesting as these tests under eccentric pressure proved to be, they were later dropped, because the determination of ultimate strength from central pressures furnishes more reliable data.

In all cases it was proved that the thin layer of mortar in the joints could not be crushed. Owing to some accidents the test piers of sandstone masonry No. 7 could not furnish data for the ultimate strength of the same. But referring to the uniform behavior of Nos. 1 to 4 it may be assumed that the ultimate strength of sandstone masonry is about the same as of granite masonry, Nos. 5 and 6.

The behavior of the quarry-stone masonry is characterized by tests of piers Nos. 8 to 15. They show a certain uniformity, inasmuch as the piers having mortar in the proportion of 1 : 2 gave better results than those with mortar of 1 : 3½. The higher age of the mortar in Nos. 12 to 15 proved to be of no influence, counteracted as it was by worse workmanship; No. 15 especially showed, after failure, poor stone laying.

Cracks appeared in the stones independently of the joints, Figure 8, and increased in number with increasing pressure, and finally failure took place independently of the joints. As shown in Figure 9, upper and lower wedge-shaped pieces remained standing after failure. These wedges were completely destroyed in themselves. It follows from this behavior of the quarry-stone masonry at the first appearance of cracks, as well as at final failure, that the masonry may be considered in the above cases as a homogeneous body of uniform elasticity and breaking resistance. Similar behavior was also shown by the brick masonry. The elasticity and the breaking resistance are, of course, dependent on the materials, the stone and mortar, but in no case is the strength of the masonry exclusively determined by the strength of one or the other of its constituents only.

The test piers of concrete, Nos. 16 to 24, gave uniform and quite unfavorable results. Failure took place rapidly and almost simultaneously with the first indications, and the tests of the poorer proportions of the concrete showed an almost complete disintegration of the body.

The more favorable results of Nos. 23 and 24 are due to the higher age of the concrete.

The great influence of iron netting imbedded in concrete is shown by the tests of the Monier piers, Nos. 25 to 27. The piers of type A, with vertical rods extending from plane of pressure to plane of pressure proved to have a very great resistance, and it was not possible to attain the complete failure of the same. In all cases the vertical rods yielded first, then the external covering material gave way, and only then the failure of the inner portion could begin. The latter showed wide vertical cracks, but complete failure was never observed, owing to the excellent quality of the concrete used. It should be noticed that the horizontal rings which surrounded the vertical rods were held together at their ends only by thin wire. With the use of thicker horizontal rings and the welding together of their ends the yielding of the vertical rods, and with them the failure of the whole body, will be pushed much higher up. The shorter age of the cubes, Nos. 25 and 26, appears in the less favorable results. The tests on prisms of type B, Nos. 34 to 37, were, notwithstanding their greater age, less satisfactory than those on type A.

The tests on piers of paving bricks, Nos. 38 to 43, gave the highest resistance of all brick piers; the low result obtained with No. 43 is evidently due to the poor workmanship of this specimen. The behavior of the paving bricks was interesting, inasmuch as very fine cracks became visible even under low pressure, which is probably due to the rigidity of the material and to an incomplete uniformity of distribution of pressure. The figures in the table correspond to somewhat wider cracks, which would indicate the beginning of failure. The behavior of the piers of hollow bricks, Nos. 44 to 49, made a favorable impression; they showed great uniformity. The proportion of the mortar used proved here, as in the case of the quarry-stone masonry, to have an influence on the results, and, the same as in the case cited, the piers composed of three blocks, Nos. 48 and 49, gave correspondingly less favorable results. But it must be remarked that the hollow spaces of the individual bricks were completely filled with mortar, so that the whole body formed one solid mass.

The tests of pier-bricks and common bricks closed the series of tests of brick masonry, their strength being lower than the above-mentioned varieties. Each series of the former showed corresponding uniformity, though the difference in mortar proportion in tests Nos. 52 to 57 did not become apparent. Failure in both cases occurred quite rapidly. As in the stone masonry, the brick masonry showed cracks fully independent of the joints, Figure 10, and here also wedge-shaped bodies remained standing after the collapse.

Attempts to measure the compressibility of the bodies gave no useful results; it was, however, established in some cases that in a gauged distance of 700 millimeters the compression reached a maximum of 1 millimeter. In other cases no measurable compression was found with the instrument used, which read to 0.1 of a millimeter. Frequently the collapse was so rapid that no measurement was possible. In order to make theoretic use of the amount of compression better instruments for measuring the same would have been necessary, which could well be had for laboratory tests, but not under the given circumstances.

To the conclusions and remarks already made above the following may be added: With few exceptions the tests have proved the great strength of masonry, compared to which the usual allowable working stresses appear to be very small. The influence of age did not prove, after the expiration of a given time, as important as it is generally held to be; on the other hand, the proportion of the mixture of the mortar used showed its influence in a whole series of tests. The tests of piers composed of artificial blocks, type B, give, as a rule, worse results than the similar results of piers of type A, made in one piece. This was due to the fact that the smaller artificial units were weakened by the manipulations of their laying after a hardening of four weeks. With materials of equally good quality the value and strength of our structures is in first time dependent on their workmanship during construction.

The usual tests of stone and mortar separately cannot be regarded as satisfactory and sufficient to base on them a reliable conclusion as to the strength of the mass composed of them. It is best in all cases of considerable structures to undertake tests on masonry blocks of as great dimensions as possible.

Table II. gives the average compressive strength at the instant of failure of the various kinds of masonry tested. They have been deduced from the above results for Portland cement mortar three to four months old. It should be remarked that the compressive resistance alone is not decisive for the excellence and suitability of the different types of construction.

Table II.—Average Compressive Stress in Pounds per Square Inch, at Failure.

	Kind of masonry.	Mortar or concrete.	Resistance.
1.	Ashlar masonry of granite....	1:2	8,110
2.	Quarrystone masonry of hard sandstone in layers.	1:2	3,550
3.		1:3½	2,560
4.	Gravel concrete,	1:2:3	1,780
5.		1:3:5	925
6.		1:4:6	711
7.	Concrete-steel in one block, Type A........................	1:3½	3,840
8.	Masonry of paving bricks.......	1:2	3,550
9.	Same of hollow bricks...........	1:2	2,845
10.	Same of pier bricks..............	1:2	2,130
11.	Same of common bricks.........	1:2	1,640

No. 1.—The test of sandstone ashlar masonry was omitted as being incomplete, but according to the above it may be taken the same as for No. 1.

No. 7.—The Monier piers of Type B give, as follows from the previous table, much less favorable results.

Nos. 8 to 11, inclusive.—For the brick masonry only mortar of the proportion of 1:2 was considered after it was found that the poorer mixture of 1:3½ did not show its influence in the series of tests.

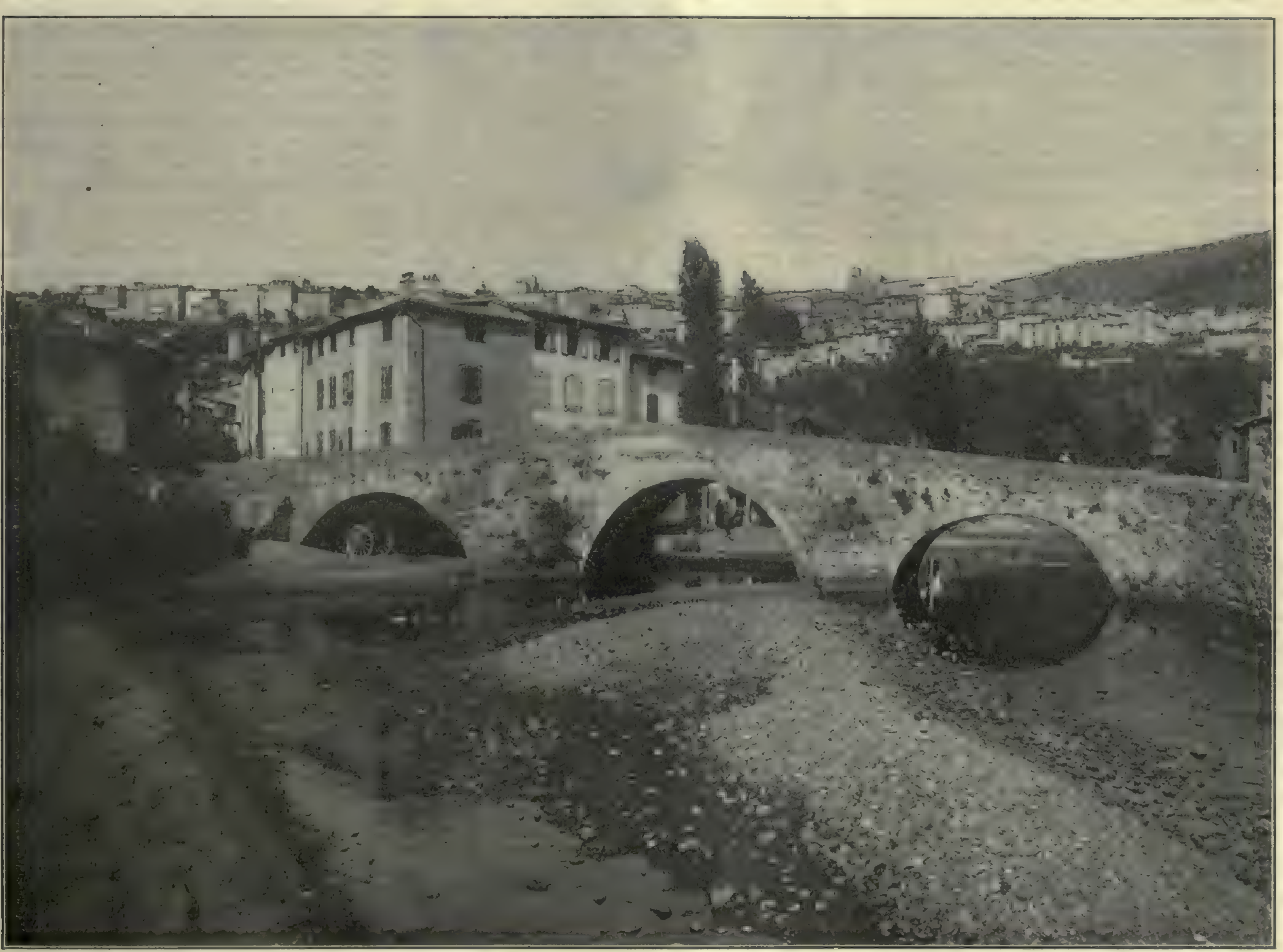
Interesting as the above tests proved to be, it became evident that the narrow limits within which they were undertaken are not sufficient to establish clearly the behavior of masonry under stress. Researches more extensive in time and in scope are required for this purpose, and only a scientific institute established for such purposes can afford an opportunity to accomplish them. No doubt the great saving which would be effected by a thorough knowledge of the materials of our structures would well repay the necessary expenses. The above tests are only a step forward; they are mainly intended to induce further research in this direction.

An Important Test of Steam Pipe Coverings is being conducted by Mr. George H. Barrus at the power station of the Manhattan Railway Company, New York, work on it having been in progress during the past two months. On Tuesday afternoon, at the invitation of Mr. Barrus, a number of engineers visited the plant and inspected the apparatus employed. To obtain as useful a test as possible the different coverings tested were placed on 2-inch pipes 100 feet in length, and were subjected to pressures of 80 and 150 pounds per square inch. The latter test is deemed of special importance, in view of the tendency to employ high steam pressures in power plant operation. The detailed results of the tests have not yet been made public.

Hot-Tube Ignition is more advantageous for small gas engines, and electric ignition for large gas engines, according to Prof. F. W. Burstall, of Birmingham, Eng., as reported at a recent meeting of the Institution of Mechanical Engineers. With the hot-tube there might, he remarked, be some delay, but with electricity it was hardly possible to suppose there would be retardation, which would be a serious matter with engines developing high forces. He advocated the Continental practice of adopting electric ignition for engines developing over 50 horse-power.

The Thermal Expansion of Cement has been studied by Mr. Carl H. Au in the physical laboratory of the Worcester Polytechnic Institute, with results corresponding to those of other experimenters. According to a note in the "Journal" of the Institute, a bar of Portland cement was placed in water in a copper bath heated by small gas jets along its whole length. The changes of length were observed by means of two reading microscopes focused on the points of needles embedded in the bar near its ends and projecting out of the water. Two thermometers were used in reading the temperatures, and during each observation the temperature was kept as nearly constant as possible until the readings of the microscopes ceased to changed. Readings were made at seven temperatures between 8 and 70 degrees Centigrade, and the coefficient of linear expansion per degree was found to be 0.0000115; this result is believed to be accurate within 2 per cent.

A Constant-Current Booster Installation of considerable interest forms part of the power equipment of the Belt Tunnel of the Baltimore & Ohio Railroad Company at Baltimore. The length of haul is 3.6 miles and the grade is all in one direction, reaching as high a figure as 1.8 per cent. One electric locomotive is used at a time, and this only against the grade, the trains in the opposite direction being allowed to coast. The load on the power station is in no way similar to that of the street railway, but is closely analogous to that of an electric elevator, the curve of performance showing a heavy initial load, a sharp descent due to rapid acceleration, and a practically steady load throughout the run. According to Mr. R. C. Hull, in the "Street Railway Journal," wattmeter readings showed, for 36 trains, an average load throughout the day of 175 kilowatts, an average load while the locomotive was in service of 525 kilowatts, and a maximum load of 1,300 kilowatts. When the locomotive load only was on the station it was found necessary to keep three 500-kilowatt generators in service. It was finally necessary to install a battery, not only capable of taking fluctuations due to starting, but of a capacity sufficient to carry a steady load due to continuous haul. It was furnished by the Electric Storage Battery Company and consists of 320 cells of chloride accumulator in tanks capable of containing 51 plates. It has a present capacity of 1,520 amperes and an ultimate capacity of 2,000 amperes at the hour rate of discharge. The booster, as stated, is of the constant-current type, having a shunt field fed from the main busses and a reversed series field. The series field was made weak enough to allow a current of 900 amperes to pass through the booster at 100 volts, which, with the generator voltage, is enough to overcome the drop in the line at that current and equal the battery voltage at discharge. At 300 amperes the boost is 300 volts and this, with the generator voltage, is sufficient to overcome the drop in the line at that current, and give, at the battery, a voltage of 800 volts, which is the charging rate when the battery is fully charged. The greater part of the time the booster will work about midway between the two extremes.



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLIII, THIERS, PONT DU MOUTIERS.
A rude but well proportioned old structure, typical of the bridges found throughout the south of France and along the Riviera.

Maintenance of Railway Tunnels in Great Britain.

Slightly condensed from a paper, published by the Institution of Civil Engineers, by Arthur Watson, Assoc. M. Inst. C. E.

The question of the maintenance of tunnels commends itself to the special attention of engineers, since it concerns structures in which defects cannot be so readily detected as in structures in the open. The author proposes to indicate the lines upon which the best practice in the maintenance and repair of railway tunnels proceeds.

The van used for the purpose of examining a tunnel is open for three-fourths of its length, having a platform sufficiently raised to permit the engineer getting as close to the roof and sides of the tunnel as possible, so that the men present can be continually sounding with hammers or mallets to detect cavities or looseness in the work. When these are discovered, dimensions are taken to locate the faults, and notes are made of the nature of repairs required. Water is undoubtedly one of the worst things to contend against, and places where large quantities are finding their way through the roof or sides are specially examined to see whether the material itself is perishing through this cause. This is of the greatest importance in old tunnels, where common bricks have been used in the construction, as they are found, with a few exceptions, to be of soft material.

Should the roof be bulging, a contour is made of the tunnel, in cross section, with an instrument designed on the pantagraph principle. It consists of a tray or board 27 inches square, about 3 feet above rail-level, and supported by a frame, the upper end of the vertical portion of which is on a level with the lower part of the tray. To this end is attached an arrangement of crossing bars with a telescopic shaft, which together form proportional dividers. On the upper end of the telescopic shaft is mounted a small wheel, which is passed round the soffit of the tunnel. On the front of the tray a piece of drawing paper is fixed, and on this is shown, in firm lines, the minimum structure of the railway. Through the first crossing of the bars a pencil is placed, the point of which is kept in contact with the drawing paper by means of a spring. When a cross section of the tunnel is required, the frame is clamped in place, a sheet of tracing paper is fixed on the tray, and the rail-level and vertical position are traced through. The telescopic shaft is now traversed round the soffit, and a correct contour is produced on the tracing paper to a scale of one-twelfth full size. The clearances can at once be measured with a scale, and instructions given for the centering ribs to be built, which will always clear the minimum structure.

The timber uprights, bearing sills, centering ribs, blue and red bricks, cement, lamps, candles, oil, tools, ladders, planking, and all necessary ironwork, are first loaded into the ballast train at the stores, and conveyed to the site of the work. Should the work be close to the outside face of the tunnel, all material can be unloaded between trains during the week; but if the tunnel is a long one, or in a busy locality, or should the work to be done be situated at a greater distance from either end than ¼ mile, the unloading must be done on Sunday, there being considerable risk in unloading and stacking materials in a hurry where, as often occurs, the clearance between the rails and the side walls is very limited. It is not desirable to place any material in the manholes, and on no account should anything be left in the space between the two running rails which would project more than 7 inches above rail-level. The bricks are stacked in the space between the two tracks to a height not exceeding 2 feet 6 inches above rail-level, and the timber, lamps, tools, and planking where most convenient. The cement is stored in a waterproof shed outside the tunnel, this shed having a planked floor, so that all cement can be turned over with shovels, and air-slacked before use. In no case must the supply be allowed to run short, as green cement is exceedingly objectionable for any class of work. The casks of oil, naphtha, gas, and petroleum are also stored in a convenient place outside the tunnel for the men to fill the lamps as they go in to their work. All the materials being now delivered at the site, the foreman in charge of the work goes into the tunnel, and, after ascertaining the portions to be repaired, proceeds to set out the position of the bearing timbers to carry the centering ribs, the under side of which must at no place be nearer to rail-level than 14 feet 3 inches, this being the clearance headway.

Square holes are then cut in the haunches of the soffit, to the required level on both sides, sufficiently deep to admit of easily and securely fixing the bearings for the centers. It may happen that the roof of the tunnel is not sound enough to support these timbers unaided, and in such cases it is best to give them independent support by cutting chases in the side walls and haunches and inserting vertical 9 x 9-inch timbers for that purpose. Care must always be taken to keep these and other timbers at least linable with the tunnel walls, for should any mishap occur, whereby a case of merchandise is detached from a goods train, and, coming in contact with these upright timbers, dislodges them, the result would be disastrous. These timbers are fixed about 6 feet apart, center to center, this being the safest length of roof to reconstruct in one operation. Of course, the nature of the repair, in all cases, governs the spacing of the centers, and this may be much less than the length quoted when the roof and haunches appear treacherous. The work of cutting out the putlog holes for the horizontal transverse bearing timbers can be done during the week, provided, of course, that the men are protected by flagmen on both lines of way. These flagmen are stationed at least half a mile in advance of the workmen in the direction of approaching traffic in long tunnels, and are provided with a bell-pull near at hand, which conveys a warning by wire to the bell fixed near the workmen; as an additional safeguard they blow a whistle. The warning thus given is sufficient to permit of the men descending and removing their ladders before the arrival of the train.

When the bearing and other timbers, centers, etc., have been cut or built to the required length or size, the first convenient Sunday is chosen, and notices are inserted in the works programme for the complete blocking of both lines of way between specified hours. The bearing timbers and centering ribs are hoisted into position by means of a single-legged derrick, fixed in the 6-foot space between the two tracks. The intervening space between the centers is planked over, and forms a platform for the carpenter to stand on while setting the centers to a correct level. This is done by means of fox-wedges, placed on the top side of the bearing timbers, and carrying the bottom member of the center frame. This arrangement is very convenient for removing them on completion. The ribs are bolted to the bearing timber, and a packing is inserted in the space between them through which the bolt passes. This method not only obviates any risk of the centers settling should the wedges, by any means, become slack, but it also gives a stiffness to the rib. It is not advisable to dog the wedges together, as there is often difficulty in slackening the centers when this practice is resorted to. The centers are constructed with two vertical queen posts, thus giving the workmen more space to pass through and to convey material to the work.

It frequently happens that the contour of the arch soffit differs in the same tunnel, although it may be a continuous section. If the difference is not very considerable, the old roof is cut out sufficiently to allow of a uniform section being substituted throughout. But if, on the other hand, the difference is such as would involve much additional excavation of rock, shale, or earth, above the roof, two sets of centering ribs are made to the different contours, and the reconstruction arranged to let each gang work toward the other, and at a convenient distance, say four lengths of 6 feet. Before these ultimately meet, the exact difference in contour is ascertained, and, by altering the top and side sweeps on three of the centers, one section is gradually developed into the other.

The first men to commence the work proper are miners; these cut out the roof in short lengths, timbering the arch to take the thrust as they proceed, commencing along the crown of the soffit, and proceeding down toward the haunches and springing. When the roof is excavated sufficiently for the proper number of rings of brickwork, it is closely poled with 6 x 1-inch sheeting in short lengths, butted together on 6 x 1-inch cross bearers; these, in turn, being carried by running timbers of 8 x 8-inch scantling, supported from the extrados of the old work. The excavated material is loaded into small wooden skips, lowered through a hole in the working platform down to rail-level, and wheeled to tip in the 6-foot space between tracks in a suitable position for the ballast train to load it. When the miners have cut out the entire width to be re-lined, and all is ready for the bricksetters, they commence to cut out another short length of 6 feet, not adjacent to the length the bricksetters are working in, but 6 feet further on, thus leaving the intermediate length of 6 feet undisturbed until the first portion is re-lined and keyed in, for convenience in timbering the roof.

The centering ribs are now accurately set to the required height with the fox-wedges, and 7 x 3-inch laggings are laid on as required, and the new work is brought up from both springings or haunches simultaneously, so as to equally load the centering, and also key in on the crown of the arch, proper attention being paid to the gauging of the bricks to ensure the keying course being tight; this can only be satisfactorily done by working out the gauge, and telling the bricklayer what he must set his courses to. At about four courses on each side of the center line of the tunnel the longitudinal 6-foot laggings are discontinued, and cross 1-inch block laggings substituted; these are of 7-foot by 3-inch timbers, with rebates sunk in the ends, fitting in corresponding rebates in the longitudinal laggings. The bricksetter proceeds to the blank end of his work, supposing it is against a finished section, and commences keying in, laying the cross block laggings as required. In this way the work is completed, as he works outwards. Of course, if there is a long length of tunnel to be re-lined, which must of necessity be accomplished in many short stages, the unfinished ends are always left with 4½-inch toothings for bonding into the succeeding lengths.

One serious difficulty always will occur if the work is confined to the central, or even any, portion of the tunnel, which does not finish at the outside face of all, because the majority of tunnels are constructed with ashlar voussoir quoins at their outside faces, and these rarely if ever require renewal. This difficulty lies in the keying in of the last length of arch over the crown, in dimensions about 2 feet in both cross and longitudinal section. It is practically impossible to rack the arch rings in this closing piece, as in doing this there would be no space left in the face rings to pass the bricks up into the back rings; and this is most apparent when one considers a tunnel with say six arch rings. The remotest ring in this case is at least 2 feet 5 inches from the upper surface of the laggings, and it is at once apparent that a bricksetter, working under the conditions obtaining in tunnels, of imperfect light and limited space, might not trouble to make a good bond unless closely watched. The method usually adopted is what is termed pigeon-hole bond, meaning that the keying bricks are jammed in lengthwise and square to the coursing joints of the other bricks in such a manner that, if a whole brick will fit, this serves for the "key," and if not, "closers" are cut to suit. Of course, conditions become more favorable for good work the nearer the face rings are approached, until fairly good bond may be expected in the second and third rings, and perfect bond in the face or soffit.

A method by which better results can be obtained is to use bonding straps of wrought iron, cut in short lengths, and forced into the bed joints of the rings with sufficient frequency to prevent the bricks tilting downwards. The bricksetter can then place his bricks to rest on these, and give each a full bed and joint of cement mortar before placing it in position. Uniform bond is thus obtained and the straps built in. This operation, again, requires very close supervision, otherwise it will not be carried out satisfactorily, as there seems but little margin for doubt that the majority of "falls" in tunnel-roofs have occurred at those points where, on examination, it has been found that pigeon-hole bond, or, more correctly, no bond at all, has been resorted to. As the work of re-lining proceeds, the cavity between the 1-inch sheeting to the roof and the crown of the outside ring is packed solid with broken stone and brick, or sometimes, when the roof appears treacherous, with cement concrete. The 8 x 8-inch running timbers are drawn for use elsewhere as the packing proceeds, but the sheeting is never drawn if once put in. The centers are struck between 4 and 7 days after the arch has been turned complete, and are then removed forward to do service in a fresh length.

The foregoing remarks apply to all classes of tunnels, whether double or single line, the only difference being that in single line the centering rib is somewhat simpler in design, and does not allow much space for the passage of the men or material through its framing. In this case arrangements are made for a trap door in the 1-inch planking between each of the centers.

It must not be supposed that the only maintenance work done in tunnels consists of entirely re-lining them, as this is not the case. Frequently the arch-rings and walls are in good repair in a general sense, but small areas require attention. These chiefly consist of loose or perished bricks in the face rings or side walls, which can easily be replaced and put in good order. This work is done on Sundays in busy neighborhoods; and between trains, on week-days, on suburban lines; it does not necessitate the erection of any centering, since all that is required can be done by the men working on a scaffold fixed between ladders. The perished bricks are cut out and are replaced by new ones; the loose rings are made secure by forcing pieces of slate between the joints, and all is made good with mortar composed of cement and sand in equal parts.

The early types of tunnels had no provision for the refuge of the platelayer from passing traffic, but in later years it has been considered necesary to allow for this in the construction of new works, and also to provide them in the existing tunnels as opportunity offers. In the latter case the side walls are cut out, and manholes are formed in blue brickwork set in cement mortar. These occur alternately about every 15 yards along each side of the tunnel.

In constructing tunnels it is often necessary to commence operations at several points along the center-line simultaneously, and for this purpose shafts are sunk from the surface of the ground above. These may become air-shafts for the proper ventilation of the tunnel when the works are complete, and remain open; but circumstances have often arisen whereby they have been bricked up on the completion of the work, owing to objections raised by the inhabitants of the neighborhood to the smoke emitted from them. In the course of years the objections have been lost sight of, and the railway company's engineer has been able to open them out again. When this is done, the same methods are employed and the same tackle is used as when shafts are repaired or re-lined. The first thing is to ascertain whether the shaft is truly vertical, by plumbing down into the tunnel, and should it be out of line, allowance must be made in setting the timber framing to permit of the shaft being rebuilt in its correct position. A timber shed is fixed over the shaft, being framed with rough-sawn timber, with the outside close boarded to keep weather out, and as a safeguard against trespassers or others getting near the shaft, should the work be left for any period. A method of carrying out this work which has proved very successful is to fix three large pulleys or wheels on bearing timbers, resting on and bolted to the frame of the shed at a convenient height above the ground-level at the top of the shaft. The largest wheel is about 6 feet in diameter, and over this passes a steel-wire cable, ⅝-inch in diameter, carrying the skip or cage. The cage is of timber, measures 2 feet 3 inches by 2 feet 3 inches by 3 feet and is banded round with 2¼ by ⅜-inch wrought-iron formed into eyelets at the upper corners for the sling chains attached to the cable to hook on. These wrought-iron bands must always pass completely around to make certain of the strength of the cage bottom. The front face is constructed to slide in two parts for convenience in loading or unloading. The two smaller wheels or pulleys are used to raise or lower the working platform on which the men and material stand during the progress of the work. The platform is made as large in diameter as the shaft will admit easily, and is suspended at both sides by cables passing over the two smaller pulleys and fixed to two winches, placed sufficiently far away to obtain a flat pitch on the cables. A 12-horsepower vertical engine with 8-inch cylinders is connected to a winding drum 3 feet 6 inches in diameter for raising and lowering the cage, and is checked by a lever foot-brake, the wood cleat of which grips round one end of the drum. Special attention is paid to the engine driver's view of the shaft-head, as his haulage varies daily, and there is always a risk of overwinding. It is of advantage to have an opening at each side of the engine shed, in line with the sight of the driver, and so placed that the cage, when raised, will obstruct his view, and, when lowering, hand-signals can be easily seen. Again, the larger the pulleys are, within reason, the less wear there is on the cables, and the cage, not being heavy, has a tendency to foul when the pulley is revolving rapidly; this is minimized by large pulleys. In raising the material, the loaded cage is hauled out of the shaft sufficiently high to allow a small car to be pushed under it, for trucking in and out of the shed. The car forms, when at rest, a complete cover for the well-hole in the flooring, and its size must always be the gauge of the hole, allowing for lap. Should the shaft be of considerable depth, it is well to fix pieces of steel rail across the opening, at a depth of about 12 yards, so that, should any mishap occur to the working platform, it would be impossible for it to fall the entire depth of the shaft.

The renewal of the brickwork is commenced at the top and proceeds downward in depths varying from 18 inches to 8 feet, and in widths of 4 feet. The old work is taken out and made good with blue brickwork in cement at once, gauging the bricks to underpin perfectly tight, and "driving" the top bricks, in succession, as the circuit is worked round. Templates to the radius of the shaft, and about 5 feet in length, are used, and the new work is 9-inch blue brickwork in cement, with dry lining at the back to prevent the water wash. No timber curbs are used to build the brickwork upon, as they rot away and eventually cause the brickwork to settle. When 4½-inch brickwork is met with, the shaft has to be timbered in 5-foot settings with 12 x 6-inch walings, 9 x 9-inch uprights, and 9 x 4½-inch running timbers behind the walings to wedge the cleats against the 1-inch sheeting; this done, the 9-inch work is set as before.

In illustration of the foregoing, the following are particulars of repairs carried out in the manner described. Cases 1 and 2 refer to double-line tunnels; and Cases 3 and 4 to single-line tunnels.

Case	1	2	3	4
Length of work, yds...	79	42	161	43.5
Sq. yds. per lin. yd...	12.3	12	11.5	14
No. brick rings renewed	5	5	5	5
Nature of traffic	Heavy	Moderate	Light	Fairly heavy
Costs.				
Material per lin yd....	$67.88	$38.11	$30.19	$57.44
Labor, per lin. yd......	100.93	51.76	39.85	85.06
Power, per lin. yd.....	1.98	3.01	3.72	3.36
Total per lin. yd.......	170.79	92.88	73.76	145.86
Total per sq. yd........	13.88	7.74	6.41	10.42

Case 1.—This tunnel was constructed in 1850, through loose earth and shale. The arch was turned in five half-brick rings of red brickwork. In course of time, through insufficient packing in the heading above the arch and also through indifferent workmanship, the arch settled badly and lost its original shape. Bricks began to drop, and at times small portions of the roof fell; these were temporarily repaired in cement, and loose bricks were wedged up, but eventually the relining of the tunnel had to be considered as a safeguard against disaster.

Case 2.—This tunnel was constructed in 1849, through loose rock. The arch was turned in block-in-course masonry, and backed with rubble. Examination made where the different lengths had been joined showed careless work in many instances, the result being that the earth above settled and forced the arch with it. Large masses of masonry fell from the roof and haunches from time to time, and as a satisfactory result could not be obtained by patching, it was decided to cut out the old work and to reline in blue brickwork.

Case 3.—This tunnel was constructed in 1852, through hard rock. The arch was turned in four half-brick rings. No provision had been made for conducting the drainage down the haunches; so, finding its way through the arch, it washed all the mortar out of the joints and weathered the bricks, which were of inferior quality, so badly as to necessitate relining the arch in blue brickwork in cement.

Case 4.—This tunnel was constructed in 1868, through loose earth and shale. The original arch was composed of five half-brick rings, but the workmanship was inferior, and the material was so poor that it weathered away under the action of moisture, and becoming too costly to maintain, it was relined in blue brickwork set in cement.

The author is indebted to Mr. W. B. Worthington, M. Inst. C. E., engineer-in-chief of the Lancashire & Yorkshire Railway, for permission to use the information contained in the paper.

Heavy Dredging with Light Machinery at Havana.

By A. H. Weber, M. Am. Soc. C. E., Assistant Engineer, Department of Cuba.

At the time of the American occupation of the Island of Cuba, at the close of the war, the only facilities for docking vessels in the Island were provided by a steel floating dry dock belonging to the Spanish Government located in the Harbor of Havana. It was currently thought that sooner or later this dock would be sold, and, perhaps, removed from the Island. This conjecture has proved true, for the United States have recently purchased the dock with the intention of transporting it either to the States or to the Philippines.

Anticipating the demand for another dock the Havana Dry Dock Company was incorporated and built a floating dry dock of 6,000 tons capacity, to be installed alongside a pier in front of a large machine shop. The dock required a depth of water of 32 feet, and there was but 12 to 14 feet on the site determined upon. It was therefore necessary to excavate 18 to 20 feet in depth over an area of 108 x 400 feet, a total calculated volume of 29,380 cubic yards in place, and this was decided upon by the interested firm with but a vague idea of the character of the material to be removed.

The only dredging plant in the Island at this time was one which, under the Spanish regime, belonged to the Junta de Obras del Puerto de la Habana, and which was turned over to the Military Government at the time of the evacuation. It consisted of a bucket and ladder dredge of about 1,000 cubic yards capacity in ordinary harbor mud, but only 200 to 600 cubic yards in hard clay, two small clam-shell dredges of the Priestmann type, with ¾-yard buckets, a seagoing tug and several iron dump scows. The first mentioned dredge is an excellent machine in soft material, but is too light in every detail for very hard material. The clam shells have a capacity of 200 to 400 cubic yards in mud, but are not at all effective in hard clay. Since the American occupation this plant has been under the control of the Department Works of the Port, of which the writer has charge. Application was made to the Military Government to have the dredging done by this department, the interested parties agreeing to pay the cost of the work and for all repairs connected therewith. As the project was one of public interest it met with the necessary approval.

Operations were started with the Priestmann dredges, which were afterward replaced by the ladder and bucket dredge. It was soon found that the work would be difficult. After dredging a few feet in depth, both rock and a very hard cementitious clay were encountered, neither of which could be handled without being drilled and blasted. An Ingersoll automatic feed steam drill with 4½-inch cylinder was procured and installed on a floating pile driver by attaching it to a 2,200-pound hammer by means of a 1¾-inch bolt, a hole for which was drilled through the hammer. With this arrangement the drill can be raised to any height in the leads with the hoisting engine, and the full length of drill steels used, and thus by lowering the machine as the drilling progresses save the delay and annoyance of lengthening the drill steels. A small pump was provided to play a stream of water into the drill hole while drilling, to force the rock chippings out. From the platform of the scow down to rock or hard clay the drill rod passes through a tube 12 inches in diameter at the top and 4 inches at the bottom, which is telescopic so as to be adjustable to the tides and varying depths of water.

Ordinarily in work of this character it would probably be better to charge the hole through the tube from the scow, but in this case a diver was employed for general service by the month and always on hand, and he charged the holes, which insured better results than would have been obtained the other way. It was intended to drill and charge a row of about 10 holes spaced 5 feet apart, and this method was tried, but owing to complaints from adjacent property owners who claimed their buildings were damaged as a consequence of the explosions a limit of 6 pounds of dynamite at a charge was placed. This made it necessary not only to fire single shots, but placed a limit on the depth of hole, for it was found by experience that the charge of 6 pounds of 60 per cent. dynamite, the explosive used, was only effective to a depth of about 6 to 8 feet, whereas the depth necessary was 12 to 16 feet. For these reasons the whole area had to be gone over two or three times. There were two ledges of rock crossing the excavation almost the full width, and one detached lump or huge boulder. The superficial area of the rock was 1,086 square yards. The rock was a medium hard limestone, soft sandstone and crystallized sandstone, the different strata lying irregularly in various directions, probably as the result of volcanic action.

The clay was unusually hard and tenacious and was almost as difficult to handle as the stone, the effect of the dynamite being but little more in one than the other. If, after a blast in the clay, it was left for a time before being removed, it would set and become almost as hard as before being disturbed, and frequently required shaking up with a new blast.

The machinery being too light for handling broken stone, many delays were occasioned by break-downs, some of which were very serious and involved large sums for repairs. The stone was usually broken by the blast into pieces weighing from 10 to 200 pounds, but occasionally pieces weighing 300 to 500 pounds would be brought up in the light buckets, which were soon badly broken and in need of renewal. There was no record kept of the respective quantities of rock and clay removed, as they were frequently both dumped into the same scow. A close approximation can, however, be made, as the outlines of each were located and plotted. The total quantity removed was 47,970 cubic yards, scow measure, of which it is estimated 10,500 cubic yards was rock. There was no determination made of the relative cost of rock and clay excavation, but from observation it was thought that the cost of the rock did not exceed that of the clay by more than 75 per cent.

The total net cost of the work was $35,733.86 or 74½ cents per cubic yard, divided as follows:

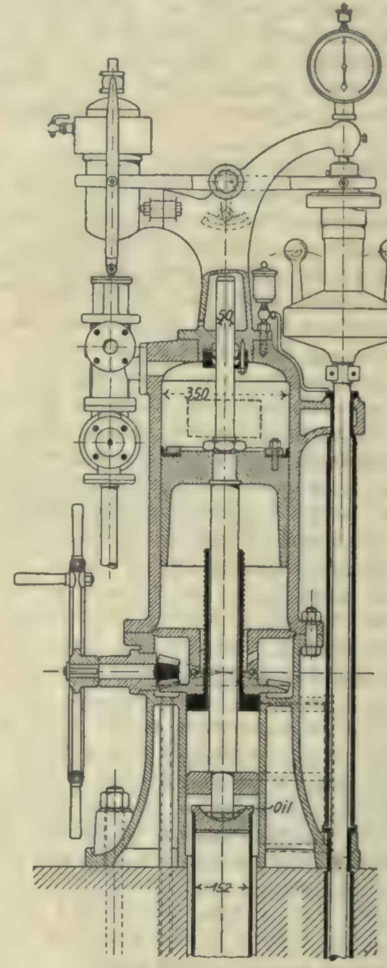
	Total.	Per. yd.
Dredges, wages, supplies and repairs	$23,627.00	49.2 cts.
Drilling, wages, supplies and repairs	5,898.39	12.3 "
Explosives	1,329.15	2.8 "
Transportation of dredgings to sea	3,642,02	7.6 "
Office and superintendence	1,237.30	2.6 "
	$35,733.86	74.5 cts.

The number of holes drilled and blasted was 1,682, and the dynamite used amounted to 5,600 pounds.

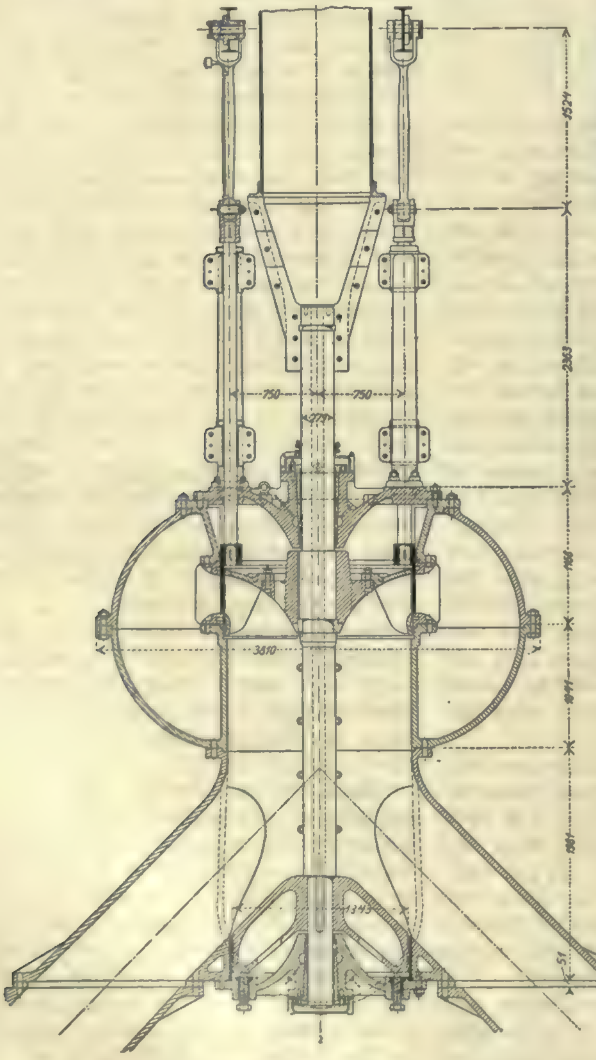
The distance from the site of the dredging to the dumping point at sea is approximately three miles.

The New Turbines for the Niagara Falls Power Company.

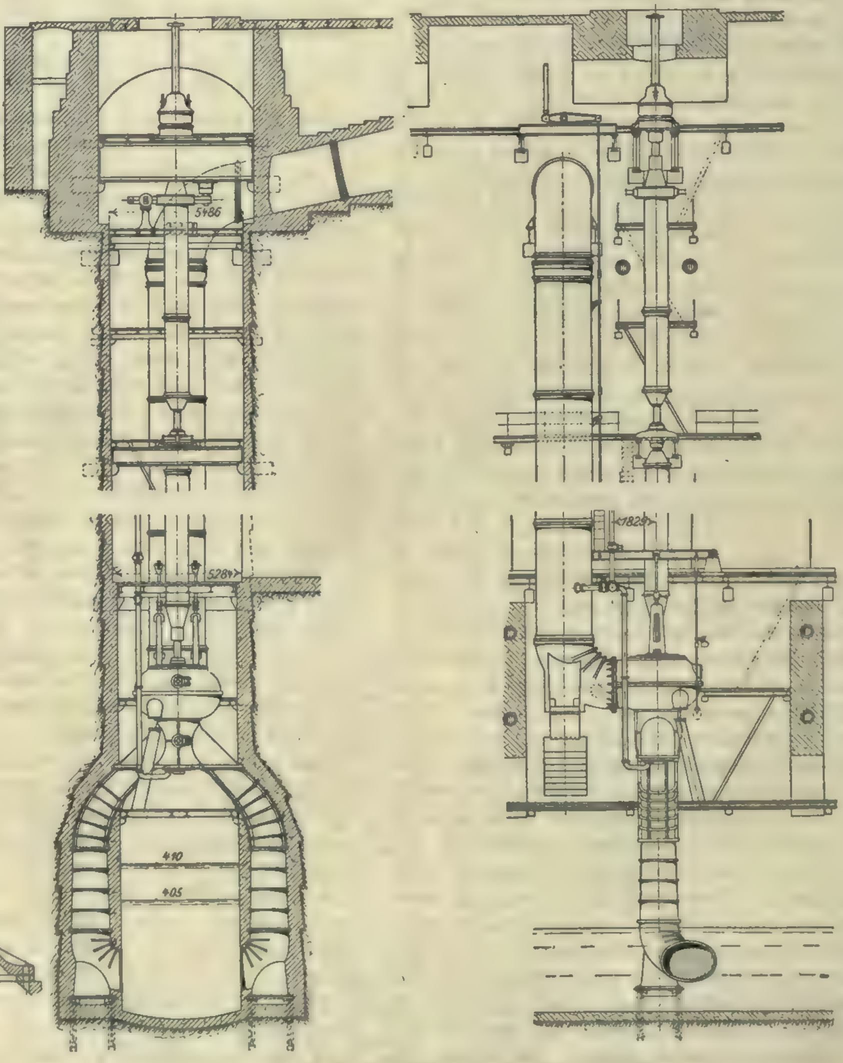
A short time ago the "Zeitschrift" of the Society of German Engineers contained a series



HYDRAULIC GOVERNOR.



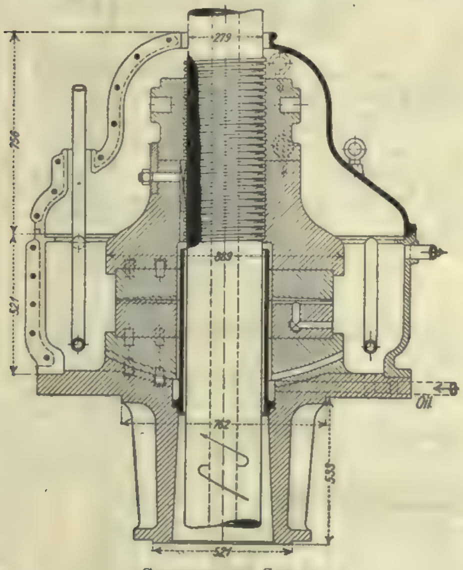
TURBINE AND BALANCING WHEEL.



ARRANGEMENT OF TURBINES AND DRAFT TUBES.

of papers on hydraulic power plants built from the plans of Escher Wyss & Company, of Zurich, Switzerland. A portion of these notes referred to the designs of the firm which have been adopted, as the result of a competition, for the second power station of the Niagara Falls Power Company, described in The Engineering Record of February 16, 1901. The conditions governing the competition were: (1) Each turbine was to develop 5,500 horse-power; (2) a net head of 146 feet was to be used in the computations; (3) the turbines were to make 250 revolutions per minute; (4) the discharge fall or draft was to be utilized as much as possible, in order to raise the efficiency; (5) noise in operation was to be avoided and the turbines to be as accessible during operation as possible; (6) the turbine casings were to have as large a section as possible; (7) the use of a thrust bearing was to be avoided if possible.

The type of turbine adopted is a Francis wheel, with a balancing disk at the bottom and a hanging bearing at the top of the shaft. The water is delivered by a 7½-foot vertical steel pipe of half-inch steel plate, and has a velocity of approach of 10 feet. The discharge pipe branches, and opens into the tail-race tunnel at the sides, so that the tunnel remains entirely unobstructed. This is important, because the fluctuations in head in the tunnel with different numbers of turbines in operation may vary as much as 16 feet; moreover, a single discharge pipe was impossible on account of the resulting contraction of the tunnel area. The turbine casing is formed of cast iron in two parts, and is so large that the velocity of the water is appreciably checked by it, allowing the stones carried down the penstock to drop to the bottom of the casing, where they can be taken out from time to time through a pipe provided for the purpose.



Support of Shaft.

The fixed or guide wheel is cast in a single piece and has 25 blades. The running wheel, of manganese bronze, cast in a single piece, is 5¼ feet in diameter, weighs nearly 4,000 pounds and has 21 blades.

Below the turbine, near the bottom of the shaft, is the balance wheel, 4.9 feet in diameter, below which water is admitted through a special pipe. By means of this disk the downward pressure can be counterbalanced to the amount of 66 to 77 tons. The moving parts, inclusive of the armature of the dynamo, weigh 71 tons, so that about 5 tons is generally carried by the bearing. The latter is of the ring type, with its oil cooled by water flowing through a coil of pipe in the housing.

The turbine shaft is built of pipe 3.28 feet in diameter, with walls about ⅝-inch thick, connected by solid pieces of shafting 11 inches in diameter at the points where guide bearings are employed.

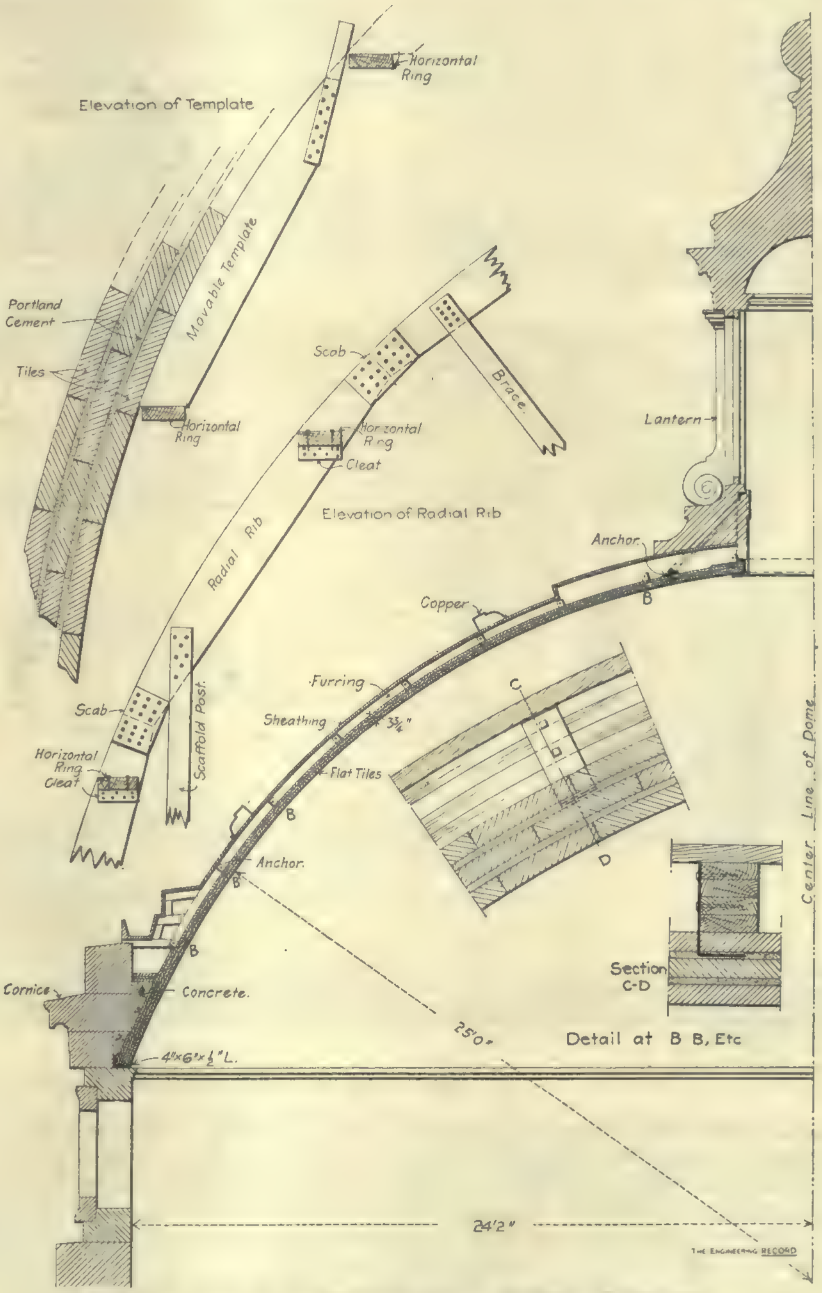
The turbine is regulated by a bronze ring, moving vertically in the annular space between the fixed and the running wheels. The lower edge of the ring is sharpened to cut through wood and like substances. It is hung by a system of weights, levers and suspender rods from a lever at the top of the shaft. The weight of this suspender system at one end of this upper lever forces the other end upward; this causes a shaft to press against the bottom of a piston working in an oil-filled cylinder. The oil is under a pressure varying in amount up to 24 tons, according to the position of the regulating valve, which depends in turn on the position of the governor, as shown in one of the cuts. This regulating apparatus is also provided with an attachment for operating it by hand.

A number of experiments have already been made at Niagara Falls with one of these governors. At one time 5,000 horse-power were thrown off as rapidly as possible, but the fluctuation in the velocity caused by this change in load was only 3.8 per cent.

The total weight of the turbine is estimated at 220 tons. The running wheel and the governing apparatus will be built in the shops of Escher Wyss & Company, at Zurich, and the remaining parts will be made in the United States according to the drawings of that firm.

The Students' Hall Dome, Columbia University.

The new Students' Hall at Columbia University is surmounted by a tile dome 48 1/3 feet in diameter inside, with a total rise of about 18 feet. The dome is composed of an upper segment having a radius of 25 feet, tangent at the haunches to a lower zone which has a somewhat longer radius. It is built of thin, hard, flat rectangular tiles and is covered outside with wooden sheathing boards, coppered. At the base it is surrounded with a circular stone cornice backed by a brick wall. A 4 x 6 x ½-inch skewback angle is seated on the wall and receives the base of the dome, which is six tiles thick for the first two courses, four tiles thick for the next seven courses or for a zone about 4 feet in height, and three tiles thick for the remainder of the shell. The dome weighs about 40 pounds per square foot, and although not built to carry any specified load is considered abundantly strong for stresses many times greater than can be imposed by its weight or by the wind pressure.



The Tile Dome of the Students' Hall, Columbia University.

It is of the Guastavino construction and has been built by the ordinary method, which is interesting on account of its simplicity and rapidity, and the fact that the incompleted structure is at all times entirely self-supporting and requires no falsework except a light scaffold for the workmen and to support the templates by which the courses are laid. An irregular group of light vertical wooden posts was built up from the ground to carry the bricklayers' scaffolds, and, being braced together with diagonal and horizontal boards nailed on, served also to support twenty-four radial curved ribs with their upper edges in the plane of the inner dome surface. These ribs were made of 5-foot lengths of 6 x ⅞-inch pine, nailed together with single light scabs, and nailed to the sides of the twelve principal vertical posts. The ribs were connected together by horizontal circular rings of short lengths of thin boards with their outer edges also in the under surface of the dome. These rings supported the ends of short templates, which were moved around the circumference of the dome in vertical radial planes to determine elements of the surface and act as guides for setting the inner course of tiles. The number of radial ribs, of course, diminished toward the upper part of the dome, and none of them at any time received any load from the tiles.

The bottom courses of tiles were laid on edge in Portland cement mortar bearing against both flanges of the skewback angle. The first two or three courses of the inside layer of tiles were laid, one ring at a time, in an almost vertical position, with their edges butted together and cemented with a thick mortar of plaster of paris and sand. Each tile was 6 inches wide, 15 inches long and ⅞-inch thick. The mortar set so quickly that the tile stuck in place without any other support, and the radial template was used only to line it in and was immediately moved forward to set the next tile. As soon as each horizontal course was completed it formed a circular arch and developed sufficient strength to support the next outer course of tiles, which was laid to break joints with the first, both horizontally and radially.

The second thickness of tile was bedded in Portland cement mortar spread over the entire spherical surface and around all the edges to make joints about ½-inch thick. The succeeding thicknesses of tiles were laid in the same manner, building up a solid shell, which was very strongly bonded and cemented together. Two masons, working away from the same starting point, laid the courses of inside tiles, two others similarly laid the second layer, and two more laid the third or outside layer, the six men thus building the complete dome in about ten days. The radial ribs were put up in short sections, each being sighted to a point in the center of the dome at the crown, and then located by measuring from the center of the dome with a steel tape to set both ends exactly at the extremity of the radius. The tiles finish against an angle-iron ring 5 feet in diameter at the crown, where there is a circular well-hole surmounted by a lantern. At frequent intervals bent plates of thin steel are built into the mortar joint between the two outer layers of tiles and project at right angles to the surface to afford fastenings for the furring.

Messrs. McKim, Mead & White were the architects for the building, and the R. Guastavino Company designed and constructed the dome.

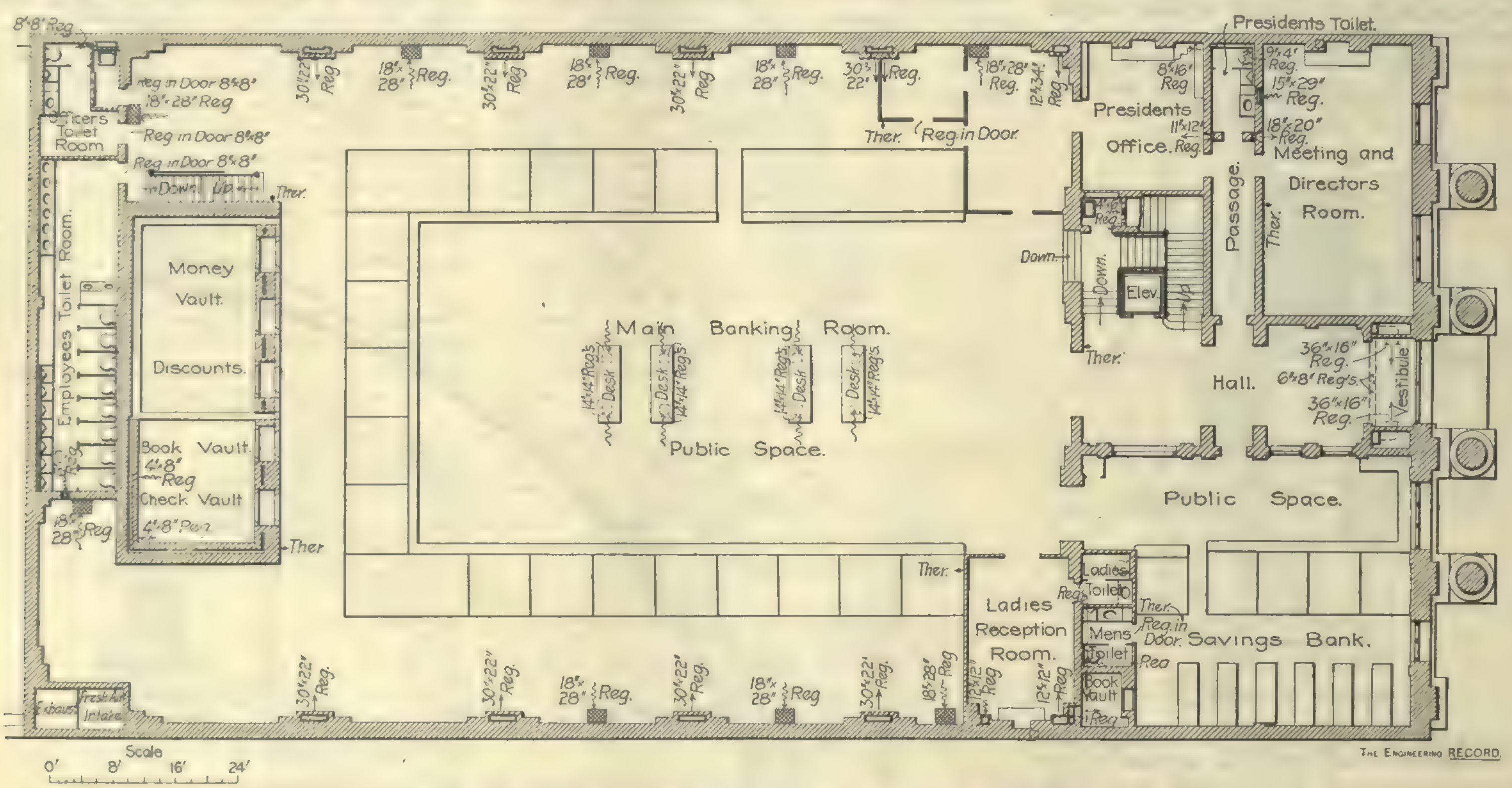
Ventilating and Heating the Chicago National Bank.

The Chicago National Bank Building is warmed by a combination plenum and exhaust system of distributing heated air in the basement and first story, and by direct radiation in the rest of the building. The general arrangement, location of parts and the design of the apparatus for this purpose presents an interesting installation, including, among other things, an elaborate device for cleansing the smoke-laden air brought into the building. Both steam and electric power are obtained from sources outside of the building. Architecturally the building is also very interesting, the principal features in this regard being described in The Engineering Record of August 31.

The building is about 90 feet wide and 182 feet long and is four stories in height in part; it is occupied exclusively by the Chicago National Bank, the Equitable Trust Company and Chicago Safe Deposit Company and the attorneys for these institutions. In the article referred to a longitudinal sectional elevation of the building was given, and in the present may be found plans of the basement and of the first or main floor. The four-story portion of the structure occupies the front, extending backward from the face of the front wall about 44 feet. The rest of the building above the main floor consists of the main banking room, which is 87 feet wide, 133 feet long and 44 feet high. The four-story front portion is built of steel columns and floor beams, fireproofed, and has a flat copper-covered roof; the banking room rises to a ceiling almost entirely of crystal glass in panels about 4 feet square, slightly ornamented. The roof above this is of saw-tooth skylights, enclosing considerable space above the ceiling. Both sides of each tooth of the roof is glazed with wire glass, and it is the intention to use canvas shades under the glass on the south exposure in case it is found that the sun's rays penetrate. Other than a brief reference to the room arrangement as indicated in the accompanying plans, it will be unnecessary in this connection to go into a detailed description, which is given in the article mentioned.

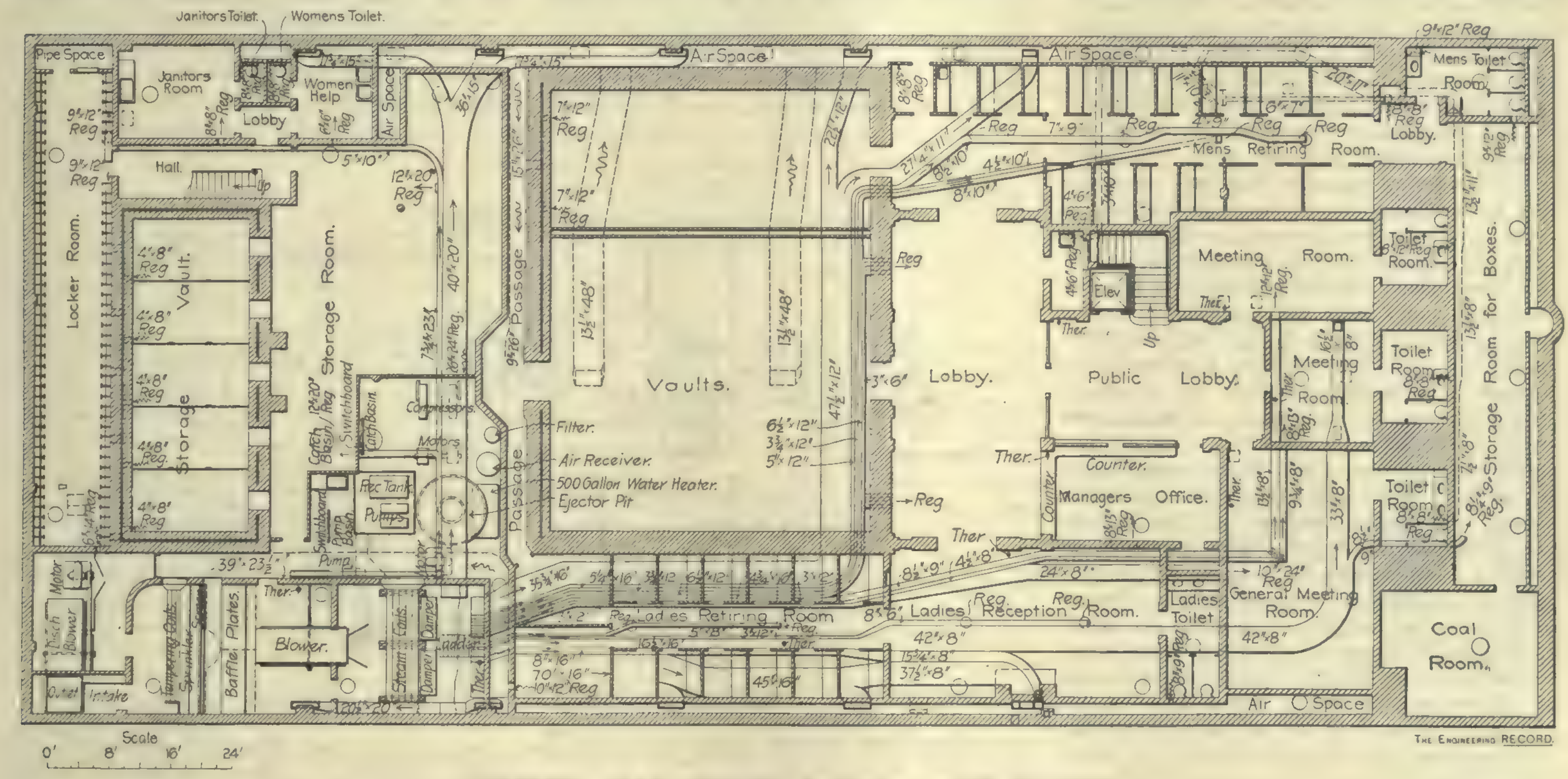
The main entrance is in the center of the front facade, which faces the north, and opens upon a hall on one side of which is located the savings bank and on the other private rooms of the bank and a stairway and elevator rising through the building to the other floors. All this portion of the floor space is comprised in the four-story part of the building, and all the space to the rear is devoted to the main banking room. As shown, this has a public space 41 x 92 feet in size, reached at the end of the hall and enclosed by the working counters of the bank. In the rear are the main vaults, forming a structure three stories in height, extending from the basement. Back of the vaults is a large toilet room for the employees of the bank.

The basement is devoted largely to offices for the safe deposit business, and contains also a large locker room underneath the main toilet room on the floor above. The heating apparatus occupies, including the room for the pumping machinery, about 1,715 square feet of floor space. Throughout the building considerable attention has been paid to providing for all the daylight possible, and half of the ceiling of the savings bank is glazed, as is also the ceiling of the president's office. The second and third floors contain thus only the stairway and elevator hall, and a long room extending across the front of the building. On the fourth floor this space is divided into two dining-rooms, one for the officers and the other for the clerks of the bank, with a steam kitchen in between. The kitchen and the various closets adjoining have skylights in the ceiling.



FIRST FLOOR PLAN, CHICAGO NATIONAL BANK BUILDING.

The air is admitted into the building through louvered openings several feet above the roof level, at a point immediately back of the four-story part of the building and at the east wall. The air inlet is a copper stack formed of a steel framework covered with copper, and the method pursued in locating it was very interesting. The building is lower than those surrounding it, and the smoke from them, swirling into this depression, made it necessary to be cautious about locating the inlet. Daily observations of the smoke were made for about thirty days, and it was found that the middle portion of the east wall under almost all conditions of the atmosphere and any direction of wind, was practically free from smoke; and the intake was accordingly located at that point. From the intake the air is carried backward in a horizontal duct in the attic space, to a vertical fresh air shaft, which drops to the blower in the basement and alongside which rises an exhaust flue carrying the discharge from the exhaust fan to the atmosphere. The horizontal duct is about 40 square feet in cross-section; one side is the wall of the adjoining building; the top is of concrete and wire lath covered with copper, and the bottom is of corrugated iron strong enough to support the weight of a man.



BASEMENT PLAN, CHICAGO NATIONAL BANK BUILDING.

At the basement the fresh air shaft opens into a chamber from which the air passes in turn through tempering coils, the air-washing apparatus, the blower, heating coils, and then into the various ducts. The duct system is of the type in which the air for all the rooms warmed by the air supply is carried in independent ducts at a temperature regulated for the room in question by means of mixing dampers at the mouth of the duct. The mixing chambers are located immediately beyond the heater. The tempering coils have the double office of maintaining only a relatively low temperature in the cold portion of the air mixed, so that drafts are less liable to occur with sudden closure of the mixing dampers against hot air, and of preventing freezing in the air-washing apparatus. There are four tempering coils, of the Waters' base pattern, made of 1-inch pipe; they measure 6 feet 6 inches from top of base to bottom of return bends, are four pipes wide and contain 126 pipes each, tested for 10 pounds pressure. The intake is provided with a shut-off damper and an opening from the basement, so that at night in cold weather the air in the building can be circulated.

Next in the path of the incoming fresh air, as indicated in the accompanying drawings, is the air-washing device, which consists of top and bottom lines of spray pipes of 1¼-inch brass pipe having brass tees with ¾-inch outlets spaced 2 inches apart. Each outlet from the tees has a knife edge flat-spray nozzle attached, this being adjustable as to the density of the water curtain. The spray pipes are supported by brass hangers and brackets. Fifteen inches back of the sprinkler is located a brass-wire screen of ¼-inch mesh. The screen is secured in place in a 1-inch angle-bar frame and has four brass stiffening rods extending from top to bottom to prevent the screen from bulging, the brass wire cloth being secured to the stiffeners every 12 inches. Three feet beyond the brass screen is an Acme water eliminator, which is an arrangement of baffle plates built of 16-ounce copper, installed under a guarantee to give 98 per cent. extraction with an average humidity of 75 to 85 per cent. between eliminator and heating coils beyond, the purpose being to establish an average of 65 to 70 per cent. humidity in the ducts and building.

The sprays and eliminator drain into a 3/16-inch steel-plate basin set on a concrete foundation 16 inches deep. This is divided by 3/16-inch steel partitions, the tops of which are at different levels, so as to allow the water to run over them from the two settling chambers under the apparatus described into a third or clear-water section, the arrangement being to prevent dirt from being carried into the pump which supplies the sprays and which draws water from the third section, using the water over and over again. The pump for this purpose is driven by belt from the shaft of the fresh-air blower. It has a 2½-inch suction from the third section mentioned and a 2-inch discharge pipe to the spray fittings. A floor of galvanized iron is fixed immediately below the eliminator, forming to the drain basin a sort of cover which pitches toward the sprays and screen, where the drain basin is open. The third or suction chamber of the drain basin has a ball cock on a water pipe to supply automatically any deficiency of water that may take place.

Immediately beyond the eliminator is located the blast fan or blower. This is of the steel plate three-quarter housing type, diameter of wheel 102 inches, width of housing 54 inches, inlet opening 73 inches in diameter, and outlet opening 54 x 57 inches. The fan shaft, which, as stated, is driven from an electric motor, which is of 25 horse-power capacity, belt connected, has two 7-inch pulleys, one loose, from which the pump for the washing device is run. The fan, as shown, is set in the middle of the space behind the eliminator and discharges into a chamber which is otherwise separated from the fan chamber. An interesting point in this connection is an arrangement to spread out the air coming from the fan over the whole area of the path of air flow. This is provided for in two deflectors attached to the outlet of the fan, one tending to send a portion of the air toward one side of the chamber and the other tending to send another portion of the air toward the other side of the chamber. This fan and the exhauster were built by the Andrews & Johnson Company, of Chicago.

Closely behind the blower, that is, next encountered by the incoming air, are the heaters. These are of the usual construction, similar to the tempering coils, but are supported above the floor to provide for a by-pass about 2 feet high. From the floor of the heating coils proper to the various ducts is an inclined floor or partition separating the hot-air chamber from the tempered air chamber, the latter being the space reached through the by-pass under the heater. The various deflector-dampers in this connection, as well as the mixing dampers at the mouths of the small distributing ducts, are shown in the accompanying cross-section through the apparatus. The division between the tempered and hot-air chambers is formed of No. 24 galvanized iron in two thicknesses, stiffened with angle bars and set about 1 inch apart and filled in between with magnesia. An iron step ladder leading from the floor of the tempered-air chamber provides access through an opening in the partition, the door being similarly constructed of two thicknesses of iron and made air-tight by means of rubber. The apparatus thus described, from the point where the air is received from the fresh-air down shaft to the various distributing ducts, is all inclosed by a hollow brick wall. Doors in these walls are also constructed of two sheets of galvanized iron with a magnesia filling.

The run of ducts is shown in the basement plan. All ducts passing in the same direction are carried closely together, as far as possible. In addition to the mixing dampers, there is also in each main duct leading from the heating chamber, in each branch and in all fresh-air flues, a volume damper for controlling the amount of air delivered through each duct. The outlets from the ducts and flues are provided with galvanized-iron air deflectors for distributing the air over the face of the register openings and deflectors for directing the air into the rooms in the desired directions. Registers in the main rooms are of bronze. The inlet or blast openings into rooms are near or in the ceiling in the basement and in the side walls from 7 feet 6 inches to 14 feet from the floor in the first story. All exhaust openings are near or in the floors.

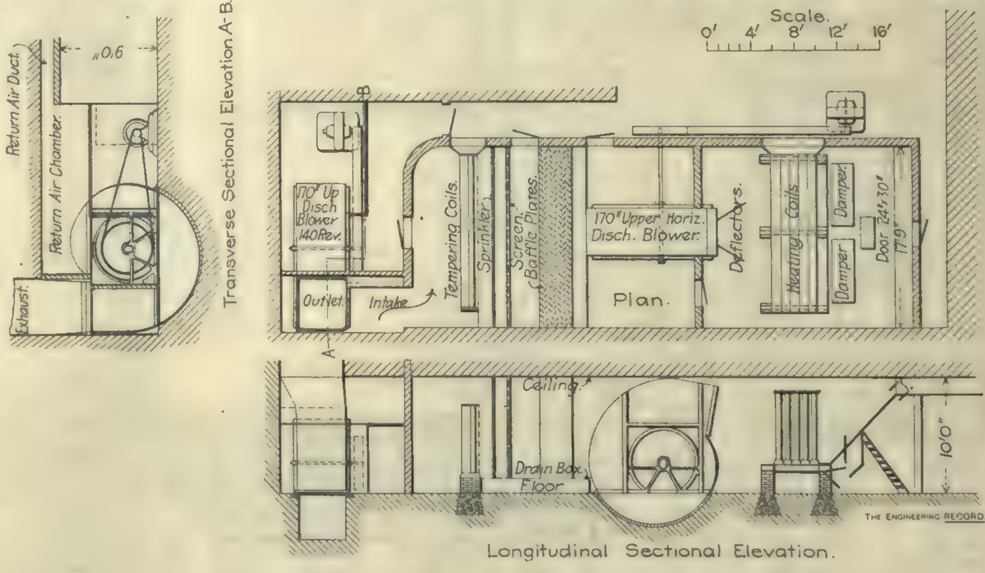
Temperature regulation is largely automatic, the principal rooms each having a thermostat which operates by means of compressed air the mixing dampers at the hot and tempered-air chamber. The main banking room is supplied from four main ducts, and there are accordingly four thermostats in that room operating as many mixing dampers. There is also a thermostat below the inclined platform between hot and tempered-air chambers, to control the tempering dampers, and also two thermostats in the tempering chamber between tempering coils and washing device, these to control the steam supply to the tempering coils, so that steam will be turned into one section of the coils when the temperature drops to 60 degrees Fahrenheit, and into the remaining section when the temperature drops to 55 degrees. The compressed air is supplied from a pair of compressors in a separate room of the basement, the compressors to maintain in a storage reservoir a minimum pressure of 15 pounds per square inch for use with a Shone sewage ejector, as well as for the temperature regulation system. The piping system for this purpose was guaranteed to remain tight under an air pressure of 20 pounds.

The accompanying table shows some figures on which the proportions of the plant are based. In the smaller rooms, or those where the inlets are preferably at heights that give rise to easily distinguishable drafts, unless care is employed, the velocity of the air through the register openings is 400 feet per minute. In rooms where the occupation is one against which this requirement does not bear much weight the velocity is 500 feet per minute. In the storage room in the front part of the basement the velocity is 700 feet per minute, and in the banking room, where the inlets are 13 or 14 feet above the floor, the velocities are 1,400 feet per minute. The blast fan was installed to move 42,089 cubic feet of air per minute, when run at 135 revolutions per minute, and the exhaust fan, it may be mentioned, is of the same capacity.

Register Velocities and Delivery in Various Rooms.

Rooms.	Reg. Veloc. Ft. per min.	Total Air. Cu. ft. per min.
Locker	400	294
Janitor	400	113
Storage	500	1,025
Ladies' Ret'g	500	558
Ladies' Recpt	400	423
Men's Retg	500	768
Lobby	400	441
Meeting	400	227
Meeting	400	157
General	400	450
Manager	400	193
Box Storage	700	183
Main Bank	1,400	31,189
President	400	284
Directors	400	709
Hall, 1st Floor	500	734

The exhaust of the more or less vitiated air is brought about in an interesting manner. In the main banking room it passes out through floor registers between the pilasters in which are the fresh-air registers and underneath the check desks in the center of the public space. The air distribution in the main banking room is thus one in which the air is admitted at high velocity from opposite sides of the room and is allowed to escape through openings spaced along those walls at the floor and in the center of the room also at the floor. Along each side of the basement a large space has been left to act as a duct into which to lead the exhaust air, and into this the floor registers give direct opening. The exhaust registers in the center of the banking room floor open into ducts which are carried over the deposit vaults to this space, as shown in the basement plan. The exhaust air spaces are all connected to an exhaust air chamber, from which the air enters a centrifugal exhauster and is by that means discharged up a shaft leading to the atmosphere alongside of the fresh-air shaft. One of the main connecting ways leading to the exhaust chamber is provided over the locker room, which has a false ceiling leaving 9 inches clear above it. All the vaults are ventilated. In the safe deposit vault the exhaust duct is on top of the wall boxes, and the front is formed by a perforated bronze cornice. The duct is connected at the rear door with the general exhaust system by means of a hinged section of duct which may be dropped out of place when the vaults are closed.



Plan and Elevations of the Ventilating Apparatus.

The exhaust fan is a 170-inch three-quarter housing fan with an up discharge. It is driven by belt from a 25-horse-power electric motor which is enclosed in a motor room within the exhaust chamber, this room formed of the double galvanized partitions with magnesia filling and running up within about 4 feet 3 inches of the ceiling. The exhaust shaft from the exhaust fan is built of No. 18 galvanized iron, anchored to the brick wall on one side and fastened to the steel work of the building on the other. A few feet above the roof it discharges into the atmosphere, its top having a copper hood. In the attic, however, there is a damper which can be operated from the basement, by which all the air can be delivered into the attic and passed out through globe ventilators in the tops of the ridges of the saw-tooth roof, 21 globe ventilators, 20 inches in diameter, in all. A part only of the air may be discharged this way, and the purpose is to allow the air in the attic to melt the snow on the glass of the roof.

Steam for the plant, which includes that for heating the building, for heating water and for heating kitchen utensils, is obtained from the plant of the Illinois Maintenance Company in a neighboring building. The condensation is collected into a receiving tank set in a steel pit below the basement floor and returned to the Illinois Maintenance Company's plant by two electric triplex pumps. Cold water for the upper stories and cold water for the hot-water heater is also furnished by this company, while the water for the basement and first stories is taken directly from the city mains. Both service pipes are provided with meters, as is also the hot-water supply from the heater. The specifications required that the temperature in all the rooms of the building should be maintained at 72 degrees Fahrenheit between 8 A. M. and 10 P. M. on each day of the heating season, which is stated to include that period dating from September 15 of one year to April 15 of the year following. The rest of the day during the heating season is to be maintained as about 50 degrees temperature and at no time to drop below 45 degrees. The steam for cooking in the kitchen in the fourth story has to be furnished at a pressure of at least 20 pounds between 10 A. M. and 3 P. M.

The steam pipes supplying the building enter it near the southwest corner, an 8-inch main for the heater coils, a 5-inch main for the direct radiation in the building and 1½-inch main for the steam to the kitchen, together with a 2½-inch return pipe for the condensation from the heating system and a 1-inch return for the condensation from the kitchen apparatus. The total amount of direct radiating surface amounts to about 1,800 square feet. The pit in which are the pumps and receiving tank is of 5/16-inch flange steel and 3 feet deep. It rests on 9 inches of concrete in a bed of cement grouting on top of the concrete. The receiving tank is 30 inches in diameter and 5 feet long, built with ¼-inch flange steel shell and designed to withstand a static pressure of 125 pounds per square inch.

The electric current for lighting and for the fan and various pump motors, for the electric elevator, which is of the Winslow manufacture, and, it may be mentioned, has its machinery located at the top of well, as there was no room in the basement, and electric current for the air compressors, is furnished by the Chicago Edison Company. The standing desks in all clerks' working rooms are lighted by special standards with cord connection to plugs in the side walls. All telephone, telegraph and bell wiring is run in conduits and floor plugs are provided under tables and desks and the wires run in conduits concealed in the desks.

The building was erected from the plans of Messrs. Jenney & Mundie, of Chicago. The contractors for steam heating were Messrs. F. W. Lamb & Company, and for the ventilating apparatus, the Andrews & Johnson Company.

LETTERS TO THE EDITOR.

THE FAIRHAVEN WATER TOWER FAILURE.

Regarding the failure of our standpipe I will say that the occurrence was accompanied by no undue circumstances, there being no wind at the time and the tank not full by some eight or nine feet. [See The Engineering Record of November 16.] There is no certainty of what did happen, but my opinion is that one of the seams in the V bottom opened suddenly, dropping an immense volume of water through the 100 feet of space to the ground, which washed away the capstone under one of the twelve legs. This left the leg hanging, and the rush of water was sufficient to break the channel irons which formed a hook about the strut system, leaving the other legs not properly supported, and the whole mass with a twisting motion came crashing to the ground. This is about all there was of it from our point of view.

Yours truly, Joseph K. Nye,
Fairhaven, Nov. 15. Pres. Water Co.

THE INTERDEPENDENCE OF SANITARY WORKS.

Sir: In his remarks on the "Interdependence of Sanitary Works," published in your issue of November 9, Mr. Croes treats of a subject which, while trite to the sanitary engineer, is by no means so to the public, and which cannot be too often repeated and enforced, on account of its importance and the degree to which it is neglected.

The erroneous opinion seems to be very general that a water supply and a sewerage system are two distinct and separate things, quite independent of each other, and as having, indeed, opposite functions, the conduits in one case containing pure water, and in the other sewage. In reality they form two ends of a single system, connected, by the art of the plumber, within the houses and other buildings of the town in which it is laid. The sewer is merely the prolongation of the water mains, and the water which flows through the latter into the house is therein transformed, as in a laboratory, into sewage and leaves it as such, by the former. I am speaking now of sewers proper, devoted exclusively or principally to the conveyance of sewage, rather than of storm water. In these sewers, what I have just written is so much the case, that the best datum for the calculation of sewer capacity is the amount of water supply consumed.

Mr. Croes expresses the belief that of the five hundred and more towns in this State provided with public water supplies, only a small proportion have sewerage systems. It is almost certain that in all or nearly all cases the water supply came first. In point of fact, this is beginning at the wrong end, and the question reminds one of the problem whether you should buy the horse before you build the stable, or build the stable before you buy the horse. Still, as few public improvements are ever made until they become imperatively necessary, it is probable that communities will long continue to buy the horse first. The flooding of cesspools and other inconveniences will, sooner or later, lead to the building of the sewers.

The principal engineering and sanitary problem involved in the design of a system of sewers, is the disposal of the product. The ideal method of disposition is to get quit of it once for all, by casting it into the sea or into some powerful river. This ideal can only be realized when the physical geography of the district permits. Otherwise the purification of the effluent is necessary, and should be, and in at least one State is, compulsory.

Mr. Croes very properly rejects the idea that water can be made "as free as air." The water itself may be, but under the most primitive system of supply you must at least pay for a bucket to bail it out with.

Very striking are the facts regarding the waste of water, which Mr. Croes gives. Probably the cheapest way to double the water supply of very many of our American towns would be to halve the waste, by the universal application of meters.

E. Sherman Gould.
Yonkers, N. Y., Nov. 11.

THE DESIGNS OF FACTORY BUILDINGS.

Sir: Owners of factories and other large plants when contemplating building, have to decide whether or not it is more profitable to employ an architect or engineer, or to make the plans themselves, or to have them made by the contractor. In numerous cases it has been shown that architects have saved their clients far more than the charge for their services, and at the same time improved the character of the building. A building recently erected by the Lester Piano Co. as an annex to its factory at Lester, Pa., is a case in point. Our firm was informed that bids had been received from contractors for a new factory building, and a member of the firm called on the treasurer of the company to inquire why we were not retained to prepare the plans for this work, as we had been retained in the past. It was explained that in this case it was believed an architect's services were unnecessary, as the plans had been made by a competent builder under the supervision of a mechanic in the company's employ who understood its needs. Several bids had been received and it was considered bed-rock prices had been secured and the amount of the architect's fee had been saved.

After examining the plans we offered to design a building which should be as good or better and be enough cheaper to pay our fee from the amount saved over the cost of the original design, and on this basis were commissioned to undertake the work. The owners intended to have a very strong two-story 63 x 141-foot brick building, for which the lowest bid received had been $12,450.

The building, as originally designed, had sixteen columns about 16 feet apart in two rows 20¼ feet apart. They supported trussed rafters in transverse bents, and two lines of 8 x 14-inch longitudinal girders in the first and second floors and in the ceiling. The ends of the floorbeams were so supported by the side walls between the windows as to produce eccentric loads. The lower ends of the columns were seated in countersunk cast-iron base plates on granite caps on brick piers 8 feet high. The longitudinal girders of the ground floor supported transverse 3 x 12-inch joists 12 inches on centers, of about 20 feet span, which were covered by ⅞-inch matched maple floor boards. The columns were made in single-story sections capped with 6 x 8-inch longitudinal corbels 4 feet long, which supported the 8 x 14-inch second floor longitudinal girders, which were butt jointed over them at every second or third column and continuous between. The 8 x 12-inch transverse beams, 5 feet 4 inches on centers, were laid across the girders and covered with 3-inch splined hemlock plank and 1¼-inch matched boards. The second-story columns were seated on the top of the longitudinal girders, and the third-story columns were seated on the transverse ceiling beams, the center portions of the rafters which were tied together with 2 x 10-inch horizontal planks at the column tops. The rafters were notched over the tops of the side walls. The first-story walls were 13 inches thick, and the first and second floors had capacities of 125 pounds and 66 pounds per square foot respectively.

Our firm arranged the columns as in the contractor's design, and seated them on stone piers. The tops of the first-story columns fit into sockets in cast-iron cap plates which support 12 x 16-inch yellow pine longitudinal girders, butt-jointed over each column center and spliced with two side planks bolted on. The second-story columns are seated on the longitudinal girders, and the 10 x 14-inch transverse beams which abut against them are tied together across their faces by pairs of iron side straps and are supported on top of the girder-splice planks. Intermediate transverse beams are placed midway between the columns, and the floor of 3-inch hemlock plank covered with 1¼-inch maple boards has a capacity of about 225 pounds per square foot. The second-story colums are capped with short 6 x 8-inch corbels flatways, which support the 8 x 12-inch longitudinal girders with butt joints and no end tie plates.

The first floor has 1-inch maple surface, laid on 2-inch hemlock planks on 3 x 6-inch sleepers 4 feet apart, laid on 6 x 12-inch continuous concrete flooring. The floor planks were bedded in composition to protect them from moisture and give them bearing on the earth fill. All columns, beams and girders are of yellow pine. The brick walls are 18 inches thick in the first story and have 8-inch arches over all window and door openings. The windows have brick sills, and the outer ends of floorbeams and rafters take bearings in the centers of the piers between the windows which occupy fully half the wall space.

The lowest bidder on the original plans made a revised estimate on the architects' plans and reduced his original bid by $1,006. Afterward a conference was held with a representative of the insurance companies and additional modifications were adopted to secure lower rates. The cost of these additional changes was about $1,000, thus amounting to the sum which had been saved by the other changes in design. The dimensions and general arrangement and style of the original plans were retained in the new design, and the increased strength and reduced cost were obtained entirely by the more scientific use of material. Much less timber was used than was at first required, but it was used more advantageously, more efficient details were made, and greater efficiency was obtained in construction. If the building had been designed no stronger than before, a much lower bid would have been obtained.

The new design provided slow-burning construction throughout, and after the building was completed and the insurance rates adjusted it was found that the saving in premiums amounted to $600 annually on the $100,000 policies carried on the building and contents. At six per cent. interest this saving represents a capitalization of $10,000, a sum nearly equal to the cost of the building. If the special features adopted after the revised estimate was made had been omitted at a saving of $1,000, the reduction in premiums would have still been about $300. At five per cent. our fee amounted to $625, which was more than saved in the difference between the original and revised bids, and which is very nearly saved every year by the reduction in the insurance rates.

Hales & Ballinger.
Philadelphia, Nov. 15.

Personal and Obituary Notes.

Mr. Walter Melius has been reappointed city engineer of Albany, N. Y., and Mr. Charles M. Bissell commissioner of public works.

Messrs. John H. & Wilson C. Ely, of Newark, have been awarded the first prize in the final competition of designs for the city hall of that place.

Mr. Robert P. Woods has resigned the office of city engineer of Wabash, Ind., to take charge of the engineering work on some electric railway construction in the vicinity.

Mr. B. J. T. Jeup has opened an office for general civil engineering practice in the Indiana Trust Co. building, Indianapolis, of which place he was city engineer until recently.

Mr. Frank E. Shedd, chief engineer of Lockwood, Greene & Co., Boston, states that the large practice of the firm will probably be continued on substantially the same lines of organization as before the death of Mr. Greene, the latter's son coming in to share the work and take his father's place.

The Board of Control of Rock Creek Park in the District of Columbia has shown its appreciation of the obligation of the District to Capt. Lansing H. Beach, Corps of Engineers, U. S. A., for his efficient work as engineer commissioner, by naming the principal thoroughfare in that reservation the "Beach Driveway."

Mr. W. H. Starr, who recently resigned the work of superintendent of the Western Division of the Alton system, has been appointed superintendent of construction for the entire road, with headquarters at Chicago. Mr. W. B. Taylor has been appointed engineer of maintenance of way of the Western Division, with headquarters at Kansas City, and Mr. George Moore to a similar position on the Eastern Division.

At the annual meeting of the Engineering Association of the South at Nashville, on November 14, the following officers were elected for the next year: President, W. H. Schurman; First Vice-President, A. J. Lamb; Second Vice-President, J. W. Kendrick; Secretary and Treasurer, Howard M. Jones; Directors for Tennessee, W. F. Foster, James Geddes, E. C. Lewis and Hunter McDonald; Directors for outside of Tennessee, J. B. Atkinson, E. E. Betts and T. F. O'Brien.

Mr. Thomas L. Raymond, M. Am. Soc. C. E., who died in New Orleans on November 15, was principal assistant engineer of the Drainage Commission of that city during the last five years. He was graduated from the University of Virginia in 1874, and a few years later entered the service of the U. S. Engineer Officers on the Gulf Coast and the lower Mississippi, in which he continued until 1888, when he was appointed chief draftsman of the Board of State Engineers of Louisiana.

A few weeks ago there was unveiled on one of the pedestals of the Victoria Embankment at London a tablet in honor of Sir Joseph Bazalgette, engineer of the main drainage of the metropolis and of the embankment on which the memorial was erected. He was the first engineer of the Metropolitan Board of Works, and few of his friends expected to see him accomplish much with that body of unsavory reputation. With the assistance of John Thwaites and a few other public-spirited and able members, he managed to get along very well, however, and did much to improve the city.

The Chemical Treatment of Sewage during storms has been found to be of no practical utility at the Manchester, England, disposal works, owing (1) to the large and rapid flow at such times, (2) to the fact that over nine-tenths of the suspended solids are deposited by subsidence alone in two hours, and (3) because the later portions of the flow are highly dilute and practically unaffected, or even rendered worse, by the addition of chemicals. Experience has further shown that, as a rule, during the early morning hours what little suspended matter there may be in the sewage settles readily of itself, and the addition of chemicals has little effect, if any.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Atlantic City, N. J.—Bids are wanted Dec. 9 for furnishing cast iron pipe, as advertised in The Engineering Record.

Topeka, Kan.—Bids are wanted Dec. 11 for furnishing material and erecting a steel water tower for the Topeka State Hospital. Edwin Snyder, Sec'y Bd. Trus. of State Charities & Corrections.

St. Petersburg, Fla.—Bids are wanted Dec. 15 for $8,000 water and sewer bonds.

Lake Providence, La.—A vote has been taken in favor of the issue of $20,000 bonds for the construction of water-works and an electric light plant.

Marshall, Mo.—City Clk. A. R. James writes that an election will be held Dec. 10 to vote on the issue of $70,000 bonds for the construction of a water-works system and an electric light plant.

Hazlehurst, Miss.—This city has retained Coleman & Malochee, of New Orleans, as consulting engineers to design and supervise the construction of water-works and an electric light plant, to cost $35,000.

Jacksonville, Fla.—Water-works and improvement bonds to the amount of $400,000 were sold Nov. 15.

Plains, Mont.—J. A. McGowan, Pres. of the Plains Water Co., writes that work will begin in March, 1902, on the construction of water-works, estimated to cost $15,000.

Helena, Mont.—City Engr. Chas. W. Helmick writes that there is no immediate prospect of construction, but that when built the water-works will be a gravity system, with wooden stave conduit, and two inverted steel syphons. Estimated cost, $600,000.

Utica, N. Y.—On Nov. 15, 1901, the Whitestown Water-Works Co., of Whitesboro, N. Y., which owns valuable water rights on Fish Creek, secured a franchise, giving it the right to lay pipe, etc., in the city of Utica, and proposes to begin at once the construction of necessary plant, which will embrace a large dam, about 20 miles of main, and other attendant structures. H. S. Patten. Supt. and Gen. Mgr., Utica.; W. G. Stone, Engr., Utica.

Springfield, O.—Bids are wanted Dec. 17 for $10,000 water-works bonds. R. N. Lantz, City Clk.

Milwaukee, Wis.—A plan is said to be under consideration to supply Jones Island with city water.

Florence, Colo.—City Engr. A. B. McFall writes that he has been directed to prepare an estimate of the cost of constructing a reservoir having a capacity of about 50,000,000 gals.

Walla Walla, Wash.—City Surveyor E. S. Clark writes that the water supply of South Grove Spring is to be developed and piped to the city; estimated cost, $50,000. Geo. Worley, Dacre House, Foreman in charge of work.

Marshalltown, Ia.—The City Council on Nov. 11 instructed the City Clerk to secure bids for material for 10 additional wells, for an increased water supply.

Meadville, Pa.—City Engr. W. A. Doane writes that the Council has passed a resolution to sink additional test wells somewhat nearer the present pumping station than the first wells, which were 6,000 ft. from the pumping station and from French Creek, the present source of supply.

Port Huron, Mich.—Contracts will soon be let for the furnishing of a new set of pumping machinery, capacity 8,000,000 gallons. H. Burton, Supt. of Water-Works.

Rocky Ford, Colo.—The Town Council has adopted the report of the Water Committee, which estimates the cost of establishing a central pumping station on lots belonging to the city, and laying an air pipe from downtown to well No. 2, and a sewer pipe conduit from well No. 2 to the pumping station; also for drilling a new well on the said lots at $5,360.

Yates Center, Kan.—E. T. Browning, of Kansas City, Mo., is said to be seeking a franchise to establish a water plant, estimated to cost about $50,000.

Pleasantville, N. J.—Pleasantville Water Co. has been incorporated, with a capital of $100,000. Incorporators: C. T. Leland, Howard E. Ahrens, P. D. Wanner, C. A. Campbell and others.

Huron, S. D.—The proposition to issue bonds for putting two artesian wells in Lake Byron Township is stated to have carried.

Anderson, Ind.—The Common Council on Nov. 4 ordered extensions of water mains amounting to about 2 miles, work to commence as soon as material can be procured. J. T. Knowland, Clk. of Water-Works.

Clifton, Kan.—Bonds have been voted for building a $6,000 water plant.

Boston, Mass.—See "Government Work."

Prairie du Chien, Wis.—Plans and specifications will be prepared for municipal water-works, and a special election held in the near future to vote on the proposition.

Santa Ana, Cal.—The City Board of Trustees has adopted a resolution providing that all receipts from the water-works system be used in extending said system.

Ft. Scott, Kan.—The city has offered to purchase the plant of the Fort Scott Water Supply Co. for $125,000.

Dillon, Mont.—Arrangements have been made to secure the services of an engineer to determine the best source from which to secure water for a system.

South St. Paul, Minn.—The Council is stated to have voted $10,000 bonds to install a water system.

South Norwalk, Conn.—At a recent city meeting $30,000 was voted for the improvement of the water system; an additional $10,000 will probably be voted in the near future. The Water Commissioners have been authorized to secure any rights of way for pipe line, water rights and privileges necessary for the betterment of the city's water system in the town of Wilton, and to build a dam in Wilton, purchase and lay pipe from North Wilton to city's present water-works.

Biloxi, Miss.—An election will be held Dec. 23 to vote on the issue of $40,000 bonds for water-works and an electric light plant.

Yazoo City, Miss.—Local press reports state that the Yazoo Improvement Co. proposes to issue $75,000 bonds for the improvement of its water-works and electric light plant.

Central City, Colo.—The City Council has authorized the construction of a reservoir having a capacity of 6,000,000 gallons.

New London, Wis.—According to plans and estimates prepared by Geo. C. Morgan, of Chicago, Ill., the total estimated cost of constructing water-works and an electric light plant is $45,992; of the amount, $33,681 is for the water-works.

Ontario, Cal.—Amended articles of incorporation have been filed by the San Antonio Water Co. of Ontario, which is capitalized for $1,500,000. Incorporators: Geo. Chaffey, Jr., W. B. Chaffey, J. C. Dunlap and others.

Trinidad, Colo.—Bids are wanted Dec. 16 for improvements to the water-works. Work to include constructing a tunnel 1,000 ft. long, taking up and relaying about 30,000 ft. of 12 and 14-in. cast iron pipe, furnishing and laying 1,500 ft. of 6 and 2,500 ft. of 4-in. cast iron pipe, constructing a reservoir having a capacity of from 2,000,000 to 10,000,000 gallons, furnishing all castings, specials and valves required for the above, etc. V. B. Humphreys, City Clk.

Hampton, Va.—Elizabeth County Supervisors have granted Arthur L. Osgood, of Camden, N. J., a franchise to supply water to the cities of Hampton, Phoebus and Old Point. Press reports state that a $200,000 system will be built.

Waterbury, Conn.—The Board of Public Works has approved the recommendation of City Engineer Cairns that an additional appropriation of $30,000 be made for improvements at the Branch reservoir.

Goshen, N. Y.—In a recent report as to the best method of improving the water-works, Jas. H. Fuertes, of New York City, recommended the construction of a new dam across the reservoir. This would increase the water supply 80,000 gals. per day. Estimated cost, $16,500.

Allentown, Pa.—A vote has been taken in favor of creating a debt of $225,000 to convey the waters of Schantz's Spring to the city.

Duluth, Minn.—The Council has adopted an ordinance authorizing the issue of $60,000 in bonds for the extension of water system.

Ardmore, Ind. Ter.—J. Weldon Baker and associates, of Joplin, Mo., have made a proposition to the city to construct a system of water-works if granted a franchise, the city having the right to purchase the system at the end of 10 years.

Atlanta, Ga.—Bids are wanted Nov. 27 for furnishing and putting in steam valves and fittings, such as feed and blow-off pipes, for the 3 new boilers at Hemphill Station, Atlanta Water-Works. Park Woodward, Supt. Water-Works.

Sharpsburg, Pa.—The Council has sold $30,000 bonds for the improvement of the water and light systems.

Sioux Falls, S. D.—Bids are wanted Dec. 1 for $210,000 water-works bonds. E. G. Ledyard, City Aud.

Hattiesburg, Miss.—Bids are wanted Dec. 12 for constructing a water-works system. A. Fairley, City Clk.; T. W. Nicol, Consulting Engr., Pollock Bldg., Mobile, Ala.

Houma, La.—It is stated that bids are wanted Dec. 20 for $27,000 bonds for constructing water-works. Dreux Angers, Town Clk.

Kiron, Ia.—Town Clk. W. M. Strahn writes that it is proposed to construct water-works at a probable cost of $3,000. Plans and specifications not yet received.

Troy, N. Y.—Local press reports state that the contract for furnishing 20-in. iron pipe for water extension has been awarded to Chas. Millar & Son Co., of Utica, for $17,399.

Waynesboro, Ga.—Governor Candler has approved the bill which authorizes this city to issue bonds for water-works and electric light systems.

Cincinnati, O.—Bids are wanted Dec. 24 for the completion of a tunnel and shafts for supplying water to the Western Pumping Station, as advertised in The Engineering Record.

Marlin, Tex.—The contract for a $45,000 system of water-works is said to have been awarded by the city to E. E. & A. R. Wright, Gonzales, Tex.

Floresville Tex.—A. G. Pickett has stated to the City Council that he can establish a system of water-works, supply to be taken from San Antonio River, for $15,000.

Deadwood, S. D.—The estimated cost of bringing water to this city from Elk Creek, a few miles south, is placed at about $60,000.

Danielsville Pa.—The Danielsville Water Co. has been granted a charter; capital, $10,000.

Lnchburg, Va.—W. C. N. Randolph, Supt. of Water-Works, has recommended the purchase of 2 100-H.-P. boilers, estimated to cost $3,500, and the placing of a 3,000,000-gal. water power pump, estimated cost $22,000; also the adoption of meters. The Council has voted to authorize the purchase of the boilers.

Ft. Wayne, Ind.—Local press reports state that the Special Committee on Water-Works will report in favor of the installation of a 6,000,000-gal. pump at Station No. 2, and either an air-compressor or a deep well pump battery at Station No. 1.

Colorado Springs, Colo.—Water bonds to the amount of $69,000 were sold recently.

Chicago Heights, Ill.—The Council has accepted the report of the committee which recommended the immediate purchase and installation of a vertical compound pumping engine; capacity not less than 5,000,000 gals.

Florence, N. J.—The Florence Water Co. has been chartered with an authorized capital of $50,000. The incorporators are William C. Jones, Camden; Thomas H. Birch and Ernest Watts, Burlington, and others.

Austin, Tex.—The Water & Light Commissioners have adopted a resolution providing for the selection of a committee of citizens to confer with them as to the best plan to pursue in regard to the rebuilding of the Colorado River dam. Ex-Superintendent of the Water and Light System H. C. Paterson has estimated the cost of rebuilding at $500,000.

Two Rivers, Wis.—The proposition to issue bonds for water-works and electric lights carried at the recent election.

Goldsboro, N. C.—The Committee on Water has been authorized to employ an expert engineer in order to ascertain the exact value of the water-works and electric light plants with a view to their purchase by the city.

La Grande, Ore.—Local press reports state that a company has been formed with a capital of $10,000. Pres., S. R. Haworth; Vice-Pres., N. G. Marberton; Secy. and Treas., F. E. Eulae; its purpose being to secure a water supply, probably from Morgan Lake, and to utilize the power that may be gathered in the descent with electric stations at suitable distances between the lake and the level of the valley. It is estimated that Morgan Lake, which is about 2 miles from the city, can be converted into a storage reservoir with a capacity of 2,000,000,000 gallons.

Hartford, S. D.—Bonds for municipal water-works are reported to have been voted at the recent election.

Matawan, N. J.—Bids will be received by the Water Committee until Nov. 30 for consulting engineer to make detail plans and specifications, necessary surveys, etc., for water-works and superintend work during construction in all its parts, at both a percentage and lump sum, estimated cost at about $34,000; also at what percentage work will be done exclusive of superintendence. Geo. B. Shepherd, Secy.

Cheyenne, Wyo.—Articles of incorporation have been filed by the North Platte Canal & Colonization Co. The capital stock of the company is $100,000, and its object is to build a canal 40 miles in length for the reclamation of 100,000 acres of land lying near the Nebraska line in the northern part of Laramie County.

Randolph, Neb.—Bids were opened Nov. 1, and contracts awarded as follows: Arnold C. Koenig, of Grand Island, Neb., Engr. in charge: To Stillwell-Bierce & Smith-Vaile Co., Chicago, Ill., at $928 for 5½ x 8 double-action triplex pump, with countershaft, rope drive and all materials for suction and discharge, etc., connections for installing in well 81 ft. deep. To Olds Gas Engine Wks., Omaha office, at $1,118 for 25 action brake H.-P. gasoline engine and erecting both pump and engine complete. To Beckenhauer & Mitchell, Randolph, Neb., at $2,400 for brick pumping station, engine foundations, enlarging bottom of well for pump chamber and lining entire well with brick.

Mansfield, La.—A. B. Wood, of New Orleans, Engr. in Charge, writes that the following bids were opened Nov. 6 for the construction of water-works and an electric light plant: E. J. O'Beirne, Birmingham, Ala., $12,288; G. Jaeger, Rich Hill, Mo., $12,800. The contract was awarded to E. J. O'Beirne; Harrisburg engine, General Electric generator, Walsh & Weiner boilers, Smith-Vaile pumps, Chicago Bridge Co.'s tower and tank, to be used.

SEWERAGE AND SEWAGE DISPOSAL.

Hamilton, O.—Bids are wanted Nov. 28 for constructing sanitary sewers and apputenances in portions of 3 streets in Sanitary Sewer Dist. No. 3; also in a portion of 10th St. in Storm Sewer Dist. No. 1. M. O. Burns, City Clk.

Ft. Wayne, Ind.—Bids are wanted Dec. 5 for constructing a main sewer in an alley north of Elmwood Ave., also local sewers in portions of several alleys. Peter Eggemann, Chmn. Bd. Pub. Wks.

Harrisburg, Pa.—Bids are wanted Nov. 25 for constructiong a 12 and 18-in. terra cotta pipe sewer. Geo. B. Stucker, Highway Commr.

South Norwalk, Ct.—The sum of $14,500 has been voted for sewer construction and repaving.

Hartford, Conn.—The Board of Street Commissioners has voted to ask for an appropriation of $20,000 for making a rock and dirt cut sewer trench from Franklin Ave. to the Folly Brook sewer; also for widening and deepening the latter.

Havana, Cuba.—Press despatches state that the Municipal Council on Nov. 15 unanimously voted to award to Michael J. Dady, of Brooklyn, the contract to pave and sewer Havana at his reduced bid of $10,913,858.

St. Petersburg, Fla.—See "Water."

Hutchinson, Minn.—Press reports state that L. P. Wolff, of Loweth & Wolff, St. Paul, has been engaged to prepare plans for a sewerage system.

Oswego Falls, N. Y.—It is understood that the Sewer Commission, which is composed of Dr. B. A. Loveless, John Roland and E. J. Hogan, will have a preliminary survey made for a complete sewer system.

Pueblo, Colo.—The City Council has passed the ordinance for sanitary and storm sewers.

Kansas City, Mo.—Plans are being prepared for a sewer to drain the water shed between Indiana, Jackson, 27th and 35th Sts., and empty into Gooseneck Creek. Local press reports state that this sewer is to be 7 ft. in diameter.

Sandy Hill, N. Y.—Sewer bonds to the amount of $62,500 were sold recently.

West Hazleton, Pa.—The Councilmen are procuring the right of way for the outlet of the sewer system, which it is proposed to establish in the borough.

Salina, Kan.—It is stated that bids are wanted Dec. 2 for constructing a sewer. A. W. Godfrey, City Clk.

Mt. Vernon, N. Y.—The Board of Aldermen has under consideration plans prepared by Snow & Barbour, of Boston, Mass., for the proposed sewage disposal plant, estimated to cost $100,000. Bonds to the amount of $40,000 are stated to have been sold for said work.

Auburn, N. Y.—The Common Council has determined to build sewers in Curtis Place and Fulton St.

Portland, Ind.—Bids are wanted Dec. 2 for constructing a 10-in. sewer in a portion of Corn Alley. Horace Antrim, City Clk.

Wausau, Wis.—Bids are wanted Dec. 2 for constructing a sewer in Washington St. John Patzer, City Clk.

Mapleton, Minn.—The contract for sewer construction in 3 streets has been awarded to E. I. P. Staede, of Mankato, Minn., for $5,998.

New Bedford, Mass.—In a recent report Wm. F. Williams, City Engr., submitted 3 propositions with probable costs, as follows, for discharging into Acushnet River the sewage now emptying into Clark's Cove. 1st plan—by a high-level intercepting sewer connecting with present sewers at points which will permit of a gravity flow to the outlet, $123,154; and $40,000 additional for pumping sewage of territory south of intercepting sewer; total, $163,154. 2d plan—forcing sewage into Acushnet River by the Shone pneumatic ejector system, $120,000. 3d plan—a direct pumping system requiring the collection of sewage at one point from which it would be discharged into the river by centrifugal pumps, $142,000.

Ashland, Ore.—Petitions are being circulated urging the City Council to act upon the question of constructing a sewerage system. Estimated cost, $20,000.

Coldwater, Mich.—Press reports state that Riggs & Sherman, of Toledo, have prepared plans and specifications for an intermittent filtration sewerage system. Estimated cost, $115,871.

Portland, Ore.—The Council is stated to have granted petitions for sewers in several streets.

Moorestown, N. J.—Press reports state that the following bids were opened Nov. 14 for the completion of the sewerage system: Elwood C. Worrell, Moorestown, $56,478; Harrison Construction Co., Newark, $44,090; John H. Hurley, Trenton, $42,935; David Peoples, Philadelphia, $42,011.

Warrensburg, N. Y.—The Sewer Commission has been organized, with C. F. Burhans as Chmn.; A. H. Thomas, Sec'y; and Dr. Gillespie, Treas. A preliminary map and plan of the proposed sewer system has been made by W. F. Woodward and will be submitted to the State Board of Health for approval.

Milford, Mass.—A committee, of which Dr. Geo. P. Cooke, Selectman, is a member, has been appointed to investigate regarding a new sewer system and report at the next Town Meeting.

Atlanta, Ga.—The Board of Health on Nov. 15 passed a resolution indorsing the movement for better sewers.

Irwin, Pa.—Bonds to the amount of $50,000 have been sold for the construction of sewers and for paving.

San Francisco, Cal.—City Engineer Grunsky has reported to the Board of Public Works that it is necessary to amend the report, on a system of sewerage, rendered in Oct., 1899. The present estimated cost is $5,600,000, or $1,000,000 more than the estimate of 1899.

Ft. Dodge, Ia.—Bids are wanted Nov. 25 for constructing a storm water sewer, approximately 1,480 ft. of 12-in. pipe, with 12 catch basins and 4 manholes, in First Ave. D. A. Weller, City Clk.

Portland, Ore.—City Engineer Chase has been authorized to proceed with the preparation of plans for a sewer system for Brooklyn. Probable cost, about $200,000.

New York, N. Y.—Wm. E. Welch, 665 Lexington Ave., has been awarded contract for building sewer in Broadway bet. Nagle Ave. and 181st St., etc., his total bid for which received Nov. 13 by Jas. Kane, Commr. of Sewers, was $24,784, and Wm. J. Moore has been awarded contract for sewer in Wadsworth Ave.; total of bid, $38,890. The former contract includes 3,569 ft. of 4-ft. x 2-ft. 8-in. brick sewer, and the latter 2,034 ft. of 3-ft. 6-in. x 2-ft. 4-in. brick sewer and 2,750 ft. of vitrified pipe.

Brooklyn, N. Y.—Dennis Norton has been awarded the contract for building sewers in 88th and 89th Sts., 1st, 4th, 5th Aves., etc.; amount, $25,000. The work includes 1,060, 2,430, 2,330 and 4,395 ft. of 24, 18, 15 and 12-in. vitrified stoneware pipe, respectively, 93 manholes and 25 receiving basins. The detail prices per item in the order given are $2.93, $1.96, $1.38, $1.13, $31.50 and $100.

Chicago, Ill.—The following bids (per ft.) were opened Nov. 16 for the completion of the Lawrence Ave. intercepting sewer; estimated number of feet, 8,218; 16-ft. tunnel: Jos. Hanreddy, 100 Washington St., $68; Fitzsimmons & Connell, Tutonic Bldg., $75; Nash Bros., 84 La Salle St., $71.90; Griffiths & McDermott, 145 La Salle St., $81.25.

Roswell, N. Mex.—Samuel Atkinson, Town Clk., writes that the following bids were opened Nov. 16 for furnishing all material and labor necessary for the construction of a sewer system: Matt & Roberts, Independence, Mo., $32,823; Hanley & McGuire, Topeka, Kan., $34,670; Rob't Beyerle, Los Angeles, Cal., $35,099. The work to include the following items: Pipe sewer, average cut 5 ft. 6 in.—3,000 lin. ft. 12 in., 2,640 lin. ft. 10-in., 29,240 lin. ft. 8-in.; Drainage pipe, average cut 6 ft. 6 in.—3,000 lin. ft. 8-in.; 2,640 lin. ft. 6-in.; 29,240 lin. ft. 4-in.; 8 flush tanks with 6-in. siphon; 1 flush tank with 8-in. siphon; 91 manholes; 2 artesian wells, 5⅝-in. casing; 3,800 ft. galvanized water pipe, 2-in.

Santiago, Cuba.—S. D. Rockenbach, Captain 12th U. S. Cavalry, Engineer Office, opened the following bids Oct. 21 for the construction of sewers: Bidders: A, J. B. Clow & Co., Havana, Cuba, $258,180; B, National Contracting Co., New York, $307,815; C, M. J. Dady, Brooklyn, N. Y., $172,139 (awarded); D, E. J. Chibas, Guantanamo, Cuba, $318,361. For detail bids see accompanying table.

Items.	A.	B.	C.	D.
Sewers:				
6-in., 32,000 ft......	$1.42	$1.14	$.98	$2.12
8-in., 13,000 ft......	1.56	1.28	1.18	2.20
10-in., 3,500 ft.......	1.20	1.05	.94	2.20
12-in., 650 ft........	1.50	1.65	1.50	2.60
15-in., 550 ft........	1.50	1.24	1.11	2.10
18-in., 1,120 ft.......	3.25	2.71	2.67	4.40
22-in., 350 ft.........	4.00	3.61	3.90	5.50
24-in., 1,100 ft......	4.00	4.33	4.61	6.00
33-in. br. double, 1,730 ft............	14.00	11.54	8.30	14.00
33-in. br. single....	13.50	9.30	5.30	10.00
42-in. C. I. pipe sewer, 1,442 ft..	12.50	3.70	3.75	7.00
24-in. C. I. force main, 960 ft......	3.20	2.14	1.55	6.00
Y's on sewers:				
6-in., 1,730..........	.70	.85	1.15	.42
8-in., 780............	1.25	1.26	1.62	.70
10-in., 210............	1.85	1.85	2.39	1.00
12-in., 40.............	2.50	2.11	3.04	1.25
15-in., 30.............	3.50	3.49	3.57	2.10
18-in., 135............	5.00	5.90	7.13	3.00
22-in., 11.............	9.00	9.44	11.06	4.00
24-in., 20.............	9.00	11.00	12.98	5.00
Slants on br. sewer, 100...............	.35	.70	5.00	.60
4-in. house connec., 32,363 ft............	.60	.79	.60	1.10
6-in. house connec., 3,550 ft..............	.65	.87	.72	1.30
3-in. farm tile, 5,000 ft.	.70	.20	.40	.31
Manholes, 132........	87.00	115.93	50.00	155.00
Sin. flush tanks, 89	110.00	156.24	55.00	190.00
Dble. flush tanks, 15	160.00	201.81	70.00	220.00
Ex. excav., 200 yds.	2.00	1.00	1.50	2.00
Extra con., 100 yds.	12.00	12.03	10.25	13.00
Extra broken stone, 100 yds..............	2.50	2.00	2.00	3.00
Extra sand, 50 yds.	2.50	2.50	2.50	3.00
Sheeting left in trenches, 1 M. B. M.	60.00	56.00	35.00	60.00
Pumping station...	77,000.00	144,964.40	45,851.29	71,000.00

BRIDGES.

Houston, Tex.—The Citizens of the Second and Fifth Wards have petitioned the County Commissioners to construct a bridge across Buffalo Bayou, connecting said wards.

Bay City, Mich.—Local press reports state that the Clerk of the County Commissioners has been directed to receive bids for constructing a swing span for Cass Ave. bridge.

Toledo, O.—Chas. McKinney is reported to have secured the contract for repairing Lafayette St. bridge, at $7,814.

Washington, D. C.—Press reports state that the Pennsylvania R. R. Co. has awarded the contract for the foundation and substructure of its bridge across Potomac River, at Washington, to Weand & McDermott, of Philadelphia, Pa.

Waukegan, Ill.—See "Railroads."

Port Huron, Mich.—It is stated that the City will be petitioned to construct a jack-knife bridge at 10th St.

New Brunswick, N. J.—Permission has been granted, according to press reports, to the New Jersey Terminal R. R. Co. to cross the tracks of the New Jersey Central R. R. on an elevated structure.

Rhinelander, Wis.—Bids will be received by the City Clerk, until Dec. 3, for constructing a 3-span steel bridge on present piers, across Wisconsin River, at Davenport St.

Thebes, Ill.—Plans are being prepared for a bridge to cross Mississippi River, from Thebes to Gray's Point. It is reported that the bridge is to be constructed jointly by the Missouri Pacific, Cotton Belt, Chicago & Eastern Illinois, and the Illinois Central, and as soon as plans have been completed bids for the construction will be asked.

Cincinnatus, N. Y.—The proposition to construct an iron bridge across Otselic River, at a probable cost of $6,000, carried at the recent election.

Camden, N. J.—Plans for Pine St. bridge over Cooper's Creek, have been ordered sent to the Secretary of War for approval.

Dennison, O.—The County Commissioners have decided to construct a stone arch bridge at Center St., Dennison, to replace present structure.

New Castle, Pa.—Plans have been submitted to Judge Wallace for approval, for the construction of a viaduct, which the railroads, the New Castle Traction Co. and the City and County authorities, contemplate constructing, at a probable cost of $87,000.

Mingo Junction, O.—It is stated that bids will soon be asked by the officials of the Wabash Ry. Co., for the construction of a bridge across the Ohio River, at Mingo Junction, to be 1,200 ft. long.

Runnells, Ia.—The Board of Supervisors has passed a resolution to construct a bridge across Des Moines River, near Runnells. Estimated cost, $8,000.

Bangor, Me.—The City Council has passed an order requesting the City Engineer to ascertain the cost of constructing a steel bridge, having a 30-ft. roadway, across Penobscot River, upon the present piers of the Bangor and Brewer toll bridge; also if the present piers are suitable to support such bridge; also the cost of constructing a steel bridge with new piers. The engineer has also been authorized to employ a bridge engineer to assist in the work. This order was passed in conjunction with an order recently passed by the Brewer City Council.

Plattsmouth, Neb.—Press reports state that the War Department has granted permission to the officials of the Burlington & Missouri River R. R. in Nebraska, for the construction of a double track bridge across Missouri River, at Plattsburg. Estimated cost, $400,000. I. S. P. Weeks, Ch. Engr., Lincoln, Neb.

Oberlin, O.—It is stated that the County Commissioners are considering the construction of a bridge at Morgan St.

Danville, Ill.—Press reports state that the Cleveland, Cincinnati, Chicago & St. Louis Ry. Co. will, in the spring, construct a steel and stone bridge across North Fork Creek, in Danville. The bridge is to have 2 spans and a total length of 170 ft.

Council Bluffs, Ia.—The City Council has ordered City Engr. S. L. Etnyre to prepare plans and specifications for a bridge to cross Indian Creek, bridge to be a skew, 80-ft. span, 18-ft. roadway, and 6-ft. walk on either side.

Erie, Pa.—Plans are being considered by parties interested (City of Erie, Penna. R. R. and Erie Electric Motor Co.), for an overhead crossing of the street and street railway, over the tracks of Penna. R. R. on East Buffalo Road. Length of proposed crossing, about 185 ft. in 2 spans. Estimated cost, $35,000.

Vincennes, Ind.—Bids will be received by the Board of County Commissioners until Dec. 14 for the construction and repair of 17 steel highway bridges.

Kansas City, Mo.—Geo. E. Kessler, Sec'y and Engr. of the Park Board, writes that the contract for the steel work on Benton Boulevard bridge has been awarded to the American Bridge Co., of New York, for $15,435. Local press reports state that bids received at the same time for the substructure have been rejected.

Bedford, Pa.—The Court has appointed Geo. W. Cunard, Surveyor, and S. B. Statler and M. H. Kramer, viewers, on the proposed iron bridge to cross Juniata River.

Donora, Pa.—It is stated that the Union Steel Co. will soon submit to the War Department for approval, plans for a bridge to be constructed across Monongahela River, at Donora. The bridge will require, according to reports, about 4,000 tons of structural steel.

Bridgeport, Conn.—Local press reports state that the officials of the New York, New Haven & Hartford R. R. Co. have asked bids, to be submitted at their office in New Haven, until Dec. 1, for the construction of a roller lift bridge across Pequonnock River, south of present structure.

Oskaloosa, Ia.—The citizens of Madison Township have petitioned for a bridge across Skunk River.

Brooklyn, N. Y.—Bids are wanted Dec. 5 for furnishing material, labor and plant necessary for the construction of a bridge across Newtown Creek, connecting the boroughs of Brooklyn and Queens. Estimated cost, $750,000. John L. Shea, Commr. of Bridges, N. Y. City.

Suttercreek, Cal.—It is stated that plans, specifications, etc., will be received Dec. 2 for a steel bridge to cross Sutter Creek, in the town of Suttercreek. C. L. Culbert, Clk. Bd. Co. Supervisors, Jackson.

Bement, Ill.—Bids are wanted Nov. 25 for constructing an iron or steel bridge, having a 150-ft. span, across Sugar Creek. Jas. H. Axtell, Town Clk.

Marion, Ind.—Bids are wanted Nov. 30 for constructing 4 small steel bridges. Geo. A. Modlin, Co. Aud.

Concord, N. C.—Bids are wanted Dec. 2 for constructing an iron bridge across Rocky River, on the Rocky River road. M. M. Gillon, Chmn. Com.

Brockton, Mass.—The Finance Committee has recommended a loan of $10,000 for a new bridge at Ames St. This bridge, if constructed, will be let by the N. Y., N. H. & H. R. R.

Frederick, Md.—C. C. Ausherman, Clk. to County Commrs., writes that the contract for constructing the substructure and superstructure of a 310-ft. bridge to cross Monocacy River has been awarded to C. Thos. Dougherty, of Frederick, for $14,050.

Lynn, Mass.—It is stated that plans have been prepared by the City Engineer for a bridge to cross the railroad tracks; cost estimated at about $900,000.

Reading, Pa.—The City Engineer estimates the cost of constructing approaches to the viaduct to be constructed at Front St., at $13,076.

Niagara Falls, N. Y.—The Niagara Falls & Suspension Bridge Ry. Co. has asked the Common Council for permission to reconstruct the bridge at Sugar St.

San Bernardino, Cal.—The Supervisors have granted a franchise to the Traction Co., to construct a bridge at Colton Ave.

Milwaukee, Wis.—The Finance Committee has decided to recommend to the City Council that $100,000 be appropriated to commence work on the 27th St. viaduct.

Cincinnati, O.—The City Engineer has submitted to the Board of Public Service plans and specifications for the construction of a viaduct at St. Clair St., placing the cost at about $14,947.

Montgomery, Pa.—The Court has appointed Captain Evan Russell, J. H. Rial and Frederick Leonard as viewers for proposed bridge to cross Susquehanna River, near Montgomery.

Port Huron, Mich.—Bids are wanted Nov. 30 for constructing a jackknife bridge at Military St. R. D. O'Keefe, Supt. of Pub. Wks.

Scranton, Miss.—Bids are wanted Dec. 2 for $10,000 bridge bonds. F. H. Lewis, Clk. Bd. Co. Commrs.

Covington, Ind.—Bids are wanted Dec. 13 for constructing the superstructure of an iron bridge, having 2 spans, a total length of 160 ft., across Coal Creek, in Van Buren Township. F. M. Hilderbrand, Chmn. Co. Commrs.

PAVING AND ROADMAKING.

Petersburg, Ind.—Bids are wanted Dec. 4 for constructing 24 miles of rock or gravel roads in Pike County. W. H. Scales, Co. Aud.

Wilkinsburg, Pa.—Bids are wanted Nov. 30 for $60,000 street improvement bonds. Address, Arthur Stuart, 907 Wallace Ave.

Cincinnati, O.—Bids are wanted Dec. 14 for improving portions of 3 roads in Symmes Township. Eugene L. Lewis, Co. Aud.

Indianapolis, Ind.—Bids are wanted Nov. 27 for grading and paving a portion of Pearl St. with brick. Harold C. Megrew, Chmn. Bd. Pub. Wks.

Columbus, O.—Bids are wanted Nov. 26 for paving with granite or other stone block, hard burned bricks or blocks, on portions of Wall and Hickory Sts., including the setting of a 5-in. curb and constructing the necessary subdrains and catch basins. Clarence M. Addison, Clk. Bd. Pub. Wks.

College Point (L. I.), N. Y.—Engineer Skeene, of the Queens Borough Highway Department, has completed the survey of 13th St. Estimated cost, $34,000 for asphalt, from 2d Ave. to 8th Ave., work to include 6,200 ft. of new curbing, resetting 500 ft. of old curbing, 7,100 sq. yds. of asphalt, and 7,100 sq. yds. of bedding.

Tacoma, Wash.—County Surveyor Noel estimates the cost of constructing the proposed county road across Tacoma tide flats as follows: Pile-bent, trestle work, 5,363 ft., at $2.25, $12,067; grading, corduroy and gravel, 5,217 ft., $7,825; gravel alone, 2,686 ft., $2,686; total, $22,728.

Lockport, N. Y.—Local press reports state that the bridge spanning the canal at obtuse angle with Main St. is to be paved with brick. Address Engineer J. C. Nehr, of Rochester.

Havana, Cuba.—See "Sewerage and Sewage Disposal."

Springfield, Ill.—The contract for paving a portion of Washington St. has been awarded to Neich, Patterson & Striffler for $18,000.

Spokane, Wash.—Property owners have decided that Monroe St. is to be paved with brick.

West Hoboken, N. J.—The Council is reported to have rejected all bids recently received for the improvement of Weehawken St. with block pavement, and decided to ask for new bids on asphalt paving. Lowest bid received for block paving, $5,225.

Elgin, Ill.—The contract for paving North St. with brick is stated to have been awarded to Smith, Mass & Brown, of Chicago, at $5,747.

St. Paul, Minn.—The Board of Public Works is stated to have awarded the contract for macadamizing Arcade St. to James Forrestal for $18,600. Granite will be used for dressing the street.

Beaumont, Tex.—It is stated that bids are wanted Dec. 3 for about 30,000 sq. yds. of brick or asphalt pavement or shell macadam; also for 9,000 lin. ft. of brick, stone or concrete curbing; estimated total cost, $70,000. T. C. King, City Sec'y.

South Bend, Ind.—City Engr. A. J. Hammond has been directed to prepare plans and specifications for paving Eddy and Laurel Sts. with brick and E. Colfax Ave. with macadam combined curb and gutter.

Buffalo, N. Y.—Bids are wanted Dec. 3 for paving Bradley St. R. G. Parsons, Sec'y Bd. Pub. Wks.

Joliet, Ill.—It is stated that bids are wanted Nov. 25 for asphalt pavement on 2 streets. Laverne H. Hopper, Clk. Bd. Local Improvements.

Irwin, Pa.—See "Sewerage and Sewage Disposal."

Albany, N. Y.—The Board of Estimates has authorized the issue of $195,000 street improvement bonds.

Sault Ste. Marie, Ont.—The question of submitting a by-law to the people, to provide for the issue of $30,000 or $45,000 bonds to be used for various street improvements, including granolithic sidewalks, macadamized roads, and the purchase of a crusher and steam road roller, is under consideration.

Louisville, Ky.—It is stated that bids are wanted Nov. 25 for 5,900 ft. of asphalt pavement on 3 avenues. Thos. P. Criag, Sec'y Bd. Pub. Wks.

Aurora, Ill.—Public Engr. M. G. Stolp writes that the Board of Local Improvements is acting on the question of constructing 5 miles of asphalt paving.

San Bernardino, Cal.—Bids are wanted Nov. 29 for paving certain streets. L. Allen, City Clk.

Chicago, Ill.—Bids are wanted Nov. 26 for plastering curb walls, constructing granite concrete gutter flags, granite concrete combined curb and gutter, grading and paving with asphalt on a portion of Franklin St.; also for grading and paving with blast furnace slag and curbing with sandstone on a portion of South Mansfield Ave. Address Board of Local Improvements.

Newport News, Va.—Bids are wanted Dec. 14 for paving portions of several streets with either sheet asphalt, block asphalt, vitrified clay brick or block, vitrified shale brick or block or granite. W. L. Cooke, City Clk.

Milwaukee, Wis.—The Finance Committee recommends to the City Council that $200,000 bonds be issued for street improvements.

Milton, Pa.—Mayor Krietzer is considering the paving of the principal streets; probably with asphalt.

Monrovia, Cal.—The citizens of Monrovia and Duarte are co-operating for the building of a boulevard.

Duluth, Minn.— The paving of East Superior St., a distance of 2 miles, is being considered. If vitrified brick is used the cost will be about $120,000.

New York, N. Y.—The following bids were received Nov. 12 by Jas. P. Keating, Commr. of Highways, for regulating, grading, etc., in Trinity Ave., Bronx Boro.: Owen Martin, $44,992; D. W. Moran, $61,487; Jas. Malloy & Co., $55,684; Chas. W. Collins, Webster Ave. and 166th St., $43,561 (awarded contract). The successful bid in detail is as follows: 40 cts., $1.20 and 0 cts. per cu. yd. for earth excavation, rock excavation and filling, respectively, the amounts of material corresponding being 5,250, 30,800 and 3,100 cu. yds.; $2 per cu. yd. for 175 cu. yds. dry rubble masonry; 60 cts. per ft. for 2,860 ft. new curb; 20 cts. per sq. ft. for 11,100 sq. ft. new flagging, and 50 cts. per sq. ft. for 430 sq. ft. new bridgestone.

Boston, Mass.—Mayor Hart has signed several orders for general street improvements in the suburban districts, among which are the following: Dorchester—Fayston St., $11,140; Vinson St., $9,181; Washington St., $12,357; Moultrie St., $22,716; Capen St., $13,335; Windermere Road, $7,368; Wayland St., $16,678; Milton Ave., $8,460; Dakota St., $5,837; Morrill St., $4,645; Hinckley St., $4,675; Oakwood St., $6,615; Rosemont St., $7,470; Ainsley St., $4,190; Blanche St., $10,805. Roxbury and West Roxbury—Winthrop St., $11,278; Fisher Ave., $19,658; Darling St., $4,548; Ritchie St., $17,023; Tower St., $16,775. Charlestown—Roland St., $16,560; Carter St., $1,850; Adams St., $11,315. Brighton—Snow St., $10,140; Oaksquare Ave., $9,105; Franklin St., $12,000; Brackett St., $4,295. South Boston—Bowen St., $8,764.

San Francisco, Cal.—Local press reports state that the following bids were opened recently for paving Mission St. with asphalt or bituminous rock, on a 6-in. concrete foundation, with granite curbing: *a*, curbing; *b*, asphalt paving; *c*, bituminous rock paving: Alcatraz Asphalt Paving Co., *a* $4,821, *b* $24,475; Flinn & Treacy, *a* 7,070, *c* $27,195; Union Paving & Contracting Co., *a* $6,363, *c* $25,738; Fairchild & Gilmore, *a* $5,463, *c* $30,108; Williams, Belser & Co., *a* $6,942, *c* $27,195. The lowest bid received for paving Potrero Ave. with bituminous rock with granite curbs was from the City Street Improvement Co. at $20,132.

Niles, O.—City Engr. Wm. Wilson writes that the following bids were opened Oct. 28 for asphalt paving on Church St.: V. Mango, Niles, $10,789; G. A. Gialdini, Girard, O., $10,888; Jas. McCracken, Warren, O., $11,192; Armstrong & McGlashen, Warren, O., $11,345; Davis & Caldwell, Youngstown, O., $12,530. The contract was awarded to V. Mango, his detail bid being as follows: Excavation, 32 cts.; 6-in. curb, 49 cts.; asphalt block pavement, $1.84; flag foundation, 14 cts.

Mobile, Ala.—City Engr. D. M. N. Ross writes that the contract for paving Water St. has been awarded to the Green River Asphalt Co., Louisville, Ky., for $48,201. The contract calls for 2,870 cu. yds. cement concrete in foundation; 17,224 sq. yds. asphalt pavement; 11,150 lin. ft. new straight stone curb set; 350 lin. ft. new circular curb set; also sewer construction with catch basins, manholes, house connections, etc.

POWER PLANTS, GAS AND ELECTRICITY.

Philadelphia, Pa.—Bids are wanted Nov. 29 for furnishing electric arc lights for the year 1902. Abraham L. English, Dir. Dept. Pub. Safety.

Asheville, N. C.—Ladshaw & Ladshaw, of Spartanburg, S. C., are stated to have completed plans and specifications for the construction of an electric power plant for the W. F. Weaver Power Co., on the French Broad River at Garman's bridge, 6 miles from Asheville. The plans call for a plant to cost $200,000 and for the installation of two 750-Kw. three-phase generators of 1,000 H.-P. each.

Marshall, Mo.—See "Water."

Reading, Pa.—It is stated that the People's Light & Power Co. will construct a new plant, to cost about $200,000.

Hazlehurst, Miss.—See "Water."

Delphos, O.—The Council has passed an ordinance granting H. L. Canfield permission to construct, operate and maintain an electric light and power plant.

Deadwood, S. D.—Colby & Tenny, of Chicago, Ill., have applied for a franchise to construct a gas plant at Deadwood. N. McDonough, City Auditor.

Biloxi, Miss.—See "Water."

Martin's Ferry, O.—The citizens are stated to have voted on Nov. 5 to issue $8,000 bonds for improving the electric light plant.

Lake Providence, La.—See "Water."

Hinckley, Ill.—The Town Trustees are stated to have granted permission to Frank C. Patten to construct and operate an electric light plant.

Waukesha, Wis.—Bids are wanted Dec. 1 for lighting the city by electricity for a period of 5, 10 or 15 years. Lamps to be arc lights of 1,200, 1,500 or 2,000 c. p., as may be required; also for such incandescent lamps of 16 or 32 c. p. as may be required for lighting in and about the different public buildings. Fred. A. Gaspar, City Clk.

Oneida, N. Y.—The Madison County Gas & Electric Co. of Oneida has been incorporated; capital, $200,000. Directors: Geo. S. Sheppard, of Penn Yan; Geo. M. Wilhelm, of Oneida, and others.

Bessemer, Ala.—The Council is reported to have granted a franchise for city lighting to the Birmingham Ry., Light & Power Co.

New London, Wis.—See "Water."

Frankfort, Ky.—The People's Electric Light & Power Co. has been incorporated, with a capital of $25,000, to furnish electric lights, power to manufacturers, and to establish an ice plant and cold storage house. Incorporators: John T. Buckley, Jos. Weitzel and others.

Meyersdale, Pa.—H. J. Wilmoth is stated to have purchased the plant of the Meyersdale Light, Heat & Power Co. It is reported that it will be enlarged and improved.

Los Angeles, Cal.—The Kern Power Co. has been incorporated, with a capital of $5,000,000, to manufacture electricity for light, heat and power purposes; also the acquirement of water rights, the construction of bridges and pipe lines. H. E. Huntington is reported interested.

Wellington, Kan.—City Clk. A. B. Cheever writes that on Nov. 12 it was voted to issue $15,000 bonds for an electric light plant.

Lake Placid, N. Y.—The Adirondack Electric Co. of Lake Placid has been incorporated, with a capital of $100,000. Directors: A. W. Boynton, of Keesville, and H. S. Isham, of Lake Placid.

Waynesboro, Ga.—See "Water."

San Leandro, Cal.—It is stated that bids will be received Dec. 23 for the purchase of a franchise for lighting the streets with electricity. R. E. Gray, City Clk.

Goldsboro, N. C.—See "Water."

Salt Lake City, Utah.—It is stated that the Utah Light & Power Co. will improve its gas and electric light plants. Jos. F. Smith, Pres.

Nicholasville, Ky.—The citizens are stated to have voted on Nov. 5 to issue $12,000 electric light bonds.

Two Rivers, Wis.—See "Water."

Seattle, Wash.—Press reports state that the Board of Public Works will receive bids until Dec. 7 for lighting the city for the coming year.

Yazoo City, Miss.—See "Water."

Moline, Ill.—Local press reports state that the People's Power Co. will enlarge its power station and gas plant. C. H. Deere, Pres.

Detroit, Mich.—Paul Doty, Gen. Mgr. Detroit City Gas Co., writes that bids will be received Dec. 2 for the construction of a 3,000,000-cu. ft. gas holder, and until about Jan. 1 for new 1,500,000-cu. ft. coal gas works. Estimated cost, $350,000. In addition to the above, $150,000 will be expended for extension of mains, new services, etc.

Jersey City, N. J.—It is stated that bids are wanted Nov. 26 for furnishing electric, oil and gas street lighting for one year from Dec. 1. Anthony Hauck, Chmn. Municipal Lighting Com.

ELECTRIC RAILWAYS.

Eaton, O.—Bids are wanted Dec. 2 for constructing and operating street railway route No. 2. I. N. Silver, Village Clk.

Cresco, Ia.—The Cresco & Southwestern Ry. Co. is stated to have been incorporated to construct an electric road southwest, probably to Mason City.

Baltimore, Md.—It is stated that the United Railways Electric Co. will construct an electric railway from Baltimore to Laurel. G. R. Webb, Pres., Baltimore.

Muncie, Ind.—The Chase Construction Co., of Detroit, Mich., is stated to have secured the contract to construct the Muncie, Hartford City & Fort Wayne electric railway from Muncie to Montpelier, a distance of about 32 miles.

Flint, Mich.—Geo. Silsbee, of Saginaw, is stated to have secured a franchise from Mt. Morris Township for the proposed street railway to be constructed between Flint and Saginaw.

Richmond, O.—The Council is stated to have granted a franchise to the Defiance, Ottawa, Kenton & Columbus Interurban Ry. Co.

Stratford, Ont.—G. G. McPherson is stated to be interested in the construction of an electric railway between this city and the town of Mitchell.

Davenport, Ia.—W. H. Kimball, Winnecke Bldg., is stated to have been engaged to make preliminary surveys for an electric railway to be constructed between Davenport and Muscatine.

Kansas City, Kan.—A charter has been granted to the Kansas City & Olathe Electric Ry. Co., with a capital of $1,000,000, to construct an electric railroad from either Kansas City, Kan., Argentine, or Rosedale, to Olathe. Directors: F. C. Goodwin, Kansas City; W. E. Smith, Rosedale, Wm. Lachman, Olathe, and others.

Manitou, Colo.—W. S. Stratton has petitioned the City Council for a franchise.

Woodbridge, N. J.—Judge S. D. Brown, B. L. Drummond, and others are reported interested in the construction of an electric railway to connect Perth Amboy with Woodbridge, Port Reading and Carteret.

Grand Rapids, Mich.—It is stated that the Detroit, Howell & Lansing Ry. Co. is to extend its line to Grand Rapids through Ingham, Eaton, Clinton, Ionia and Kent counties.

Cumming, Ga.—The Cumming & Buford Electric Ry. Co. is reported incorporated, with a capital of $500,000. Incorporators: R. J. Owens, Buford, Ga., and J. G. Puett, Cumming.

Paulsboro, N. J.—The Paulsboro Traction Co. is reported to be considering the question of extending its line through Gloucester County.

Union City, Ind.—The City Council is stated to have granted a franchise to the Richmond, Union City & Portland Interurban Ry. Co. to operate over the streets of this city.

New Castle, Ind.—The New Castle, Cadiz, Martinsville, Pendleton & Western R. R. Co. has been incorporated, with a capital of $50,000, to construct an electric line from New Castle to Pendleton, through Henry and Madison counties. Directors: R. H. Cooper, T. M. Reece, Wm. Hardy, and others.

Marion, Ind.—The Eastern Indiana Traction Co. is stated to have received a franchise from the Grant County Commissioners to construct a line between the east Grant County line and Gas City. Geo. T. Whittaker, of Dunkirk, Ind., is one of the incorporators.

Ft. Wayne, Ind.—Robt. H. Carnahan, Jas. H. Simonson and others, of Ft. Wayne, have petitioned the Council for a franchise to construct an electric railway in this city.

New Haven, Ind.—The Council is stated to have granted a franchise to the Ft. Wayne & Lima Electric Traction Co.

Chicago, Ill.—The Chicago & Indiana Air Line Ry. Co. is stated to have been formed, with a capital of $1,500,000, to construct an electric railway between Chicago and Mishawaka, Ind. Geo. W. Bryson, of South Bend, Ind., and Jas. Parmlee, of Cleveland, O., are among the incorporators.

Evansville, Ind.—The Vanderburg County Commissioners are stated to have granted a franchise to the Evansville & Princeton Traction Co. F. J. Van Orman, of Evansville, is one of the incorporators.

Newport, R. I.—A bill has been introduced in Legislature providing for the incorporation of the Newport & Bristol Ferry St. Ry. Co., which proposes constructing an electric railway in Newport, Middletown and Portsmouth. Incorporators, F. B. Coggeshall, Geo. G. Weaver and others.

St. Louis, Mo.—The St. Louis, Kirkwood & Manchester R. R. Co. is stated to have petitioned the St. Louis County Court at Clayton for a franchise to construct and operate an electric railway from St. Louis to Manchester.

Temple, Tex.—J. M. Carter, of Dallas, has petitioned the City Council for a franchise for an electric railway from Temple to Belton.

Rouseville, Pa.—The Council is stated to have granted a franchise to the Citizens' Traction Co. of Oil City, Pa.

Los Angeles, Cal.—The Pacific Electric Ry. Co. has been incorporated, with a capital of $1,000,000, to construct and operate 452 miles of railway in Los Angeles, San Bernardino, Riverside, Orange, Ventura and Santa Barbara counties. Directors: A. Borel and C. de Guigne, of San Francisco, and others.

Mason, Mich.—The Council is stated to have granted a franchise to the Rapid Ry. Co.

Whittier, Cal.—The Council is stated to have granted a franchise to T. E. Newlin.

Royersford, Pa.—The Council is stated to have granted a franchise to the Royersford Ry. Co., which proposes constructing a line from Royersford to Collegeville, Phoenixville and King of Prussia. Dr. C. H. Detwiler, Pres., Royersford.

Iowa City, Ia.—The Council is stated to have granted a franchise to Col. Dows for an electric railway between Iowa City and Cedar Rapids.

Massena, N. Y.—The Massena & Raymondville Electric R. R. Co. has been incorporated, to operate an electric road from Massena to Raymondville; capital, $80,000. Directors: W. J. McKinney, H. N. Warren and W. J. Patch, of Massena.

Youngstown, O.—The County Commissioners are stated to have granted a franchise to the Mahoning Valley Ry. Co., to construct, maintain and operate a line over the Albert St. extension.

Coshocton, O.—The Newark, Zanesville & Coshocton Electric Ry. Co. is stated to have received a franchise through the town.

Fremont, Mich.—A. F. Tibbits, of Fremont, is stated to have petitioned the Council for a franchise through the village for a line to be constructed from Grand Rapids to Ludington.

Paris, Ky.—The Georgetown & Lexington Traction Co. is reported to be preparing to begin a survey for an electric line to Paris.

Lafayette, Ind.—The Lafayette & Indianapolis Rapid Ry. Co. has been incorporated, with a caiptal of $250,000, to construct an electric railroad from Lafayette to Indianapolis, a distance of 75 miles. Incorporators: A. O. Behm and H. A. Taylor, of Lafayette, and others.

Paterson, N. J.—The Paterson & State Line Traction Co. is reported incorporated, with a capital of $100,000, to construct an electric railway to connect this city with the park at the Palisades at Fort Lee, via Hackensack and Englewood. Thos. A. McIntyre, of New York, N. Y., Preston Stevenson and Frank Frost, of Paterson, are the incorporators.

Ventura, Cal.—It is stated that bids will be received Dec. 7 for a franchise to construct an electric railway on all county roads, applied for by J. A. Driffill, B. S. Virden and F. O. Engstrum. Geo. E. Farrand, Co. Clk.

Belton, Tex.—The Council is stated to have granted a franchise to H. M. Carter, of Dallas, for an electric railway between Belton and Temple.

Van Wert, O.—Bids will be received Dec. 9 for constructing a railway on certain streets. H. C. Redrup, City Clk.

Fitchburg, Mass.—The Fitchburg & Leominster St. Ry. Co. will lay about 4 miles of track the coming season, including extensions and double track. Both girder and T-rail will be used. Address W. W. Sargent, Supt.

Toledo, O.—The Toledo, Hicksville & Ft. Wayne R. R. Co., of Toledo, has been incorporated, with a capital of $15,000, by Chas. P. Griffin, A. K. Detwiler and others, to construct an electric railway from Toledo through the counties of Lucas, Fulton, Williams and Defiance.

RAILROADS

Dallas, Tex.—The City Council is stated to have granted the Dallas & New Mexico R. R. Co. a right of way through the city.

Warren, Tex.—It is reported that The Warren & Corsicana Pacific R. R. is to be extended from the present terminus in Polk County, Tex., northwesterly a distance of about 225 miles. J. I. Campbell, Pres., Houston.

Blythesville, Ark.—The St. Louis, Caruthersville & Memphis, the St. Louis & Memphis and the Memphis & St. Louis Ry. Companies are reported to have been consolidated under the name of the St. Louis & Memphis. The road is built to Blythesville and Luxora, a distance of 19 miles. Frank J. Cunningham, Gen. Mgr., New Madrid, Mo.

Omaha, Neb.—A press report states that the Union Pacific R. R. Co. will expend about $2,000,000 in improvements in Omaha, including the erection of shops at a cost of $750,000. J. B. Berry, Ch. Engr., Omaha.

Ft. Worth, Tex.—The City Council is stated to have passed an ordinance granting the right of way into the city over New York Ave. to the International & Great Northern R. R. Co. J. D. Trammel, Ch. Engr., Palestine, Tex.

Cape Girardeau, Mo.—A charter has been granted to the Cape Girardeau & Northern R. R. Co., with a capital of $900,000, to construct a railroad from Cape Girardeau, Mo., to Crystal City, Mo., a distance of 90 miles. Newman Erb, of New York, N. Y., is one of the incorporators.

Waukegan, Ill.—The Chicago, Waukegan & North Shore R. R. Co. is stated to have secured a right of way into this city from the north, on the east side of the Northwestern tracks. It proposes constructing a viaduct at Glen Flora Ave.

Harriman, Tenn.—It is reported that the Harriman & Northeastern R. R. is to be extended from Petros to the Tennessee River. H. E. Rodes, Gen. Mgr., Harriman.

Yazoo City, Miss.—A charter is stated to have been granted to the Yazoo City & Western R. R. Co. to construct a railroad from Yazoo City to Riverside Junction. Incorporators: R. L. Bennett and W. A. Henry, of Yazoo City; Geo. B. Smith, of North Tonawanda, N. Y., and others.

Indiana, Pa.—It is stated that the Buffalo, Rochester & Pittsburg R. R. Co. will extend its line from Punxsutawney to Indiana. J. M. Floesch, Ch. Engr., Rochester, N. Y.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Lancaster, Wis.—The Grant County Commissioners are stated to have voted to erect a court house, to cost about $80,000.

Washington, D. C.—A press report states that the plans of A. A. Ritcher, of Lebanon, Pa., have been accepted for the Memorial Reformed Church in Washington, D. C., to cost about $90,000.

Crowley, La.—The plans of the J. Rieley Gordon Co., of Dallas, Tex., are stated to have been accepted for the $75,000 court house for Acadia County.

Covington, Ky.—The bids received for the construction of the public library in Covington are reported to have been rejected by the Trustees on Nov. 15, all being in excess of the $75,000 in the treasury to build the library. New bids will be advertised for.

Brooklyn, N. Y.—The Armory Board on Nov. 19 approved the issue of $250,000 bonds for an armory for the Second Naval Battalion of Brooklyn.

Passaic, N. J.—Peter Reid is stated to have given this city $50,000 for a public library.

Mankato, Minn.—Bids will be received by the Library Board until Dec. 17 for erecting a library. Estimated cost, $30,000.

Baltimore, Md.—Bids are wanted Dec. 4 for erecting a factory for the Maryland Penitentiary. H. S. Magruder, Archt., 710 Maryland Trust Bldg.

St. Paul, Minn.—Bids will be received by the Board of State Capitol Commissioners until Dec. 3 for fireproofing the Capitol. Cass Gilbert, Archt., Endicott Bldg.

Muncie, Ind.—The contract for the erection of a $50,000 library will be let by the city on or about Feb. 1, 1902. C. A. Budd, Chmn. Com.

Bolton, Mass.—Anna E. Whitney, of Lancaster, Mass., is stated to have given this town $10,000 for a public library.

Polk, Pa.—Bids will be received by the Secretary of the State Institution for Feeble-Minded of Western Pennsylvania, at Polk, until Dec. 11, for erecting a hospital for the Institution. John A. Wiley, Sec'y.

Lenox, Mass.—The contract for erecting the town hall is stated to have been awarded to Jas. Clifford's Sons, of Lenox, for $36,000, and Wm. B. Bull, of Lenox, received the contract for the heating, plumbing and electric wiring of same for $5,482.

Newark, N. J.—The City Hall Commission is stated to have selected the plans of John H. & Wilson C. Ely, 756 Broad St., for the proposed city hall to be erected on Broad, Green and Franklin Sts., to cost about $1,000,000.

Springfield, Mo.—Andrew Carnegie is reported to have given this city $50,000 for a public library.

Montgomery, Ala.—The plans of Frank Lockwood, Columbus Investment Bldg., are stated to have been accepted for a $60,000 edifice for the First Baptist Church. Dr. Chas. H. Stokely, Pastor.

Livingston, Ala.—A correspondent writes that a new $16,000 building will be erected to replace the Sumter County Court House recently destroyed by fire.

Green Bay, Wis.—It is stated that bids are wanted Dec. 5 for erecting a library. F. H. Martin, Chmn. Com.

Clinton, Ia.—It is stated that St. Patrick's parish will erect a $25,000 edifice. Rev. J. A. Murray, Pastor.

Niagara Falls, N. Y.—Local press reports state that the Library Board will receive plans until Jan. 6 for a public library.

Boise, Idaho.—Bids will be received by the Board of County Commissioners until Dec. 16 for erecting a jail and fireproof vault adjoining the court house. M. W. Clark, Chmn.

New York, N. Y.—Bids are wanted Dec. 4 for furnishing material and labor and erecting Fire Department repair shops, at 12th Ave. and 56th St. John J. Scannell, Fire Commr.

Chambersburg, Pa.—It is reported that J. A. Dempwolf, of York, will prepare plans for remodeling the court house at Chambersburg.

Batavia, N. Y.—The Board of County Supervisors, R. Tracy Miller, Chmn., has under consideration the proposition to build a jail at a cost of about $30,000.

Bridgeport, Conn.—Bids are wanted Dec. 11 for erecting a city hall. Hugh Stirling, Chmn. Com. on New Municipal Bldg.

Albia, Ia.—Bids are wanted Nov. 30 for erecting a township hall in Bluff Township. R. E. Canning, Township Clk.

Jackson, Miss.—Architect Wm. S. Hull, of Jackson, writes that the contract, for erecting the court house, has been awarded to C. T. Thompson & Bro., of Birmingham, Ala., for $57,000.

Johnson City, Tenn.—The following bids for furnishing materials and constructing hospital buildings at the Mountain Branch of the National Home for D. V. S., near Johnson City, Tenn., were opened Nov. 11 by M. T. McMahon, Pres. Bd. Mgrs., N. H. D. V. S., N. Y. Life Bldg., N. Y. City: *a*, entire work; *b*, electrical work; *c*, masonry, plastering, carpentry, ironwork, etc.; *d*, heating, etc.: Smith & Wilson, Bristol, Va., *a* $385,923; the Knoxville Elec. Co., Knoxville, Tenn., *b* $8,989.88; Nicholas Ittner, Atlanta, Ga., *c* $239,457; United Eng. & Contracting Co., New York City, *b* $7,564; Baker, Smith & Co., *d* $28,875; M. T. Lewman & Co., Louisville, Ky., *c* $254,733; Grace & Hyde Co., New York City, *a* $298,800; Holtzelaw Bros., Hampton, Va., *c* $235,000; E. Rutzler, New York City, *d* $35,258; Herman Probst, New York City, *a* $345,213, *c* $283,136; *J. E. Parrish, Lynchburg, Va., *a* $268,037, *c* $230,900. *Bids were all in excess of appropriation and award was for four buildings (complete) at $183,497.

Tallahassee, Fla.—The following bids are stated to have been opened Nov. 14 by The Capitol Commission for additions and alterations to the Capitol: Gilmore & Davis, Tallahassee, $67,777; Nicholas Ittner, Atlanta, Ga., $70,972; H. W. Otis, Jacksonville, $69,688; Columbia Southern Construction Co., $72,000; S. S. Leonard, $67,000; J. C. Parish, Lynchburg, Va., $65,793 (awarded); Unker & Co., $68,400.

BUSINESS BUILDINGS.

Baltimore, Md.—Baldwin & Pennington, 44 South St., are reported to have prepared plans for a 7-story brick and stone warehouse, to be erected on Liberty and Lombard Sts. for the Lloyd L. Jackson Co. Jos. W. Crook, Secy.

Benton Harbor, Mich.—C. F. Sparrell, of Benton Harbor, is stated to have prepared plans for a 5-story brick building for the Order of Patricians, to contain stores, offices and lodge rooms, to cost $40,000.

New York, N. Y.—The Wall Street Exchange Building Association has been incorporated, with a capital of $2,000,000, to erect an office building at Exchange Pl. and William St., with an "L" running through to 41 and 43 Wall St. Richard L. Edwards, Bank of State of New York, is one of the directors.

Detroit, Mich.—The plans of Al. W. Chittenden, 34 Congress St., are stated to have been accepted for the Detroit Boat Club's house at Belle Isle, to cost $50,000.

Denver, Colo.—It is stated that the Association of the Woodmen of the World will erect a $25,000 building on Tremont St.

Philadelphia, Pa.—The contract for interior rebuilding of the Merchants' Exchange at 3d and Walnut Sts., for the use of the Stock Exchange, is stated to have been awarded to W. A. & A. E. Wells, for $160,685.

Los Angeles, Cal.—R. C. Young, 427 S. B'way, is stated to have been selected to prepare plans for a 5-story hotel, 215 x 160 ft., to be erected on 4th and Main Sts., for Col. Jas. B. Lankershim, to cost about $200,000.

Kansas City, Mo.—The canning building of the Cudahy Packing plant is reported to have been burned on Nov. 15.

New York, N. Y.—It is stated that Henry Corn will erect a 12-story loft building at 476 B'way, to cost about $400,000.

St. Louis, Mo.—Eames & Young, Lincoln Trust Bldg., are stated to have prepared plans for the T. P. A. World's Fair Hotel, to be erected south of the park, to cost about $200,000.

Montreal, Que.—It is stated that bids are wanted Nov. 27 for the plumbing, heating and ventilating of a building for the Bank of Montreal. Andrew T. Taylor, Archt., 43 St. Francois Xavier St.

Vandergrift, Pa.—C. M. Schwab is stated to have given this town $50,000 for a Y. M. C. A. building.

Mason City, Ia.—It is stated that bids are wanted Dec. 11 for erecting a 2-story brick orphans' home at Mason City. J. W. Marshall, Sec'y I. O. O. F. Orphans' Home, Storm Lake, Ia.

Pittston, Pa.—It is stated that Y. M. C. A. will erect a $50,000 building.

Cincinnati, O.—G. W. Drach, Lincoln's Inn Court, is reported to be preparing plans for a 7-story business building, to be erected at 18 W. Canal St. for Sam'l W. Frost.

Chicago, Ill—It is stated that plans have been completed for the Henneberry printing house, to be erected at 552 to 558 Wabash Ave., at a cost of $80,000.

The Y. M. C. A. is stated to have purchased a site on Hermitage and Wilson Aves., upon which it is proposed to erect a building to cost $40,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

115 Christopher St, br loft bldg; c, $40,000; o, Lizzie L Chamberlain; a, E G Gollner; masons, Bohland & Alkier.

137 Hudson St, br warehouse; c, $30,000; o, Sam'l Weil; a, Louis Korn.

5th Ave & 29th St, br office bldg; c, $30,000; o, Pennsylvania R R Co; a, Wm H Brown; bldr, Ambrose B Stannard.

B'way, 33d to 34th Sts, br and stone store; c, $700,000; o, Herald Square Realty Co; a, Buchman & Fox; bldr, Geo A Fuller Co.

DWELLINGS.

Boston, Mass.—It is stated that Mrs. C. F. Sprague will expend about $150,000 in remodeling, improving and enlarging her country house in Brookline.

Villanova, Pa.—Horace Trumbauer, Land Title Bldg., Philadelphia, is stated to be preparing plans for a $100,000 residence to be erected here for Anthony J. Drexel.

Toledo, O.—Geo. Mills, Gardner Bldg., is stated to have completed plans for a bachelor apartment house, to be erected on Madison and Michigan Sts. for A. L. Spitzer.

Chicago, Ill.—John S. Woollacott, Chicago Opera House Bldg., is stated to have prepared plans for a 3-story apartment house, 100 x 475 ft., to be erected on N. Halstead and Clark Sts., to cost $100,000.

Jas. Speyer & Son, 164 La Salle St., have completed plans for an apartment building, to be erected by T. E. Ryan, on Grand Boulevard, s. of 38th St.; cost, $125,000.

Plans have been prepared by S. S. Beman, Pullman Bldg., for a residence for Nelson Morris on Michigan Boulevard and 36th St.; cost, $75,000.

SCHOOLS.

Gambier, O.—Kenyon College is stated to have received a gift of $50,000 for the erection of a dormitory.

Pittsburg, Kan.—Bids will be received by the Board of Education until Dec. 12 for furnishing material and erecting a high school manual training building at Pittsburg. A. E. Maxwell, Clk.

Great Falls, Mont.—The School Board is reported to be taking steps toward issuing $30,000 bonds for the erection of a school.

Colorado Springs, Colo.—The citizens on Nov. 11 are stated to have voted to issue $100,000 bonds to enlarge the school room capacity. Geo. Elstun, Chmn. Bldg. Com.

New Haven, Conn.—One of the Yale student dormitories, known as the Hutchinson, and owned by Frank W. Benedict, of New Haven, was burned Nov. 16.

Homestead, Pa.—The School Board of West Homestead is stated to have decided to erect a 10-room school, at a cost of $40,000.

New York, N. Y.—Plans have been filed by C. B. J. Snyder, Archt., 59th St. and Park Ave., for a 5-story brick school to be built by the city on Houston, Lewis, E. 3d and Manhattan Sts.; estimated cost, $300,000.

Merom, Ind.—B. A. Palmer, New York, N. Y., is stated to have given $30,000 to Union Christian College, located at Merom, Ind.

Cambridge, Mass.—A. H. Gould, 42 Court St., Boston, is stated to have been selected to prepare plans for a 16-room school, to be erected on Willow St., to cost about $70,000.

Stanford University, Cal.—It is stated that Mrs. Stanford has authorized Resident Architect Hodges to announce that a stone gymnasium will be built on the campus next year.

Marlin, Tex.—Bids will be received by Wm. Shelton, Mayor, until Dec. 9 for $20,000 school bonds.

West Des Moines, Ia.—Bids will be received by Proudfoot & Bird, Archts., Des Moines, until Dec. 2 for erecting the West Des Moines High School. Bids will not include electric wiring, engines and generators.

Columbus, O.—Bids are wanted Dec. 16 for erecting a school in Jefferson Township. A. A. Rhodes, Clk. Bd. Educ.

Alton, Ill.—The Board of Education, T. H. Perrin, Pres., will soon let contracts for the construction of a $50,000 high school.

Franklin, Pa.—It is stated that bids are wanted Dec. 2 for erecting the Franklin High School. Owsley & Boucherle, Archts., Wicks Bank Bldg., Youngstown, O.

Newton, Mass.—Bids will be received by Geo. H. Elder, Pub. Bldg. Commr., Rm. 10, City Hall, West Newton, until Nov. 25, for installing a ventilating and heating plant in the proposed school on Ash St., Ward 4, Newton.

Norman, Okla. Ter.—Bids will be received by the Regents of the University of Oklahoma, c|o Arthur J. Williams, Archt., Oklahoma City, until Dec. 6, for erecting a University Building at Norman. D. L. Larsh, Sec'y.

Alexandria, La.—The citizens are stated to have voted on Nov. 12 to erect a high school; probable cost, $50,000.

San Marcos, Tex.—It is stated that bids are wanted Dec. 16 for erecting a building for the Southwest Texas Normal School, at San Marcos. Joseph D. Sayers, Gov.

Akron, O.—Bids are wanted Nov. 30 for erecting Lane school; estimated to cost $35,000. F. O. Weary, Archt., Savings Bank Bldg.

Brooklyn, N. Y.—The following bids were opened Nov. 18 by the Committee on Bldgs., Bd. of Educ., New York City, for the erection of Public School No. 141, Boro. of Brooklyn: Geo. Hildebrand, $192,947; Thos. Cockerill & Son, $183,900; P. J. Walsh, $199,000; Wm. P. McGarry, $194,673; Wm. & Thos. Lamb, $174,413; H. M. Weed & Co., $193,000; Rutan & Heningham, $182,060; Alfred Nugent & Son, $177,790; John Auer & Sons, $195,000; Peter Cleary, $179,970; Chris. J. Kenny, 186 Remsen St., $172,360 (awarded); John Thatcher & Son, $191,900; P. Gallagher, $207,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Cincinnati, O.—Bids are wanted Dec. 11 for the collection, removal and disposal of garbage for a period of 5 years, from June 1, 1902; also for the collection, removal and disposal of dead animals, etc., for a period of 3 years and 11 months, from July 3, 1902. Edwin Henderson, City Clk.

Newport News, Va.—Local press reports state that bids will be received by the City Clerk until about Dec. 9 for erecting a building for the garbage crematory.

Dallas, Tex.—Bids are wanted Dec. 12 for constructing a garbage crematory of 25 tons daily capacity; also for crematory of 50 tons daily capacity. Hugh Raines, City Engr.

Sea Isle City, N. J.—Press reports state that it is proposed to erect an incinerating plant for the disposal of the city's garbage.

Jersey City, N. J.—Bids were opened Nov. 19 for sweeping, cleaning and removing all dirt, ashes and garbage from the streets of the city for the year beginning Dec. 1, 1901. The engineer's estimate was as follows: 4,000 lin. miles of streets paved with stone to be swept and cleaned, at $10 per mile; 2,000 lin. miles of streets paved with asphalt, to be swept and cleaned, at $4 per mile; 140 lin. miles of streets paved with macadam or telford, to be swept and cleaned, at $9 per mile; removing ashes and garbage for the year, $20,000. Bids received were as follows: Jas. Harrington, Jersey City, 88 per cent. of the engineer's estimate; Henry Byrne, Jersey City, 75 per cent.

GOVERNMENT WORK.

Baltimore, Md.—Bids are wanted until Dec. 16 for furnishing materials (except metal work) and labor necessary for the construction, erection and delivery of the Point No Point Lighthouse, Md.; separate bids are wanted for the metal work, as advertised in The Engineering Record.

Cincinnati, O.—Bids are wanted at the U. S. Engineer Office until Dec. 16 for constructing steel lock gates for Lock No. 9, Muskingum River, as advertised in The Engineering Record.

Portsmouth, N. H.—Bids will be received at the Bureau of Supplies & Accounts, Navy Dept., Washington, until Nov. 26 for furnishing at the Navy Yard, Portsmouth, a quantity of crushed granite, sand, cement, cast iron water pipe, pipe fittings, etc. A. S. Kenny, Paymaster-Gen., U. S. Navy.

Boston, Mass.—The following bids for laying a water main from Gallup's Is. to Ft. Standish were opened Nov. 18 by Capt. A. M. Palmer, Depot Q. M.: Geo. W. Townsend, 202 Atlantic Ave., Boston, Mass., $10,971—$25 per ton for blasting boulders and ledges that weigh over 6 tons, time required—60 days; John T. Cavanagh, Boston, Mass., $13,000.

Ft. Leavenworth, Kan.—Contracts for the construction of the new buildings at Fort Leavenworth are stated to have been let to the lowest bidders, with the exception of the heating apparatus in barracks No. 45, which was awarded to Harris & Algor instead of the Peoria Heating Co. For lowest bids received, see The Engineering Record of Nov. 9.

Ft. Banks, Mass.—Bids are wanted Nov. 28 for erecting, heating and electric wiring an addition to barracks. Address, W. W. Hamilton, Q. M.

Portland, Ore.—Bids are wanted Jan. 14 for constructing a light station at Lincoln Rock, Alaska. Address Capt. W. C. Lang, Corps Engrs., U. S. A., Engr. 13th Light-House Dist.

Washington, D. C.—Bids were opened Oct. 16 by Capt. John Stephen Sewell, Corps of Engrs., U. S. A., for furnishing and installing electric elevators in the Government Printing Office Building. Bids were received on 7 items, as follows: *a*, lifting capacity in pounds; *b*, maximum speed with maximum load ft. per minute; *c*, maximum speed with half load; *d*, maximum speed with empty car. Item No. 1—*a*, 4,000; *b*, 300; *c* and *d*, each 350: Item No. 2—*a*, 5,000; *b*, *c* and *d*, each 350: Items Nos. 3, 4 and 5—*a*, 500; *b*, 200; *c*, 250; *d*, 300: Item No. 6—lifting capacity 6,000 lbs. at a speed of 100 ft. per minute: Item No. 7—each elevator to have 2 cars, having lifting capacity of 500 pounds at speed of 300 ft. per minute, under push-button control. Bids received were as follows: *Contract awarded:

Items.	*Otis Elevator Co., New York.	Marine Engine & Mech. Co.,
No. 1	$12,400	$14,078
No. 2	39,600	43,130
No. 3	11,600	12,997
No. 4	5,900	6,641
No. 5	6,700	7,074
No. 6	2,975	3,267
No. 7	6,200	6,778
Total	$85,375	$93,965

MISCELLANEOUS.

Seattle, Wash.—Engr. in Charge W. N. Wilbur, 1328 1st Ave., Seattle, writes that the Golden Thirty Placer Mining Co. proposes to construct a dam and ditch in the Mount Baker District. Estimated cost, $10,000.

Buenos Aires, Argentine Republic.—Bids will be received by the Commissioners of the Drainage Works of the Province of Buenos Aires, for the construction work in connection with over 620 miles of main drainage canals, branch trenches and accessory works in certain regions subject to inundations. Further information may be obtained by writing to the Secretary, Argentine Legation, 16, Kensington Palace Gardens, London, W., Eng.

Natal, South Africa.—Bids will be received by the Concessionnaire for furnishing material and constructing the Durban pier at Natal. Specifications, etc., may be obtained at the office of R. St. George Moore, Inspecting Engr., 17 Victoria St., S. W., London, Eng.

Norfolk, Va.—City Treas. H. S. Herman writes that on Nov. 14 Atlantic City Ward voted in favor of issuing $480,000 bonds for public improvements.

Ottawa, Ont.—Engineering experts have reported that the cost of constructing a channel of a uniform depth of 20 ft. between Georgian Bay and Lake Nipissing, will be $4,000,000. The distance is 61 miles.

Boise, Idaho.—The State Land Board has granted a petition for a 15-year franchise for the improvement of St. Joe and St. Mary's Rivers, to the St. Joe Improvement Co., which is composed of the William Howard Land & Lumber Co., of Pennsylvania; the Menasha Woodenware Co., of Wisconsin; the St. Joe Lumber Co., of Harrison, and the Coeur d'Alene Lumber Co., of Coeur d'Alene City, Idaho. Improvements will extend for a distance of 60 miles, and the cost is estimated at $50,000.

Portland, Ore.—The Port of Portland Commission has decided in favor of the construction of a floating drydock 400 ft. long, with a lifting capacity of 10,000 tons. Probable cost, $225,000.

NEW INDUSTRIAL PLANTS.

The American Radiator Co., Chicago, is about to erect a new plant at Buffalo for making cast-iron house heating boilers. A portion of the equipment in the Detroit plant will be removed to Buffalo.

The Wellsville, Pa., Whip Co. contemplates rebuilding its plant, recently burned, in the shape of a letter E, 100 x 200 ft., with 2 stories and basement.

The Sharon, Pa., Sheet Steel Co. will erect 10 hot mills and 9 cold mills having an annual capacity of 35,000 tons.

William Bros, Minneapolis, Minn., will erect a 300 x 112-ft. boiler shop and a 40 x 100-ft. power house, in which high-pressure boilers and a 100-H.-P. Corliss engine will be installed. Hydraulic and air tools and electric cranes will also be installed.

The Gulf Coast Shipbuilding & Dry Dock Co. has been incorporated to construct a shipbuilding and marine railway plant on the Bay of Mobile, Ala., and a dry-dock and ship repairing plant at Port of New Orleans, La. The officers are: Pres., Chas. M. Jesup, New York; Vice-Pres., Cassius M. Wicker, New York; 2d Vice-Pres. & Sec'y, S. B. McConnico, New York; 3d Vice-Pres. & Treas., Rob't C. Morris, New Orleans, La.

The Paul A. Sorg Paper Co., Middletown, O., is erecting a 2-story and basement, 72 x 100-ft., addition to its plant, in which a power plant of 100 H.-P. will be installed.

C. M. Conradson, Wilmington, Del., is interested in the erection of a machine-tool plant at Warren, Pa., to include a 60 x 300-ft. erecting shop; 30 x 150-ft. fitting room; 30 x 210-ft. storeroom; 30 x 90-ft. wash room; 150 x 210-ft. machine shop; 30 x 60-ft. power house; 30 x 60-ft. forge shop, and 30 x 150-ft. tool room; all of brick and structural steel.

The British and Southern States (U. S. A.) Cattle Abattoir & Produce Co., Ltd., with $5,000,000 subscribed, has ben incorporated to export cattle and produce, erect abattoirs, canneries, freezing houses, warehouses, factories, etc. H. J. Lamar, Macon, Ga., is interested in the company.

The Advance Thresher Co., Battle Creek, Mich., is erecting 9 buildings, including a foundry; engine erecting shop; engine machine shop; engine test house and jacket room; engine paint shop; separator paint shop; paint storage building; dip room and separator erecting shop. The buildings will be equipped with induction motors and air hoists, heated by steam and lighted by electricity. There will be no addition to the power plant, as the present plant is large enough to supply power for the new buildings.

The John Smith's Sons Brewing Co., Youngstown, O., will erect an engine and boiler house with an ultimate capacity of 1,000 H.-P. and ultimate refrigerating capacity of 300 tons; the initial installation will be 500 H.-P. in water-tube boilers, 100 tons refrigeration, with auxiliary pumps, small lighting plant, etc. Contracts for all of the parts have not yet been let. The stock house is also being rebuilt, and the company is in the market for structural iron, brick, and cement. Address L. R. Whyte, Cons. Engr.

For ice plant and cold-storage house at Frankfort, Ky., see "Power Plants, Gas and Electricity."

J. S. Jackson & Son, Bath, Me., makers of tackle blocks, will erect a brick forge shop. The power will be taken from the present plant.

BUSINESS NOTES.

The Oklahoma Bridge & Steel Structural Works Co., principal office at Enid, has been chartered, with a capital of $100,000. The incorporators are: C. F. Tobin, Hillsboro, Ill.; J. L. Randall, Kansas City, Mo.; N. H. Sturgis, Guthrie, and J. P. Renshaw and J. B. Linden, Enid.

The York, Pa., Mfg. Co. has issued a booklet entitled "Some Recent Sales," giving a list of some of the plants sold by the company between Jan. 1, 1898, and Jan. 1, 1902. During the present year the company sold 96 machines of an average capacity of 80 tons.

The York, Pa., Bridge Co. expects to break ground in a few days for a 200 x 40-ft. bridge shop, with power plant in a separate building. The power plant and part of the tools have been purchased. G. W. Drury, Mgr.

The Ball Engine Co., Erie, Pa., reports receiving the following orders: Three tandem compound engines arranged for direct connection to Westinghouse generators for the Pennsylvania R. R. Co.'s Arcade Bldg., Philadelphia; a compound direct-connected engine for the electric plant of the Bisbee, Mont., Improvement Co., and an engine for M. R. Williams & Co., Piedmont, N. Y.

James Leffel & Co., Springfield, O., report the following recent sales of their steam engines and boilers: An 8 x 10 engine for Porto Rico; a 50-H.-P. automatic engine, with 60-H.-P. boiler, for flour mill in Wisconsin; an 8 x 10 engine with 25-H.-P. boiler, for hat factory at Oaxaca, Mex.; a 6½ x 10 automatic engine for an electric plant near Santiago, Cuba; a 6-H.-P. horizontal engine and boiler for a portable sawmill in Wisconsin; a 6½ x 10 engine and boiler for Barranquilla, Colombia; a 7½ x 10 automatic engine, and 3-H.-P. vertical engine and boiler, for Spain; a 7 x 10 engine and boiler for Monterey, Mex.; a 9½ x 12 automatic engine for flour mill at Decatur, Ind. The company is also installing considerable new equipment in the way of machine tools, new power plant, including a 100-K.-w. direct-connected unit, new blower system of heating, new electric traveling crane over large erecting floor, and new down-draft furnaces in connection with new blacksmith shop equipment.

A. J. Beckley, of the Perforated Screen Works, Garwood, N. J., is rebuilding the works of the Trenton Quarry Co., Trenton, N. J., and will soon cut several tunnels through the stone preparatory to the erection of additional crushing machinery in the spring. The address of the quarry is 223 Bellevue Ave.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Nov. 26.	Grand Rapids, Mich Adv., Eng. Record, Nov. 16.	Nov. 16
Nov. 28.	Hendricks, Minn	Nov. 16
Nov. 27.	Atlanta, Ga	Nov. 23
Nov. 30.	Ft. Dade, Fla	Nov. 16
Nov. 30.	Matawan N. J	Nov 23
Nov. —	West Lebanon Ind	Oct. 19
Nov. —	Farmersville, Tex	Oct. 12
Dec. 1.	Bement, Ill	Nov. 9
Dec. 2.	Fayette, Miss	Nov. 9
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 2.	Caruthersville, Mo Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Dec. 2.	San Luis Obispo, Cal	Nov. 16
Dec. 4.	Sale of pumping works, Chicago, Ill Adv., Eng. Record, Oct. 12.	Oct. 12
Dec. 9.	Pipe, Atlantic City, N. J Adv., Eng. Record, Nov. 23.	Nov. 23
Dec. 10.	Wilmington, O	Nov. 9
Dec. 11.	Topeka, Kan	Nov 23
Dec. 12.	Hattiesburg, Miss	Nov. 23
Dec. 16.	Trinidad, Colo	Nov. 23
Dec 17.	New York, N. Y	Oct. 19
Dec. 18.	Philadelphia, Pa	Nov. 16
Dec 21.	Tunnel, etc., Cincinnati, O Adv., Eng Record, Nov. 23.	Nov. 23
Dec. —	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. —	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close		See Eng. Record.
Nov. 25.	Ft. Dodge, Ia	Nov. 23
Nov. 25.	Harrisburg, Pa	Nov. 23
Nov. 26.	Pittsfield, Mass	Nov. 16
Nov. 28.	Hamilton, O	Nov. 23
Nov. 28.	New Philadelphia, O	Nov. 16
Nov. 29.	Binghamton, N. Y	Nov. 9
Nov. 29.	Glenville, O	Nov. 9
Dec. 1.	Pasadena, Cal	Nov. 9
Dec. 2.	Portland, Ind	Nov. 23
Dec. 2.	Wausau, Wis	Nov. 23
Dec. 2.	Salina, Kan	Nov. 23
Dec. 5.	Ft. Wayne, Ind	Nov. 23
Dec. 6.	Chicago, Ill Adv., Eng. Record, Nov. 16.	Nov. 16

BRIDGES.

Bids Close		See Eng. Record.
Nov. 25.	Bement, Ill	Nov. 23
Nov. 28.	Manassas, Va	Nov. 16
Nov. 30.	Marion, Ind	Nov. 23
Nov. 30.	Cincinnati, O	Nov. 9
Nov. 30.	Port Huron, Mich	Nov. 23
Dec. 1.	Bridgeport, Conn	Nov. 23
Dec. 2.	Bridge plans, Suttercreek, Cal	Nov. 23
Dec. 2.	Concord, N. C	Nov. 23
Dec. 3.	Rhinelander, Wis	Nov 23
Dec. 5.	Brooklyn, N. Y	Nov. 23
Dec. 7.	Greenfield, Ind	Nov. 16
Dec. 7.	Cincinnati, O	Nov. 16
Dec. 12.	Saginaw, Mich	Nov. 9
Dec. 13.	Covington, Ind	Nov 23
Dec. 14.	Vincennes, Ind	Nov. 23
Dec. 14.	Melan arch bridge, Des Moines, Ia Adv., Eng Record, Nov 9, 16.	Nov. 9
Dec. 14.	Steel bridge Des Moines, Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 16.	Boise, Idaho	Nov. 16
Jan. 8.	Victoria, B. C Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

Bids Close		See Eng. Record.
Nov. 25.	Joliet Ill	Nov. 23
Nov. 25.	Louisville, Ky	Nov. 23
Nov. 26.	Columbus, O	Nov. 23
Nov. 26.	Chicago, Ill	Nov. 23
Nov. 27.	Indianapolis, Ind	Nov. 23
Nov. 29.	San Bernardino, Cal	Nov. 23
Dec. 2.	Toledo, O	Nov. 9
Dec. 3.	Jeffersonville, Ind	Nov. 2
Dec. 3.	Trenton, N. J	Nov. 16
Dec. 3.	Buffalo, N. Y	Nov. 23
Dec. 3.	Beaumont, Tex	Nov. 23
Dec 4.	Petersburg, Ind	Nov. 23
Dec. 5.	Sullivan, Ind	Nov. 16
Dec 6.	Cincinnati, O	Nov. 16
Dec. 14.	Cincinnati, O	Nov. 23
Dec. 14.	Newport News, Va	Nov. 23

POWER, GAS AND ELECTRICITY.

Bids Close		See Eng. Record.
Nov 26.	Jersey City, N. J	Nov. 23
Nov. 26.	Lancaster, Pa	Nov. 9
Nov. 29.	Philadelphia, Pa	Nov. 23
Dec. 1.	Waukesha, Wis	Nov. 23
Dec. 2.	Gas holder, Detroit, Mich	Nov. 23
Dec. 2.	Lemoore, Cal	Nov. 2
Dec. 2.	Franchise, Whittier, Cal	Nov. 9
Dec. 7.	Seattle Wash	Nov. 23
Dec. 10.	Wilmington, O	Nov. 9
Dec. 23	Franchise, San Leandro, Cal	Nov. 23
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
——	Gas plant, Boonton, N. J	Nov. 9

GOVERNMENT WORK.

Bids Close		See Eng. Record.
Nov. 25.	Cable, Washington, D. C	Nov. 16
Nov. 26.	Ft. Ethan Allen, Vt Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Nov. 26.	Pawhuska, Okla Ter	Nov. 9
Nov. 26.	Portsmouth, N. H	Nov. 23
Nov. 27.	Annapolis, Md	Oct. 26
Nov. 28.	Ft. Sill, Okla. Ter	Nov. 9
Nov. 28.	Ft. Banks, Mass	Nov. 23
Nov. 29.	Htg. and vent., Kansas City, Kan Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Nov. 29.	San Francisco, Cal	Nov. 16
Nov. 30.	Slips, Norfolk, Va	Nov. 9
Nov. 30.	Bldg., New York, N. Y	Nov. 9
Nov. 30.	San Francisco, Cal	Oct. 12
Nov. 30.	Ft. Dady, Fla	Nov. 16
Dec. 2.	Htg. apparatus, Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 2.	Watertown, Mass	Nov. 16
Dec. 3.	Wiring, etc., Clinton, Ia Adv., Eng. Record, Oct. 19 26.	Oct. 19
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
Dec. 4.	Tampa, Fla	Nov. 9
Dec. 7.	Quay wall, San Francisco, Cal	Nov. 9
Dec. 11.	Milwaukee, Wis Adv., Eng. Record, Nov. 2, 9.	Nov. 2
Dec. 12.	Mobile, Ala	Nov. 16
Dec. 16	Light House, Baltimore, Md Adv., Eng. Record Nov. 23.	Nov. 23
Dec. 16.	Metal Work for Lighthouse, Baltimore, Md. Adv., Eng Record, Nov. 23.	Nov. 23
Dec. 16.	Cincinnati, O Adv., Eng. Record, Nov. 23.	Nov. 23
Dec. 17.	Creston Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 21.	Washington, D. C	Nov. 9
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23.	Nov. 23
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 14.	Portland, Oreg	Nov. 23

BUILDINGS.

Bids Close		See Eng. Record.
Nov. 25.	Heating school, Newton, Mass	Nov. 23
Nov. 26.	School, Peekskill, N. Y	Nov. 16
Nov. 26.	Court house plans, Washington, Ga	Nov. 16
Nov. 27.	Heating bank, Montreal, Que	Nov. 23
Nov. 27.	Pub. bldgs., Ottawa, Ont	Nov. 16
Nov 30.	Court house, Williamson, W. Va	Nov. 16
Nov. 30.	School, Washington, D. C	Nov. 16
Nov. 30.	Capitol plans, Harrisburg, Pa	Aug. 31
Nov. 30.	School plans, Oshkosh, Wis	Nov. [illegible]
Nov. 30.	School chapel, Waco, Tex	Nov. 16
Nov. 30	School, Marquette, Mich	Nov. 16
Nov. 30.	School, Akron, O	Nov. 23
Nov. 30.	Town hall, Albia, Ia	Nov 23
Dec. 1.	School, Dickinson, N. D	Nov. 16
Dec. 1.	Library plans, Fresno, Cal	Oct. 26
Dec. 1.	Bus. bldg. Mobile, Ala.	Nov. 9
Dec. 2.	School, Franklin, Pa	Nov. 23
Dec. 2.	School West Des Moines, Ia	Nov. 23
Dec. 2.	Jail, Crockett, Cal	Nov. 9
Dec. 2.	Court House, Hazelhurst, Miss	Oct. 19
Dec. 2.	Library, Houston, Tex	Nov. 16
Dec. 3.	Church, Richford, Vt	Nov. 16
Dec. 3.	Fireproofing Capitol St. Paul, Minn	Nov 23
Dec. 4.	Public Building, New York, N. Y	Nov. 23
Dec. 4.	Public Buildings, Baltimore, Md	Nov. 23
Dec. 5.	Library, Green Bay, Wis	Nov. 23
Dec. 6.	School, Norman, Oklahoma Ter	Nov. 23
Dec. 11.	Business Building, Mason City, Ia	Nov. 23
Dec. 11.	City Hall, Bridgeport, Conn	Nov. 23
Dec. 11.	Hospital, Polk, Pa	Nov. 23
Dec. 12.	School, Pittsburg, Kan	Nov. 23
Dec. 16.	School, San Marcos, Tex	Nov. 23
Dec. 16.	Jail, Boise, Idaho	Nov. 23
Dec. 16.	School, Columbus, O	Nov. 23
Dec. 17.	Library, Mankato Minn	Nov. 23
Dec. 20.	Court house, Des Moines, Ia Adv., Eng. Record, Nov. 16	Nov. 16
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
Feb. 1.	Library, Muncie, Ind	Nov. 23

MISCELLANEOUS.

Bids Close		See Eng. Record.
Nov. 25.	R. R. tunnel, Philadelphia, Pa Adv., Eng. Record, Nov. 16.	Nov. 16
Nov. 25.	El. Ry. power house, Tribes Hill, N. Y	Nov. 9
Nov. 26.	El. Ry., Celina, O	Nov. 9
Dec. 2.	Electric railway, Eaton, O	Nov. 23
Jan. 6.	Library, Niagara Falls, N. Y.	Nov. 23
Dec. 7.	Electric Railway franchise, Ventura, Cal.	Nov 23
Dec. 9.	Garbage building Newport News, Va	Nov. 23
Dec. 9.	Electric railway, Van Wert, O	Nov. 23
Dec. 11.	Garbage disposal, Cincinnati, O	Nov 23
Dec. 12.	Garbage Crematory, Dallas, Tex	Nov. 23
Dec. 31	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Mar. 31.	El Rys., Rockhampton Australia	Nov. 2
——	Drainage work, Buenos Aires, Argentine Republic	Nov. 23
——	Pier, Natal, South Africa	Nov. 23

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Compressive Strength of Masonry.

Although masonry is the oldest of the materials employed in engineering construction, it is probably that of which engineers possess the least certain information as regards carrying capacity. This is due to a number of reasons. The processes by which either iron or steel are produced in any of their many grades are under accurate control, so that the quality of the finished product is predetermined within very narrow limits. This is true not only of the chemical composition of the structural metals used by the engineer, but also of their physical properties.

The case is altogether different with even the best of the natural stones used by civil engineers, and almost equally true of the artificial stones. Both granite and limestone of the best grades are exceedingly variable in their physical resisting qualities as well as in their texture and frequently in their chemical composition. For this condition of things there is no help. Uncontrolled heat and other geologic agencies have been active in the formation of the natural ledges of granite, limestone, sandstone and other rocks available for structural purposes, with a range of results so wide that probably by far the larger portions of any rock nominally available must be considered waste, or, at any rate, unsuitable for structural purposes.

The case for artificial stones is somewhat better, but they are by no means entirely free from the same class of defects. Probably bricks and certain special artificial stones comparatively costly to produce reach nearer to a true uniformity of quality than other artificial masonry material; but even they are far enough from being ideal in uniformity of physical characteristics. When the best of concretes are considered, the uncertainties attached to the results of mixing and putting in place certainly lead to a wide range of ultimate resistances.

All these facts do not militate against the possession by the engineer of materials of great structural valve in both natural and artificial stones, but it must be admitted that the ideal uniformity of quality in masonry has not yet been attained. Hence, the results of all careful investigations as to elastic properties, ultimate resistances or rates of thermal changes of dimensions for either natural or artificial stones or masonry constitute a distinct addition of value to the technical knowledge of civil engineers. The admirable reports of the "Tests of Metals and other Materials for Industrial Purposes," issued annually by the Secretary of War, contain data of the desired character and have added largely to the engineer's knowledge of the compressive and other resistances of masonry, but much yet remains to be done. A valuable series of similar investigations has been undertaken by the Austrian Society of Engineers and Architects through a committee appointed for the purpose, an account of which, so far as completed, was printed in The Engineering Record of November 23. By referring to that issue it will be observed that the materials employed in the tests were granite, hard sandstone, concrete and brick masonry, the joints being filled with Portland cement mortar of the proportions 1 cement to 2 sand and 1 cement to 3½ sand. The phenomena attending the failure of both the granite and sandstone blocks and those of masonry were naturally essentially identical with those exhibited in corresponding tests at Watertown, Mass., among others, chipping or flaking of the material, longitudinal cracks appearing at incipient failure and conical-shaped fractured portions of the test pieces.

The first feature arresting the attention of the American engineer is the ultimate resistance of the 12-inch granite cubes, ranging from 8,550 to 10,910 pounds per square inch; whereas the ultimate resistance of American granite employed for engineering structures may generally be expected to run from 14,000 to 20,000 pounds per square inch. It is stated that these granite cubes showed "very coarse fractures," hence it is probable that the quality of the stone was not of the best. Sandstone is an exceedingly variable material, but the values exhibited by the Austrian tests are well within the limits of ultimate resistance of the "hard sandstone" of this country.

Among the most interesting results are those belonging to concrete and concrete-steel blocks. There are few details as to the fabrication of the concrete specimens, but it is difficult to understand why concrete as rich as 1 cement, 2 sand and 3 broken stone should not have given higher results than 1,780 and 1,850 pounds per square inch at the age of three and one-half months. Indeed, all the results for the concrete are lower than tests of similar material at the Watertown Arsenal have shown. Again, while the paving brick masonry tests exhibit excellent results those belonging to the common brick masonry seem rather low, even for the age of three and a half months.

As in tests of all such material the ultimate resistances vary with the character of the mortar, although it is stated that the "mortar in the joints could not be crushed;" and, further, that the strength of the masonry was not determined exclusively by that of either of the constituents. This, however, is not so clear. The tests at the Watertown Arsenal have shown conclusively that a weak mortar, such as one of lime, reduces greatly the ultimate resistance of the masonry in a considerably larger number of tests than those made by the Austrian committee. A close scrutiny of the latter does not appear to contradict that conclusion, although the tests are too few in number to give clear definition to any conclusions whatever. A weak mortar does not necessarily induce failure of masonry wholly by its own crushing, but partially by yielding in spots so as to fail to afford support in such places and thus permit more or less failure of the stones or brick in detail. The real effects of strong and weak mortar can only be clearly exhibited by making the contrasts sharp; that is, by testing masonry specimens in which there is a great difference in the mortars employed.

The great enhancement of strength produced by steel imbedded in concrete is admirably brought out in the tests of the concrete-steel prisms. The presence of the metal adds strikingly to the ultimate resistance and shows that the combined material is worthy of all the confidence placed in it. It is a serious question, however, whether in these cases higher results would not have been attained if the steel rods parallel to the direction of loading had been a little too short to touch the bearing faces of the testing machine.

Research Work of Technical Societies.

The technical societies of Germany and Austria carry on an amount of research work which gives them a standing in the community worthy of notice. In both these countries, the government often requests them, either alone or in conjunction with other organizations, to investigate some problem in applied science, such as the proper dimensions of chimneys, and the results of such work are generally embodied in the building-police laws. Probably no other single feature of their labors so enhances the standing of the engineering profession in the estimation of the public as this work. The foreign investigations of more purely technical subjects, like the studies and tests of arches by the Austrian Society of Engineers and Architects, have also been of wide usefulness and have demonstrated the great possibilities of professional researches by the national societies.

Such work is still in its infancy, however. In this country very little has been done, although that little has been gratifying. The standardization of boiler and engine tests by the American Society of Mechanical Engineers, the recommendations for cement testing and for rail sections of the American Society of Civil Engineers, the standard methods of water analysis now under investigation by the American Public Health Association, and the code of competitions of the American Institute of Architects are achievements of immediate and far-reaching value, while the specifications of the American Section of the International Association for Testing Materials have been recognized by engineer and manufacturer alike as of much usefulness already and of greater prospective benefit. Nevertheless it appears that this field of society work is by no means cultivated in this country to the extent it is in Great Britain, Germany and Austria, and it might be well to consider its possibilities at this time, when there is such a stir and commotion in association circles. The great value of such investigations by society committees lies in the freedom from partiality and bias obtained by the appointment of proper committeemen, and the thoroughness and value of work done under the immediate direction of so many competent specialists. The idea is really an old one so far as the American Society of Civil Engineers is concerned, for nearly thirty years ago a committee succeeded in persuading Congress to establish a national board of army and navy officers and civil engineers charged with the investigation of the properties of iron and steel. The board came to an early end four years later through adverse legislation, but it bequeathed to the army the excellent testing machine at the Watertown Arsenal, which has yielded annually valuable engineering data.

New Power Plant of the National Cash Register Company.

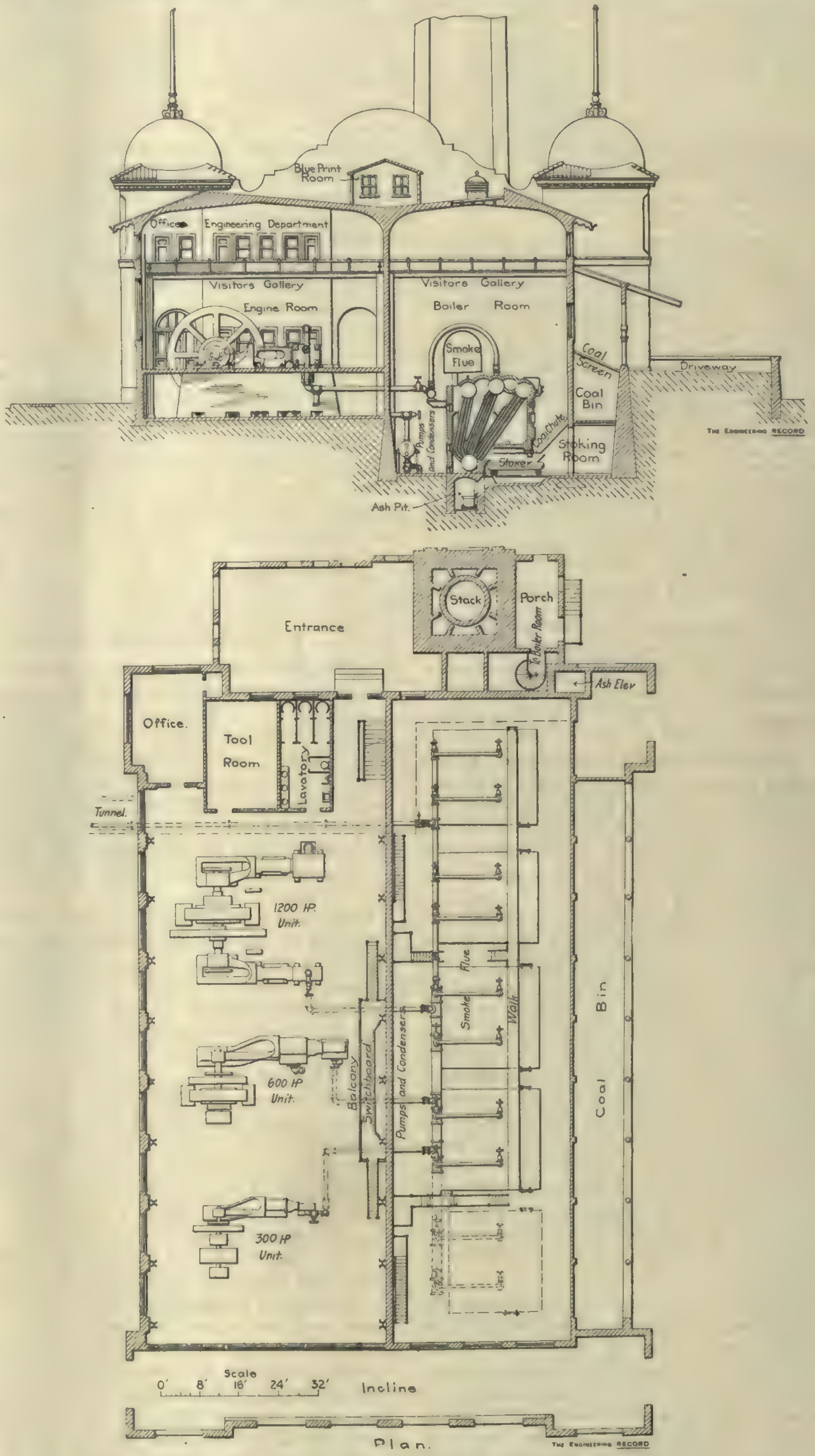
Owing to the growing business of the National Cash Register Company it was recently found necessary to increase its steam plant. The location of the old power house, between large buildings, made it impossible to enlarge it as rapidly as was desirable, and it was decided to design an entirely new station, which is the subject of this article. Plans and designs for the installation of the machinery were first made, together with a preliminary sketch of the type of building desired, which were submitted to the architect as a basis for his design of the building. The building is 108 x 178 feet, the engine room being 48 x 130 feet and the boiler room 48 x 130 feet. Before commencing the plans, an open well was sunk, to determine the character of the soil beneath the proposed site of the power plant as well as the water level. A feature of the plant is that the boiler room is depressed, in order to handle the coal by gravity and without the use of any conveyor system.

The grade of the boiler room is about 15 feet above the permanent water level, and the power house is so designed as to make it possible, in the future, to run bottom-dump coal cars directly over the coal bunkers, as shown in the cross-section of the plant. In the engine room is a visitors' gallery, which is nearly 50 feet above the boiler room floor and above the engines. The building also contains the offices of the engineering department of the company, as well as a blue-print room on the roof.

As the old plant contained much machinery, in good condition, it was decided to utilize it in the new station, and the boiler equipment, therefore, consists of four Babcock & Wilcox water-tube boilers of 200 horse-power each, set in two batteries and removed from the old station, and four new Stirling boilers, rated at 250 horse-power each, set in two batteries. This rating is based on 10.4 square feet of heating surface per horse-power, Am. Soc. M. E. standard, and one square foot of effective grate area is provided for each 50 square feet of heating surface. The fuel used is nut and slack. Two of the Babcock & Wilcox boilers are equipped with Murphy stokers and two with Babcock & Wilcox chain grate stokers. The automatic stokers used under the new boilers are of the chain grate pattern, made by the Green Engineering Company, of Chicago. The coal is conveyed from the coal bins to the stoker hoppers by gravity, through chutes as shown. The ashes are dropped into hoppers under the fire boxes and from there dumped into ash cars, which run under the boilers in a tunnel extending the full length of the building. This tunnel is connected to the air space between the inner and outer shells of the stack to give ventilation. The ashes are elevated from the dumping bin for the cars to an elevated bin by means of a bucket conveyor. From this elevated bin, located in one of the corner towers, the ashes are spouted directly into the carts by which they are removed.

The feed water is taken from a return-water reservoir and from there is pumped to the boilers. There are four boiler feed pumps, three of which were in use in the old plant. The new pump is of the horizontal duplex pressure pattern, with outside end-packed water plungers of brass, and was furnished by the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio. The feed-water heater is a special form of the Cochrane type, and is divided into two separate compartments; one for receiving the hot-water returns from the heating system and one for the make-up water used in the boilers. The temperature of the feed water delivered to the boilers is about 210 degrees Fahrenheit.

All piping is carried under the engine room floor in tunnels, and is so arranged as to give a gravity return to the condensed water from the heating system. As the heater is located on the level of the boiler room floor it is possible for the return to enter the heater directly without any auxiliary devices. Oil separators are put into the exhaust line from the engines to protect the boilers from oil, each engine having its own vacuum oil separator. The water for the condensers is obtained from six wells located under the boiler room, and passes through two sand traps 30 inches in diameter and 12 feet long before going to the pumps, each trap being connected up with three wells. There are three condensers, of 1,200, 600 and 300 horse-power capacity, respectively. The 600 horse-power, which was made by the Stilwell-Bierce & Smith-Vaile Company, and the 300 horse-power, which was made by Henry R. Worthington, were removed from the old station. The new 1,200 horse-power condenser was furnished by the Wheeler Condenser & Engineering Company. This condenser is placed directly over the air and circulating pumps and is supported on columns. All pumps, condensers and other auxiliaries are on the same level with the boilers and are placed in a space 14 feet wide, running the entire length of the building, as shown on the accompanying plan.



POWER PLANT OF THE NATIONAL CASH REGISTER COMPANY.

The engine equipment consists of three engines, as follows: One 1,200 horse-power cross-compound with 26 and 54-inch cylinders and 48-inch stroke, made by the C. & G. Cooper Company, of Mount Vernon, Ohio, and direct-connected to an 800-kilowatt direct-current, General Electric generator, of a speed of 80 revolutions per minute; one 600 horse-power tandem compound Buckeye engine with Wheeler reheater, direct-connected to a 485-kilowatt direct-current General Electric generator running at 130 revolutions per minute; and one 300 horse-power tandem compound Buckeye engine, direct-connected to a 225-kilowatt Siemens & Halske revolving field, direct-current generator running at 160 revolutions per minute. The steam pressure is 165 pounds.

The entire electric system is operated on 220 volts, and the current generated is used to operate 130 power motors and 4,000 incandescent lamps distributed through the works of the company.

A 40-ton hand-power traveling crane spans the engine room, which was furnished by the Cleveland Crane & Car Company, of Cleveland, Ohio. The engine room is heated by the hot blast system, using an air washing device to remove all dirt. The air is exhausted on the level of the engine-room floor into the boiler room to give ventilation, and at the same time supply air for combustion.

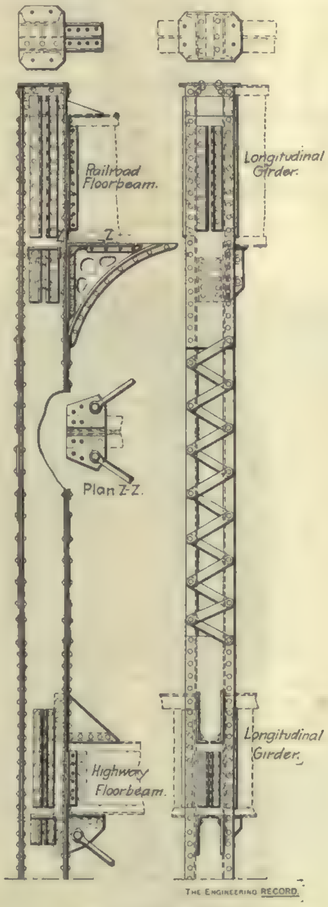
The plant was designed by Mr. E. A. Deeds, at that time head of the engineering department of the National Cash Register Company, but now factory manager for the Natural Food Company at Niagara Falls, N. Y. Mr. Frank M. Andrews, of Dayton, was the architect consulted in connection with the work, and E. P. Roberts & Co., of Cleveland, were also consulted relative to details of the above plant.

The South St. Paul Belt Railway Bridge.

The South St. Paul Belt Railway is about four miles long and connects the Union Stock Yards in St. Paul with the main lines of the Chicago, Milwaukee & St. Paul and the Chicago, Burlington & Quincy railroads at Newport, Minn., where it crosses the Mississippi River on a steel bridge and viaduct 1,632 feet in total length. The bridge is from 20 to 21½ feet wide on centers and about 50 feet in maximum height from low water to rail base. Beginning at the east end there is a 440-foot viaduct, one 442-foot draw span, five 140-foot fixed spans and one 50-foot girder span. The single-track railroad is carried on top of the viaduct and 140-foot span, and a highway floor is carried below it with 13 feet vertical clearance, which brings it at lower chord level in the through draw span. In consideration of a bonus from Newport township and the city of South St. Paul, the single-track bridge was built wide enough to provide for a highway floor 18 feet wide in the clear between the trusses. Under the 50-foot span this roadway is deflected from the axis of the bridge and beyond it the railroad is carried on a 1,039-foot pile and timber-trestle approach.

The piers are of magnesium limestone from Mankato, Minn., and have pile foundations which, except in one case where they are bedded in concrete, have timber grillages. The draw-span fender-piers are of pile and timber with a rock filled timber crib at the up-stream end. At the east side of the river, at the end of the draw span, there is an up-stream pile and timber sheer-boom 800 feet long, to facilitate the passage of log rafts through the openings.

The viaduct has 30-foot towers 80 feet apart, and between each pair of them are two 40-foot plate-girder spans, supported in the middle by a rocker bent. The viaduct piers are all built up to the same level and the posts are all vertical, and except in the end bents, are from about 33½ to 35 feet in length, varying to suit the grade. The posts are made with two 15-inch channels, latticed, with their webs transverse to the bridge axis, and have 1-inch base plates, 26 inches square, stiffened by three longitudinal gusset web plates, two of which are riveted to the flanges and in the tower posts receive the connection pin for the longitudinal strut and diagonals. In the sides of the tower there are two pairs of 1⅜-inch square diagonal rods in both upper and lower panels, and in both tower and rocker bents there are two pairs of 1 3/16-inch square diagonals below the highway floorbeam. The single bent which is seated on the draw span pier has special post bases with longitudinally slotted holes for the anchor bolts, and each post is seated on a cast expansion bed plate with longitudinal grooves in its planed upper surface. A longitudinal knee brace is also connected to the foot of this post and to the main girder.



Viaduct Column.

The main girders for both highway and railroad floors are web connected to the sides of the columns, and are also seated on shelf angles with reinforced horizontal flanges. The highway girders have 3 x 4 x ½-inch flange angles and 39 x ¼-inch web plates in three sections, spliced with two vertical rows of rivets in double cover plates. The railroad girders have two 3½ x 5 x 9/16-inch angles and one 10½ x ⅝-inch cover plate 25¾ feet long in each flange and a 54 x 5/16-inch web plate in three sections, spliced with double cover plates and two vertical rows of rivets. The top flanges of the girders are flush with the tops of the viaduct columns, and are field riveted to their projecting cap plates. At the single column bents, 110 feet apart, both roadway and railroad girders have one fixed connection, as already described, and one expansion connection where the rivets through the end vertical stiffener angles are omitted, and the girders are supported wholly by the heavier shelf connections to which they are attached by bolts in slotted holes.

The floorbeams are uniformly 13 1/3 feet apart, and are connected directly to the viaduct columns and to the main girders at all splices. In the highway floor they have 3 x 7/16-inch flange angles and 24 x ¼-inch web plates; in the railroad floor they have 5 x 3½ x ⅝-inch flange angles and 42 x ⅜-inch web plates. All of them are web connected in the usual way to the main girders, with their bottom flanges just clearing those of the main girders and are connected to them by horizontal lateral-pin plates. Every third floorbeam is web connected to side plates riveted across the viaduct post flanges and is also riveted to double-web top and bottom knee brace brackets, as shown in the post details. The railroad floorbeams have wide knee braces with curved flange angles on the under sides and very short knee braces, made of pairs of horizontal angles with their 5-inch flanges riveted across the post webs and to the top flanges of the floorbeams, on the upper sides. The highway floor has wooden joists laid on the top flanges of the floorbeams, and the railroad floor has two lines of 20-inch 64-pound I-beam stringers 8 feet apart. The stringers are web connected to the floorbeams with vertical pairs of angles, except at expansion joints, where they are seated without bolts or rivets on shelf angles and are web bolted through slotted holes between pairs of vertical angles riveted to the floorbeam webs. All panels in both floors have lateral rods with forked loop eyes and sleeve-nut or clevis adjustments.

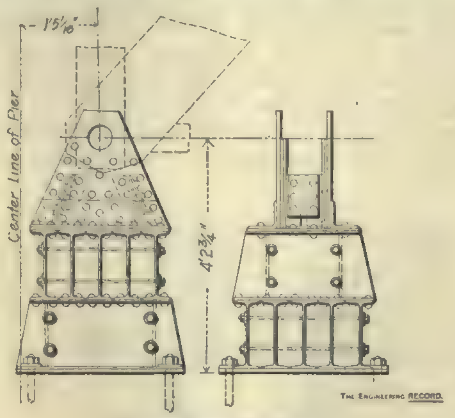
The 140-foot deck spans are simple seven-panel Pratt trusses proportioned for a total assumed dead load of 2,310 pounds per lineal foot of span. The highway floor is proportioned for a live load of 900 pounds per lineal foot, equivalent to 50 pounds per square foot, and for two 25,200-pound electric cars each with two axles 7½ feet apart and on tracks 9½ feet apart on centers. The trusses are proportioned for a live load of two locomotives with 120,000 pounds on four axles and a train load of 3,400 pounds per lineal foot, approximately, equivalent to a uniform load of 3,800 pounds per lineal foot. The floorbeams and stringers are proportioned for a live load of 34,000 pounds on

Double-Deck Belt Line Bridge, South St. Paul.

each of four axles 5 feet apart. There are 1-inch lateral rods in the upper deck, but the total wind pressure of 600 pounds per lineal foot is assumed to go through the vertical posts and to be transmitted to the piers by the bottom lateral system of rods from 1 inch to 1¾ inches square.

The fixed end pedestals of the 140-foot span on the drawspan pier were built up to a height of nearly 4¼ feet by two crossed sets of 15-inch I-beams riveted together and to the base plate of the pin-connected shoe. On each end of each intermediate pier there was a grillage of six transverse 10-inch I-beams, 6 feet long. These beams were countersunk riveted to top and bottom bed plates and were secured to the masonry by four anchor bolts screwed down on hook washers over the outer flanges of the beams. On top of each grillage was seated one fixed end shoe and one roller end shoe, the latter supported on eight 3⅝-inch rollers, which travel on a bed of nine 70-pound rails with planed heads.

The railroad floorbeams are web-connected to the vertical posts a little below the top chords and have top and bottom knee braces, as shown in the illustration. The highway floorbeams have their lower flanges flush with the bottom plates on the vertical posts to which they are field riveted, and their ends are cut to clear the lower chord bars. The ends of the webs project beyond the end vertical stiffener angles and are field riveted between vertical angles which are shop riveted to the sides of the posts. These post angles also carry knee braces which are field riveted to the top flanges of the floorbeams. By this arrangement all the field rivets in the floorbeam connections are accessible and are easily driven. At the stringer connections, there is on each side of the floorbeam web a 14½ x 9/16-inch plate with four vertical rows of rivets, and two connection angles 1½ inches apart, which take bearing on the top and bottom chord flanges. They are shop riveted to the floorbeams and receive the field riveted ends of the stringers, which are fillered out even with the vertical flanges of their chord angles.



Fixed Span Pedestal.

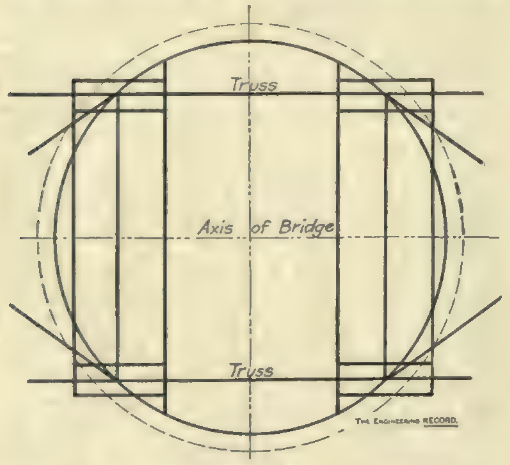
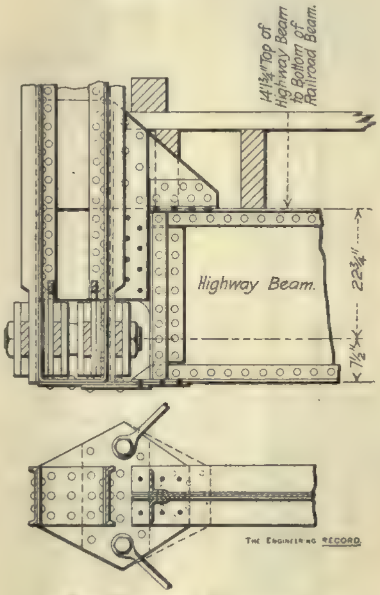
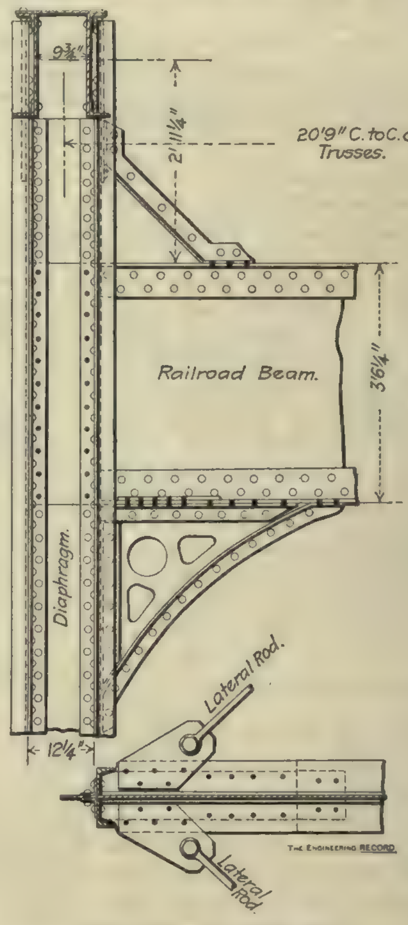


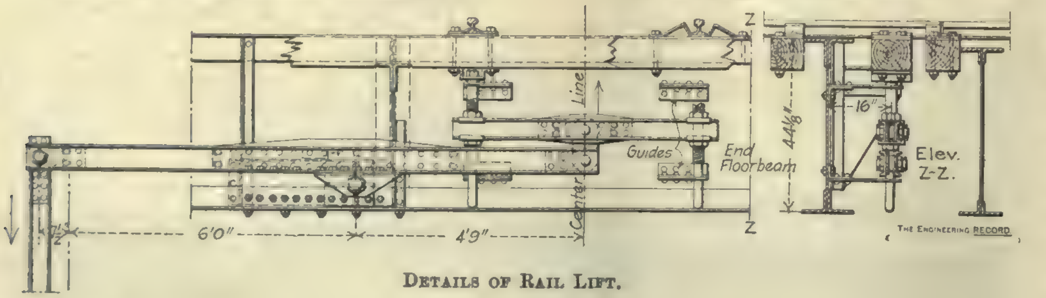
Diagram of Drum-Loading Girders.



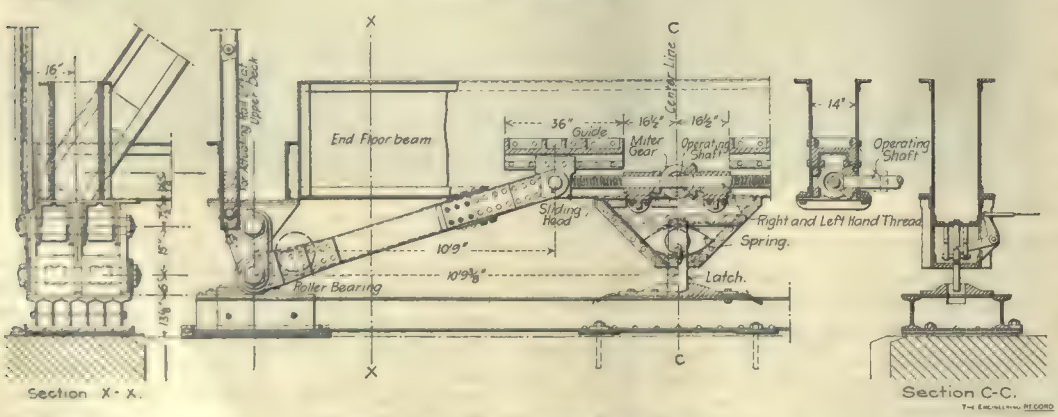
Lower Deck of Fixed Span.



Upper Deck of Fixed Span.



Details of Rail Lift.

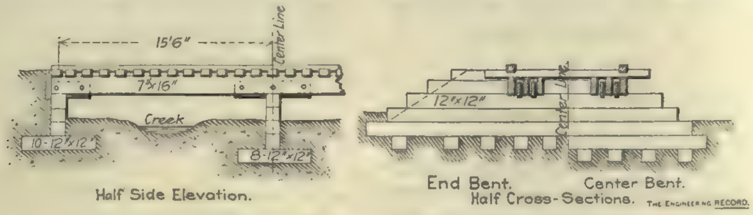


Latching and End-Lifting Mechanism.

In the 440-foot draw span the dead load was assumed at 2,300 pounds of metal, 660 pounds for railroad and 400 pounds for highway floor, making a total of 3,360 pounds per lineal foot of span, about equal to 50,000 pounds per panel per truss. The live loads were assumed the same as in the deck spans, except that on the highway floor the live load was increased to 100 pounds per lineal foot and to 70 pounds per square foot for single and for two-panel hangers. A wind pressure of 150 pounds per lineal foot was assumed for the top laterals and all considered as carried to the center by the lateral system in the railroad floor and to be all transmitted through the vertical posts to the bottom chords. A wind pressure of 550 pounds per lineal foot was assumed to be carried by the bottom lateral system, three-quarters of it going to the center of the span. Throughout the trusses the unit stresses from dead loads were taken twice as large as those from live loads. This gives, in the main ties and eyebar chords, 9,600 pounds and 19,000 pounds; in the counters, 7,500 pounds and 15,000 pounds; in the riveted tension chords, 9,000 pounds and 18,000 pounds; in the compression chords and inclined posts, $p = 8{,}000 - 30\ (l \div r) + 20$ per cent. for steel; and in the vertical posts, $p = 7{,}000 - 40\ (l \div r) + 20$ per cent. for steel where p is the live load stress in pounds per square inch so that 2p is the dead load stress per square inch. Members which are subject to combined stresses are proportioned for the whole of the greater stress plus 0.8 of the lesser stress. Beam and stringer flanges and lateral rods are proportioned the same as in the 140-foot spans.

The stresses were calculated for four cases; first, for the span swinging, under dead load only, second, for the span closed, under dead load only and considered as continuous over three supports; third, with the span closed and having a live load on one arm only and moving in either direction; fourth, for the span closed and entirely covered with live load. Besides these cases, a fifth case was considered by combining case one or two with case three or four.

The draw has two independent spans with curved top chords connected across the top of the pivot pier tower, 72 feet high and about 18½ feet wide. The trusses are 21½ feet apart on centers, and each has seven 30-foot panels and is 44 feet deep at the hip joint, the great depth being necessary to give the required clearance of 22 feet above the railroad track. The maximum sections of the principal members are as follows: Top chord, two 7 x 1 11/16-inch eyebars and two 7 x 1 9/16-inch eyebars; main ties, four 6 x 1 5/16-inch eyebars; end post at pivot pier, one 18 x ½-inch, two 18 x 9/16-inch, and two 11 x ½-inch plates, and eight 3½ x 3½ x ½-inch angles; bottom chord, two 18 x 9/16-inch plates and four 3½ x 3½ x ½-inch angles; tower post, four 3½ x 4 x 7/16-inch angles, four 3½ x 3½ x ⅝-inch angles, one 22½ x ⅝-inch plate and two 18 x ⅝-inch plates; tower diagonals, two 1¼ x 1¼-inch bars; top laterals, one 1⅝-inch rod; bottom laterals, two 4 x 1-inch bars.



Half Side Elevation.

Half Cross-Sections.

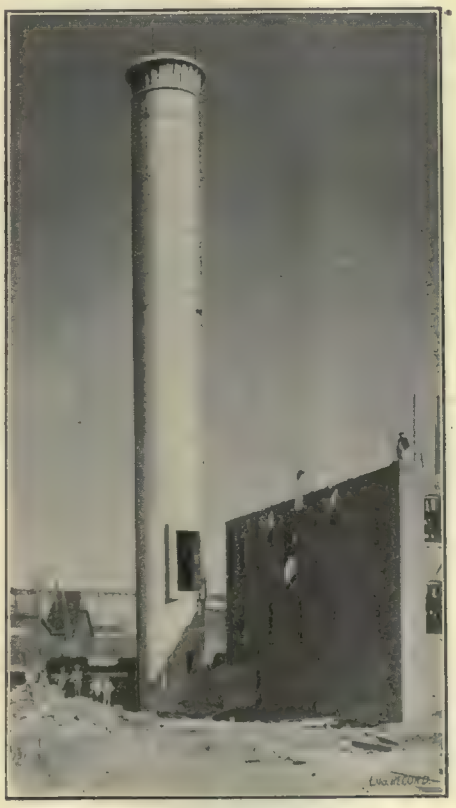
Low Bents of Railroad Approach Viaduct.

The pivot ends of the trusses and the vertical posts of the center tower are pin-connected to four shoes, each of which is directly over the center line of the drum and supported in the middle of a pair of short girders connecting the ends of twin transverse girders arranged as shown in the diagram. The transverse girders are seated on top of the drum and are spaced to distribute the total load equally to eight equi-distant points of the drum. They are 54 inches deep, with 6 x 6-inch flange angles, and 7/16-inch cover plates, and the drum is 28½ feet in diameter with a 54-inch web, two 6 x 6-inch angles and two cover plates in each flange.

The drum is braced to the pivot by eight triangular radial girders with solid webs at the inner ends and latticed at the outer ends. It is supported on 56 cast-steel wheels 18¼ inches in diameter and 10½ inches wide, which run between a cast iron lower tread and a forged steel upper tread. The lower tread and the cast iron rack are bolted to the cast iron track, and all of them are made in 16 segments each, with finished radial joints, which are staggered. The wheels are bored for the 1¾-inch ends of radial rods 1¼ inches square, which are pin-connected to a horizontal plate revolving on a shoulder at the top of the pivot casting. These rods have collars shrunk on inside the wheels and the wheels have hub bearings against vertical turned washers. The wheels are set in a live ring consisting of an outside circular 6-inch channel with vertical web and an inside circular 4 x 3-inch angle.

Each end of the drawbridge is supported on a pair of 10-inch horizontal transverse I-beams, about 24 feet long and 2¼ feet apart, which are bolted to the tops of the piers. Four short beams are bolted between the long beams at each end and connected to top and bottom cover plates, forming solid bearings for the ends of the trusses. The top plates are hollowed to form a rest and stop for the truss supports, which are double cast steel suspended rollers swinging transversely to the bridge axis. They are operated by inclined struts like toggles, which are moved in and out by screws, driven through a miter gear from a longitudinal shaft, as shown. Eccentrically pivoted to the roller suspension link is a vertical lever which, when the rollers are swung, operates a rocker beam which lifts the ends of the track rails. The vertical latch engages a beveled seat on the pier beams, is suspended from a carriage spring and is raised from the middle of the bridge by a wire and a right angle lever.

The timber trestles for the railroad approach are of the usual pile bent construction, except where they are very low, and a solid wall of transverse timbers on longitudinal sills buried below the surface is used, as shown in an accompanying sketch. Special care is taken to space the track stringers 3 inches apart by separator planks 5 1/3 feet long, which are bolted to the double length stringers and serve to splice them at joints, besides locking them to the bents over which they are dapped. A 50-horse-power gasoline engine was at first installed to operate the machinery, but was replaced by a steam engine.


A 108-Foot Concrete-Steel Stack.

The bridge was designed and built under the supervision of Mr. Chas. F. Loweth, M. Am. Soc. C. E., of St. Paul. The general contract was secured for the Pittsburg Bridge Company by its representative, Mr. W. M. Curtis, M. Am. Soc. C. E., who had charge of construction for the contractors. The contract for the substructure and protection piers was sub-let to Mr. Chas. Stone, of St. Paul.

A 108-Foot Concrete-Steel Chimney.

A 108-foot chimney of concrete-steel construction has recently been completed in Jersey City, N. J. It is built according to the Ransome system, which employs cold-twisted square steel bars to reinforce the concrete, and it has a constant inside diameter of 8 feet, enclosed in a double shell, the two parts of which are at their common base 7 and 4 inches thick, respectively. The stack forms part of a plant which the Central Lard Company, of New York, is erecting at Seventeenth and Cole Streets, and for which Mr. Henry Floy, of New York, is the engineer. It was built by the Morris Building Company, of New York.

The chimney is supported on a concrete-steel base or footing on the top of long piles. The shaft proper extends 8 feet below the grade line to the base, which is 4 feet 6 inches deep, its upper part, as indicated in the accompanying drawings, being sloped off to form a truncated cone. The site on which the plant is being erected is an extremely marshy one, and has to be filled in some 10 or 11 feet to bring it to a chosen grade line. The piles were driven to solid rock, and their average length is about 58 feet, with their tops 11 feet below finished grade level. They are of yellow pine 14 to 18 inches in diameter, and over the area of the chimney footing, which is 24 feet in diameter, 56 were driven, one pile, therefore, to about 8 square feet of footing area. The tops of the piles are imbedded 18 inches in the concrete; in addition to this, the piling is tied to the piling of the power-house foundation, as shown in an accompanying cut, a 2-inch rod extending from each of two straining blocks to a pile in the foundation of the power house.

The arrangement of the chimney piles is shown in an accompanying drawing. They are placed symmetrically with respect to two axes through the center of the foundation, one parallel with the adjacent side of the power house and the other perpendicular to it, and are arranged in lines parallel with this wall, for convenience in driving. These lines are so located and the piles spaced along them in such a way that the greater number per unit area are located around the outside of the foundation, where the stresses due to wind moments are greatest.

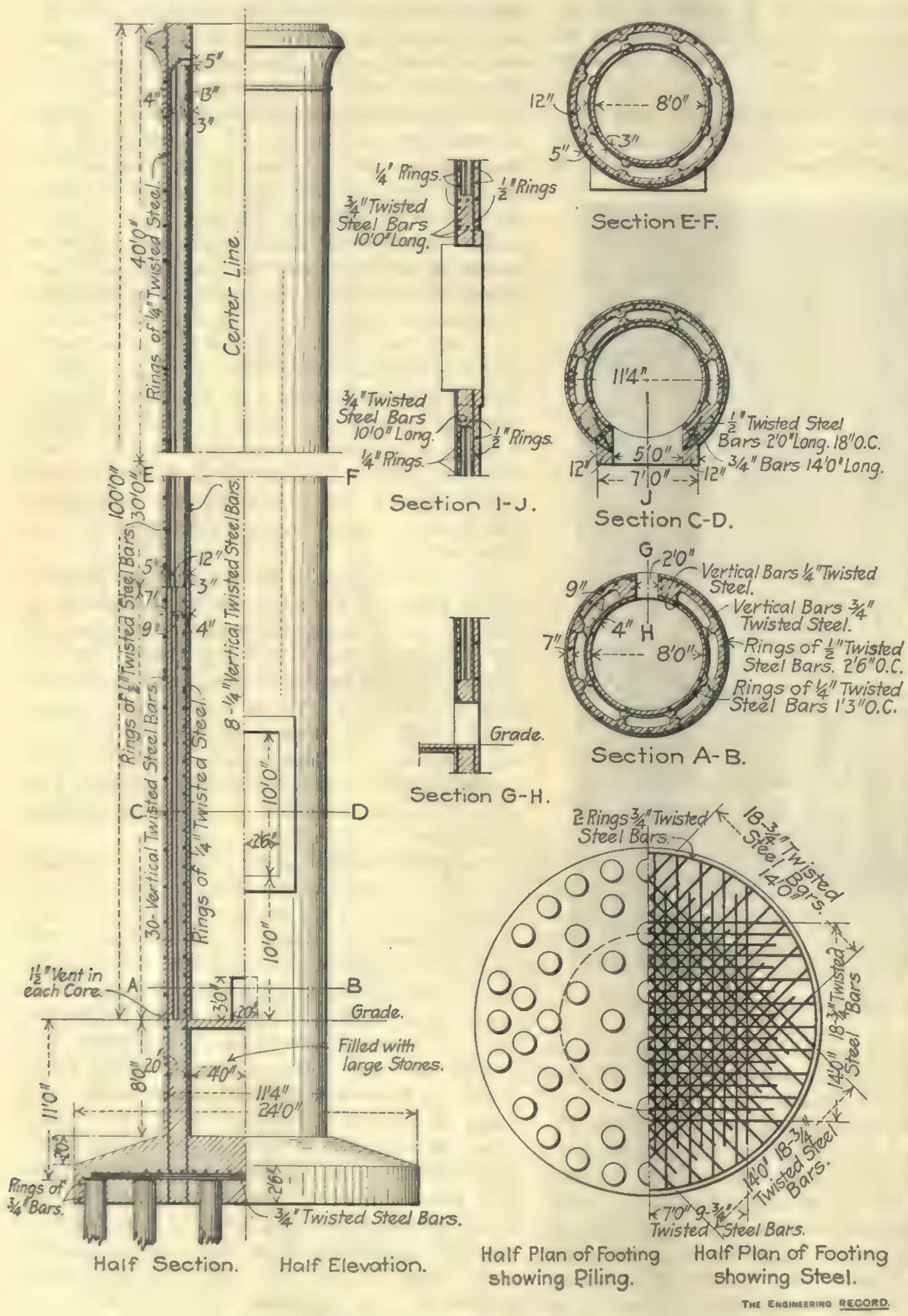
The concrete footing proper contains about 56 cubic yards of concrete and is reinforced by four layers of twisted bars above the piles and by two twisted bars which are welded into two rings imbedded in the concrete around the outside of the piles. These bars are all ¾-inch square bars, cold twisted. Each of the four layers consists of 18 bars, spaced about 10 inches apart, those of each layer running in one of four directions, as indicated in the accompanying drawings.

The reinforcement of the shaft of the chimney consists of continuous vertical twisted bars, spaced around in both the outer and inner shells, and successive horizontal rings of twisted steel in both the outer and inner shells. The vertical bars in the outer shell are of ¾-inch square steel, 30 in number, and those in the inner shell are of ¼-inch square steel, 8 in number; the former are thus spaced about 13 inches apart, while the latter are about 38 inches apart. The rings in the outer shell are of ½-inch square steel; those in the inner shell, of ¼-inch steel; in the former case, the rings are 2 feet 6 inches one above the other, center to center; in the latter, they are half that distance apart, making twice the number of rings. The rings are located outside the vertical bars. The smoke breeching connection and clean-out door are shown, together with the details of steel reinforcement for these openings.

The double shell construction, it will be noticed, begins at grade level, below which the shaft rises from the concrete footing in a single shaft 20 inches thick, filled in the interior with large stones. The outer shell has eight ribs spaced around on the inside, extending from the bottom of the stack to the top, and the inner shell has an equal number on its outside, directly opposite those of the outer shell, leaving about 2½ inches clearance. The ribs, as shown in the sections, form eight cores; these have a 1½-inch vent at the bottom in each case and at the top of the chimney are open with the interior, the inner shell having a vertical clearance of 5 inches, in which expansion changes may take place. The top of the chimney is ornamental, as shown in the accompanying reproduction of a photograph of the structure, and it is fitted with four lightning rods, tipped with copper on top, made continuous with four of the vertical steel twisted rods and grounded below the foundation, the lightning rods being provided in accordance with the theory that the pointed conductors offer paths for the gradual dissipation of the atmospheric electrification.

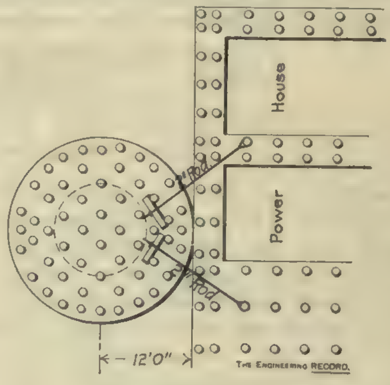
The concrete used in the chimney consists of one part Atlas Portland cement to five parts of crushed stone and its screenings, passing a ¾-inch ring. The twisted metal work is of mild steel, furnished under a specification that required an ultimate strength of not less than 60,000 pounds per square inch and the property of being bent cold 180 degrees around a bar of the same diameter as itself without signs of fracture on outside of the bent portion. The chimney was built under a guarantee that all repairs would be made for a period of five years of any defects caused from faulty construction or materials, the internal temperature of the flue not exceeding 750 degrees Fahrenheit, or from tornadoes, the wind pressure not exceeding 50 pounds per square foot, measured on flat surface. The cost of the chimney, not including the piling, was about $3,500. Its weight, including footing, is about 350 tons.

It was constructed from staging of 2 x 4-inch timbers erected in the flue, the staging carrying two overhanging beams above, from which the forms for the inside and outside faces, both of which are of constant diameter, were suspended each by four rods. Five feet were built alternate days, the forms being raised in the intervening days. The forms were 12 feet long, leaving a lap of 7 feet on the finished work during the addition of the succeeding 5 feet. The forms were all operated by turning hand wheels on the rods in the overhanging structure which were threaded. Notwithstanding great care to avoid them, horizontal rings were formed at the bottom of each 5-foot zone, due to the small but necessary clearance between form and completed portion; after the chimney was built, the chimney surface was dressed to give it the appearance of finished stone by means of a hammer which was suspended by a rope from the top of the stack, pulled out a short distance from the shaft and allowed to swing back against it.

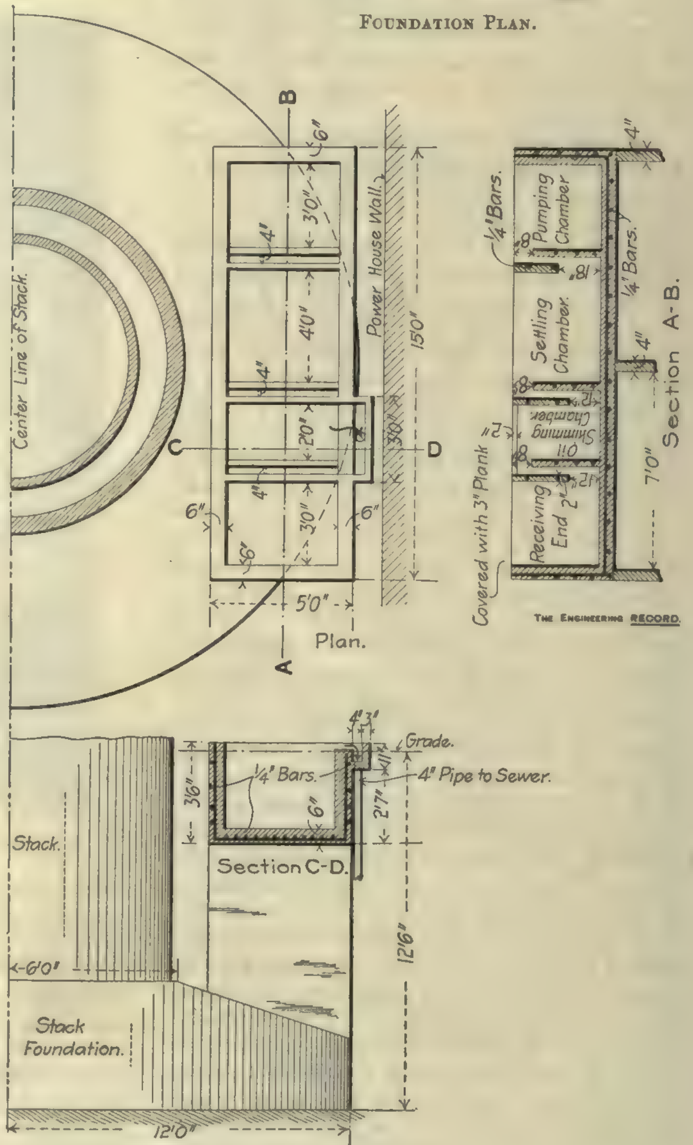

5"
13"
3"
4"
40'0"
Rings of ¼" Twisted Steel.
Center Line.
100'0"
30'0"
E
F
12"
3"
4"
5"
7"
9"
Rings of ½" Twisted Steel Bars.
30-Vertical Twisted Steel Bars.
8-¼" Vertical Twisted Steel Bars.
Rings of ¼" Twisted Steel.
C
D
10'0"
26"
10'0"
1½" Vent in each Core.
A
B
30"
20"
Grade.
Filled with large Stones.
11'0"
8'0"
20"
40"
11'4"
24'0"
Rings of ¾" Bars.
26"
¾" Twisted Steel Bars.
Half Section.
Half Elevation.
¼" Rings.
½" Rings
¾" Twisted Steel Bars 10'0" Long.
¾" Twisted Steel Bars 10'0" Long.
½" Rings.
¼" Rings.
Section I-J.
12"
8'0"
5"
3"
Section E-F.
11'4"
I
J
½" Twisted Steel Bars 2'0" Long. 18" O.C.
¾" Bars 14'0" Long.
12"
5'0"
12"
7'0"
Section C-D.
G
2'0"
Vertical Bars ¼" Twisted Steel.
Vertical Bars ¾" Twisted Steel.
Rings of ½" Twisted Steel Bars. 2'6" O.C.
Rings of ¼" Twisted Steel Bars 1'3" O.C.
9"
7"
4"
H
8'0"
Section A-B.
Grade.
Section G-H.
2 Rings ¾" Twisted Steel Bars.
18-¾" Twisted Steel Bars. 14'0"
14'0" 18-¾" Twisted Steel Bars
14'0" 18-¾" Twisted Steel Bars.
7'0" 9-¾" Twisted Steel Bars.
Half Plan of Footing showing Piling.
Half Plan of Footing showing Steel.
The Engineering Record.

Elevations and Sections of the Chimney.

An interesting auxiliary to the stack has been created in building a hot-well for the power plant on the sloping footing of the chimney, this utilization of the chimney base making it unnecessary to construct an additional foundation for the hot-well, which it was convenient to locate outside of the power building itself. The construction of this well is indicated in an accompanying cut. It consists of four chambers, the receiving end, an oil skimming chamber, where the oil may be skimmed into an overflow, a settling chamber larger than the others and provided with a large exit passage to keep as low a velocity of flow as practicable, and the pumping chamber, from which a pump draws its supply. The well is intended for the reception of grease-laden water from engine and pump, drips, etc. It has a cubic contents of about 150 cubic feet. As shown, it is about on grade, and is supported by three piers seated on the chimney footing. Its outside walls and the bottom which spans the piers, are 6 inches thick; these are reinforced by two layers of ¼-inch bars, a transverse set which passes down one side and up the other, on 12-inch centers, and over these a longitudinal set extending from the top of one end through the bottom to the top of the other end, on 4-inch centers.



Foundation Plan.



Concrete-Steel Hot-Well.

Oil for Clay Roads.

The use of oil on dirt, gravel and macadam roads has been practiced so often that it no longer is an engineering novelty, but an experiment in oiling a buckshot road near Clarksdale, Miss., presents several new features. Buckshot is a tough black clay and about as poor a road material as can be imagined. The experiment was made under the direction of Major T. G. Dabney, chief engineer of the Yazoo Levee District, on 1,500 feet of roadway, which was first reshaped with a road machine and then was thoroughly rolled with a five-ton roller. The road then received a sprinkling of water from a street sprinkler, with the idea of forming a coalescence of the small buckshot crumblings on the surface. After several days' exposure to the sun for drying the surface, a layer of coarse lake sand was spread on 400 feet of the roadbed to a depth of about one-quarter of an inch, and an application of finer sand was made upon an additional extent of 400 feet to the same thickness. On the remainder of the roadbed the buckshot surface was left naked.

When these preparations had been completed late in the evening the application of the petroleum was just begun, when a hard rain that night and the next day caused a suspension of the application. Six days later the application of the oil was resumed. The surface of the roadbed had then become dry, but an inch and a half below the material was found to be gummy. This was not a favorable condition for applying the oil, but for fear that another rain would supervene and defeat the experiment for the present season, and having no means for storing the oil, it was determined to continue the operation of spreading the oil, which was completed in two days. It fortunately happened that for nineteen days preceding the date of the report no rain had fallen, and sunshine had been almost continuous. The maximum daily temperature during this period ranged from 61 to 79 degrees, while the minimum ranged from 55½ to 58½ degrees. This favorable weather operated to greatly improve the conditions for the experiment, over what might have been anticipated at the outset.

Five days after the last of the oil was spread the road was again rolled with the five-ton roller, which passed over it three times. This rolling was not deemed sufficient, but the team used was not available for a longer time. On the two following days a loaded wagon was for a day and a half driven continually back and forth over the oiled surface, so as to pack thoroughly every part of it, after which the roller was again used for half a day to give a smooth surface, which completed the operation.

The extent of roadbed covered with oil is 1,100 lineal feet, of which 800 feet had a surface treatment of sand, and 300 feet was naked buckshot. On this extent of roadbed was spread about 95 barrels of petroleum of 42 gallons to the barrel. This quantity of oil is believed to be in excess of requirements under proper conditions and with proper appliances for its application. But having nothing better than an old and rickety street sprinkler that distributed the oil very unevenly, it was necessary to put on an excess in order to get the entire surface covered. The width of the roadbed treated varied from 36 to 43 feet, measured between the bottoms of side drains.

While no pains were spared to make the experiment as thorough as it was practicable to be made, yet the conditions were not satisfactory, and Major Dabney is not at all sanguine of the best results. The most unsatisfactory feature of the experiment is the lateness of the season in which it had to be made, which did not admit of continued exposure to high temperature, which is necessary to dry out the more fluid part of the oil and harden the surface of the road before exposure to traffic during wet weather. Another difficulty encountered, which was an incident of the lateness of the season and consequent shortness of the time available, was the lack of facilities for doing the work, in the matter of labor and time, and the poor device for spreading the oil on the road.

As regards the quantity of oil used, about one-half, or a little more, per square yard of surface covered would be sufficient if properly applied; and, furthermore, that about one-half the width of the roadbed treated would answer all the purposes of public travel if the application of oil should prove a complete success.

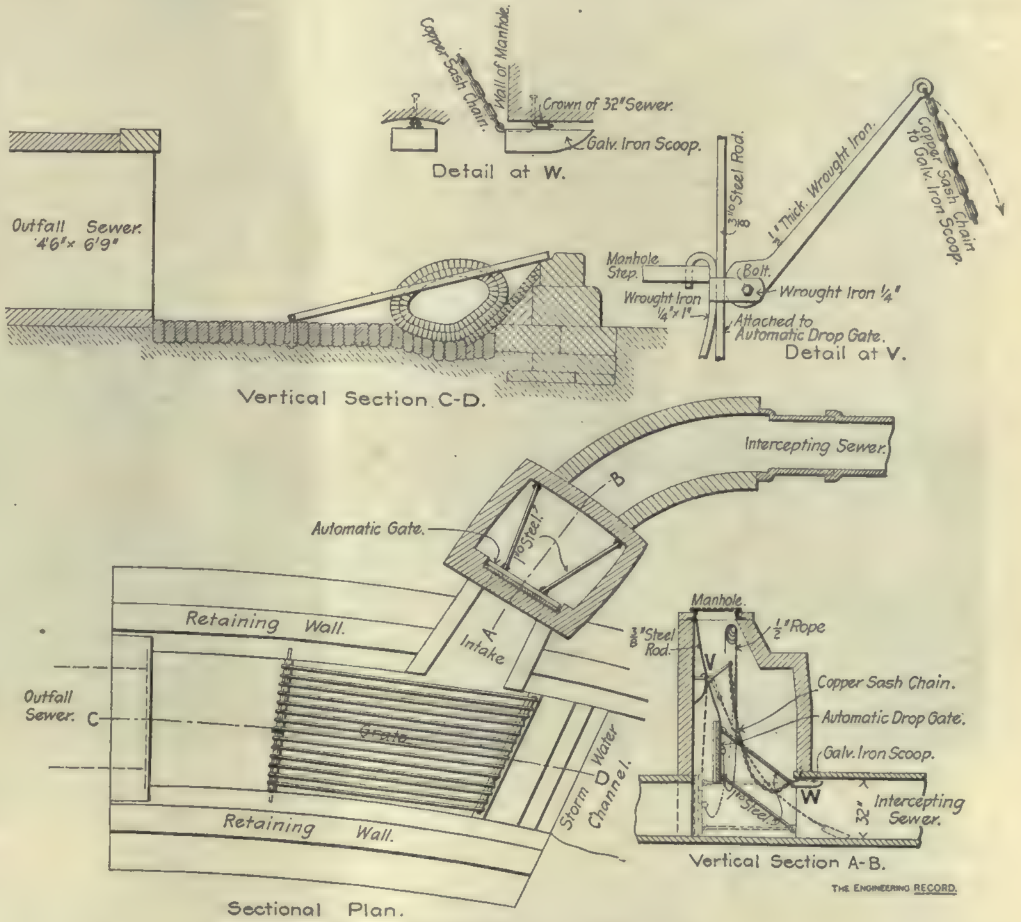
The oil should be applied in the early summer, at the earliest period when the roadbed is found to be perfectly dry and hard. Then the oil should be evenly spread on a smooth, hard surface, and after some days' exposure to the sun should be rolled, after which one or more additional applications should be made in the same manner, the rolling being made very thorough. Indeed, during dry weather it is probable that the common traffic of the country would be an advantage to the roadbed.

With this constant packing and exposure to hot sunshine, the volatile parts of the oil would be extruded and evaporated, leaving only the gummy residuum, which, under pressure and mixed with the surface material, should form a tenacious asphalt-like cake as a covering and protection to the hard material underneath.

The expediency or otherwise of the application of sand to the buckshot surface will probably not be determined by this experiment, in the absence of the high temperature necessary to dry out the fluid part of the oil. The suggested necessity of roughening the surface of the roadbed to prevent the oil from running, which was one of the functions of the sand to perform, was found in practice not to exist, as the oil was readily absorbed by the dry buckshot and did not run at all.

An Automatic Drop Gate for Intercepting Sewers.

There has recently been constructed on one of the intercepting sewers at Altoona, Pa., an automatic drop gate, of which some details are shown in the accompanying illustrations. This intercepting sewer was cleaned not long ago at a considerable cost, and a gate has been constructed in order to make the periods between cleanings as long as possible, by preventing the ingress of stones and gravel during storms. The grate bars shown in the drawing are covered with a 6 x 12-foot wire screen with 2-inch mesh. This screen prevents the brick, stones and other rubbish from gathering under the bars ready to be swept into the interceptor by the first rush of storm water. The intercepting sewer has a chamber at its intake, containing a gate which is hinged at the top and bottom to the walls of the chamber. Under ordinary conditions this gate is held upright, as shown in the diagram, by a steel rod and a cam lever. The end of this lever is provided with a copper chain running to a galvanized iron scoop. This scoop is held at the crown of the sewer so lightly that the first full rush of the water through the interceptor whirls it along in the current, pulling down the lever and releasing the rod which holds the gate. The latter falls against the mouth of the intake, checking the flow, which remains shut off until some one sets the apparatus again. City Engineer Harvey Linton, who designed the apparatus, states that the weight of the gate is hardly sufficient to make it close tightly. It always drops during every considerable rainfall, but one side is usually about an inch from the bottom.



The Automatic Drop Gate at Altoona.

The Temperature in the Gas-Engine Cylinder is at times nearly 2,000 degrees Centigrade (over 3,600 degrees Fahrenheit), according to calculation by Prof. Frederic W. Burstall in the second report of the Gas-Engine Research Committee, of the Institution of Mechanical Engineers.

The Construction of Earth Dams.

The full report, with the exception of the introductory and a few other paragraphs, of Messrs. J. James R. Croes, Edwin F. Smith and Elnathan Sweet, retained by the New York Aqueduct Commission to consider the plans for the earth embankments at the New Croton Dam and Jerome Park Reservoir.

The New Croton Dam.—This dam is built across the valley of the Croton River, from north to south, about three miles from the Hudson River. At this point the channel of the river was near the foot of the north bluff, which rose 150 feet in a distance of 350 feet. The face of this bluff was excavated to solid rock and a masonry wall about 1,000 feet long was built parallel to the course of the river, with its coping for 750 feet at the elevation of 200 feet above the level of mean tide water of the Hudson River, or 150 feet above the river channel, and for 250 feet at an elevation of 196 feet, forming a spillway for the water which may overflow the dam in freshets. On this portion it is proposed to place flashboards 4 feet high, making the elevation of the water surface ordinarily 200 feet above tide-level. On the line of the dam the channel for the water is over a solid masonry wall about 200 feet long at top, abutting against the rock of the hillside at the northern end, and at the southern end against a tower of masonry, in which are placed gates for emptying the reservoir if necessary, the sills being at the elevation of 100 feet above tide.

South End of Masonry Dam and Wing-Wall.

Junction of Masonry Dam and Core-Wall, Upstream.

The bottom of the valley is nearly level south of the river for 400 feet, and the hillside then rises 100 feet in 300 feet, and then 70 feet in 400 feet more, to the elevation of 220 feet above tide-level.

From the wasteway to the point on the hill on the south side of the valley where the surface of the ground was 110 feet above the channel of the stream, a distance of 735 feet, the dam is designed to be built of solid masonry, with cut-stone faces, from the original surface of the ground to the elevation of 210 feet above tide level, or 10 feet above the proposed full water surface of the reservoir. Below the original surface of the valley the earth and rock have been excavated to a depth of from 120 feet to 160 feet, until solid rock was reached. This pit was filled with rubble masonry, which at the lowest point is 216 feet wide, and at the stream-level is 120 feet wide, and forms the foundation of the dam, the width of which is gradually diminished in accordance with the latest theories of masonry dam construction, until at the full-water elevation of the reservoir it is 19.2 feet wide.

In the original plans it was provided that this masonry dam should be 625 feet long, but on September 16, 1896, it was determined to extend the masonry 110 feet further into the hillside, to its present location, where the solid rock foundation and the natural surface of the hillside are respectively 45 and 50 feet higher than at the original location. This change was recommended by the chief engineer, Mr. Alphone Fteley, from his "present knowledge of the foundation and the experience gained from the erection of high embankments in connection with other dams" in the Croton Valley.

At this point the solid masonry dam terminates abruptly, being there 195 feet high, with a bottom width of 160 feet. At the end the masonry is built up square, and 150 feet wide. From this point to the southerly end of the dam, a distance of 454 feet, the present partially executed plans provide that the dam shall consist of an earthen embankment 46 feet wide at the top, with side slopes of two horizontal to one vertical, and having on its center line a wall of rubble masonry built up from the solid rock, 6 feet wide on top, and increasing in width until at and below 150 feet from the top it is 18 feet wide. The slope of the embankment inside of the reservoir is to be covered with a layer of broken stone, on which will be laid a heavy block-stone paving. The slope on the downstream side will be sodded.

You ask us to consider the plans for the construction of this earthen portion of the dam, the work thus far done in building it, and whether any changes or modifications should, in our opinion, be made in the plans.

In determining the plan of construction for this part of the dam financial considerations were doubtless predominant. It has been abundantly proven that up to a height of 60 feet or 70 feet an embankment founded on solid material, and constructed of well-selected earth, properly put in place, is fully as durable and safe as a masonry wall, and far less costly. In this case the foundation is the natural hillside of compact glacial drift.

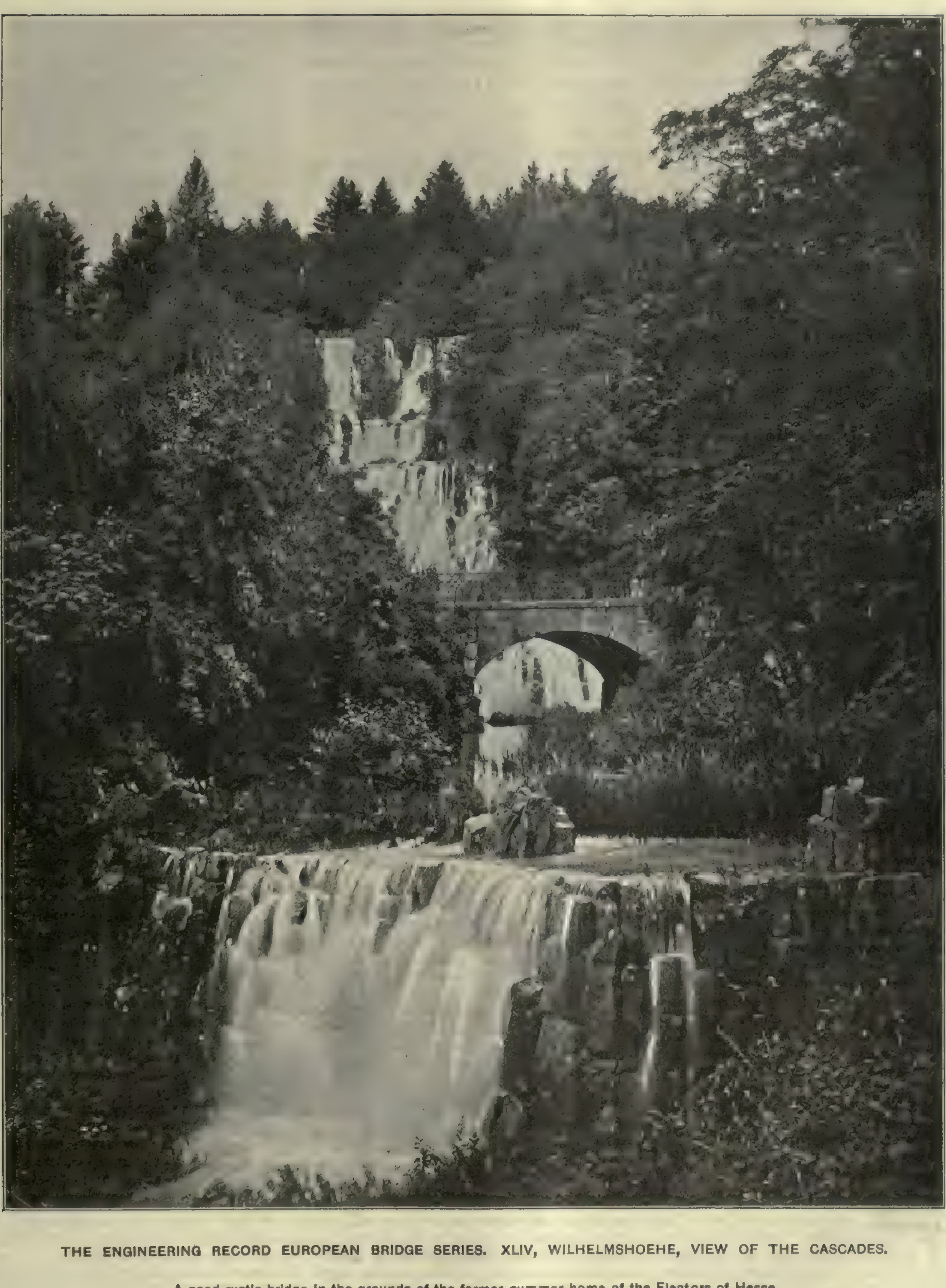
The design of this embankment is that which has been followed in all the earthen dams constructed in the Croton Valley for the past thirty years. In the center of the bank is built a wall of rubble masonry, generally founded on the solid rock, and intended to prevent the free passage of water, but not heavy enough to act alone as a retaining wall for either water or earth. It is endeavored to make this wall watertight, but in most cases such efforts have not been entirely successful. On each side of this wall is built an embankment of selected earth free from large stones, laid in thin horizontal layers, wet, and compacted by carting over, ramming and rolling with heavy grooved rollers.

On the side toward the reservoir, the slope of the bank is paved with stone; the slope of the other bank is sodded. This is the latest accepted engineering practice in this part of the country for the construction of earthen dams of moderate height to retain the water of reservoirs. The variations which occur in construction are in the steepness of the slopes, the character of the paving of the water slopes and the methods of compacting the material as it is put in place. The plans and specifications for this work are carefully drawn and the material to be used is of such a character as to make it certain that if constructed under proper supervision the 300 feet of the dam from the southerly end will be safe beyond peradventure.

The remaining 150 feet, comprising the junction between the masonry dam and the earthen embankment, presents, however, a different problem. The structure at this point is unlike any existing earthen embankment of which we have knowledge. In order to enable the masonry dam to be founded, a pit was excavated to 150 feet below the surface of the ground and 160 feet wide at the bottom. The sides of this excavation slope outward and upward, so that at the surface of the ground the pit at one end is 30 feet deep, 20 feet wide at the bottom and 110 feet wide at the top; and at the other end, where the masonry wall begins, the pit is 135 feet deep, 160 feet wide at the bottom and 560 feet wide at the top, and this end is open to the valley. The bottom of this pit is 60 feet below the bottom of the proposed reservoir.

After filling this pit to the level of the bottom of the reservoir, it is necessary, in order to make the connection between the masonry and earthen sections of the dam, to construct in it an embankment, which at one end is 70 feet high, and is 20 feet wide at the bottom, 110 feet wide at 30 feet above the bottom, then widens out to 206 feet, and is then drawn in to 46 feet wide at the top. At 75 feet from the end it is 100 feet high, 50 feet wide at the bottom, 400 feet wide at 40 feet above the bottom and 46 feet wide at top. At the northern end it is 150 feet high, 250 feet wide at the bottom, 560 feet wide at 80 feet above the bottom and 46 feet wide at the top.

This end abuts against a masonry wall 150 feet wide, and the portion of the bank which extends beyond the masonry on each side has



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLIV, WILHELMSHOEHE, VIEW OF THE CASCADES.

A good rustic bridge in the grounds of the former summer home of the Electors of Hesse.

to be supported by a sloping embankment extending down the face of the masonry dam 300 feet on the upper side and 200 feet on the lower side. These supporting banks are conical in form, the base being carried around to meet the natural surface of the ground above and below the dam. This embankment is built up above the natural original surface of the ground to a height of 40 feet at the south end and 70 feet at the north end.

There is no earthen dam of equal magnitude in existence, so far as we can learn, and there are, therefore, no precedents to guide us in forming an opinion as to whether such a structure can be made safe.

As regards the stability of such a structure against overturning or sliding on its base, no question can exist. The point to be considered is whether an earthen dam like this can be made sufficiently impermeable to water to prevent the outer slope from becoming saturated and thus liable to be washed out and slide.

Whether such a result can be accomplished depends largely upon the character of the material employed in the construction of the bank. We examined the material which has been used in the building of the embankments so far constructed, and we made some experiments on the permeability of the material when placed in embankment and when subjected to the action of water. We also procured several samples of material taken from the embankments and from pits in the vicinity, giving a fair idea of the nature of the materials which have been and which may be used in the banks, and had tests of them made by the Hydraulic Laboratory of Cornell University. All the tests indicated that this material, which we found to be almost identical in character with that which has been used in the construction of all the earthen dams in the Croton Valley, is permeable to water under any head from 3 to 150 feet, and that when exposed to the direct action of water it disintegrates and assumes a flat slope, the surface of which is best described as slimy.

WEATHERED FILL AT SOUTH END OF DAM.

CORE AND WING WALLS AT SOUTH END OF DAM.

On examining the face of excavations which have been made in various parts of the Croton Valley we observed that the materials composing the glacial drift are not as a general rule evenly distributed or intermingled, so as to form a homogeneous mass. There are distinct masses of gravel and boulders, beds of sand and finer gravel and large pockets of a very fine sand with a small amount of clay, forming a very compact material when not exposed to the action of water, but dissolving readily and becoming quite fluid when water reaches it. On inspecting the hillsides along the valley of the river above the New Croton dam instances may be seen where it is plain that the ground water has at some quite recent date penetrated to such a pocket of hard-pan, as it is termed, dissolved it, carried it to the face of the nearest steep slope and sloughed off the face, causing a landslide of the superincumbent mass of more solid material.

In a well-built earthen dam the various classes of material are thoroughly intermingled, forming a mass better adapted to resist such action by the water of percolation, but it is never safe to permit such water to appear on the outer slope of the embankment.

In seeking information as to the actual saturation of high earthen embankments, we were unable to find any recorded data as to the penetration of water into embankments and the slope assumed by the water in passing through banks of earth artificially constructed with care.

There are in the Croton Valley six earthen dams, of heights varying from 50 feet to 90 feet, which have been in use for from three years to twenty-three years, and we accordingly secured from the Chief Engineer of the Water Department permission to test the actual extent of the saturation of these embankments by driving pipe wells into them at different points and noting the elevation at which the water stood in such pipes.

In all of the dams on which observations were made, the entire bank on the water side of the core-wall appears to be completely saturated. On the opposite side of the core-wall water was found to be standing in the embankment in every case.

It will be observed that the extent of the saturation of the outer banks of these reservoirs varies greatly. These variations are doubtless due to the differences in the material employed in the banks, the degree of care taken in building the banks, and to the age of the embankments.

At the Middle Branch Dam, which was built by the Department of Public Works and filled in 1878, the outer embankment near the core-wall is saturated with water to within 15 feet of the water level in the reservoir, and the surface of this saturation slopes away from the wall at a gradient of about 21 feet per 100 feet, being at the lowest point noted within about 7 feet of the surface of the embankment. The presence of water near the surface of the bank at this point is plainly indicated by the character of the vegetation on the embankment.

At the Bog Brook Dam, which was constructed by the Aqueduct Commissioners and has been in use since 1892, the outer embankment near the core-wall is saturated to within 7 feet of the water level in the reservoir and the slope of saturation is 35.7 feet per 100 feet towards the toe of the bank, for 50 feet, and then 40 feet per 100 feet for 40 feet, being at that point very near the natural surface of the ground on which the bank is built.

At Titicus Dam, which was built by the Aqueduct Commissioners and has been in use since 1895, the core-wall has proved an impervious barrier and there is no water in the outer embankment until a depth of 40 feet below the reservoir level is reached. The presence of this water is readily accounted for by the supposition of there being a slight flow of ground water from the natural surface, which at this point rises away from the core-wall, forming a pocket.

When this confined water finds an opportunity to escape to the toe of the embankment, it assumes a slope of 10.7 feet per 100 feet, indicating a quite porous embankment.

At the Amawalk dam, which was built by the Department of Public Works and has been in use since 1897, the outer embankment near the core-wall is now saturated to within 31 feet of the water level in the reservoir, and the slope of saturation is very uniform, at the rate of 17 feet in 100 feet. This indicates a considerable porosity in the embankment and also that, as in the case of the Carmel auxiliary dam, the saturation of the bank is not as complete as may be expected in a few years. There are places on the slopes of this dam where it is evident that the percolation water of saturation is mingled with ground water from a contiguous hill-side and very nearly approaches the surface.

At the Carmel main dam, built by the Aqueduct Commissioners and in use since 1896, the saturation near the core-wall is within 9 feet of the water level of the reservoir and the slope is at the rate of 35 feet per 100 feet toward the toe of the embankment.

At the Carmel auxiliary dam water was encountered at 26 feet below the water level of the reservoir, but on the pipe being driven down 6 feet further, the water disappeared in a few days, showing the existence of a small pocket of water in the bank, which, being penetrated, drained out at a lower level. This indicates that the core-wall is not absolutely tight, and that with the lapse of time the bank will probably become saturated until the slope of the flow in the saturated bank is determined.

The embankments of the Middle Branch and

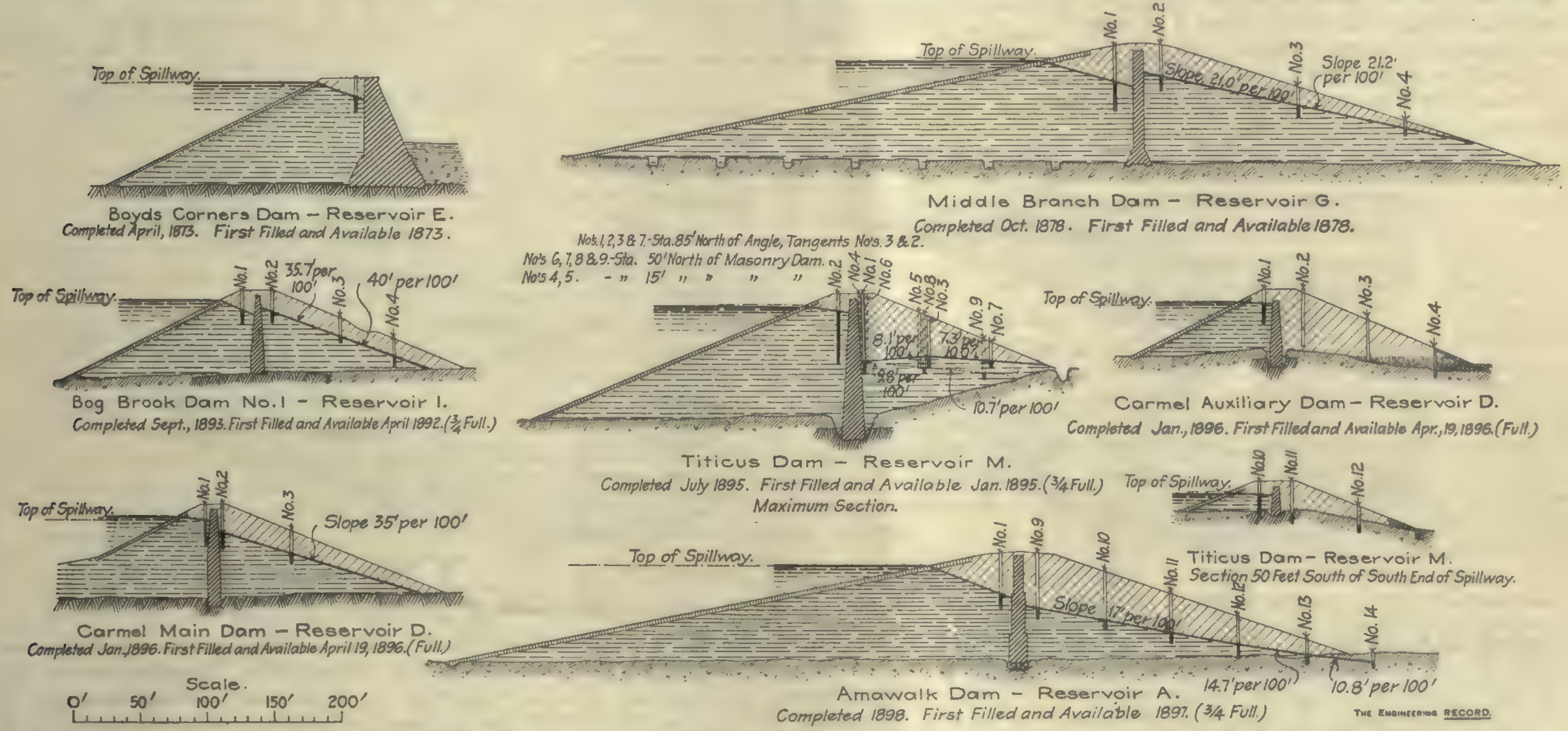
Amawalk dams were differently constructed from the dams built by the Aqueduct Commissioners. The same care was not required to be taken in either the construction of the core-wall or in the selection and placing of material in the embankment. In all of these embankments the outside slope is flatter than is proposed for the New Croton dam.

On applying the data from these tests to the proposed cross-section of the New Croton dam embankment it appears that taking the loss of head in passing through the core-wall and the slope assumed by the water of saturation in each case examined, the maximum safe height of an earth embankment with its top 20 feet above the water level and its outside slope two to one, would be:

On the basis of the loss of head and saturation at	Feet.
Middle Branch	63
Bog Brook	100.6
Titicus	82.3
Amawalk	72
Carmel Main	102.5

In embankments of greater height than these the outer slope would be saturated and the dam unstable and unsafe.

We are of the opinion that the observations made at the Bog Brook dam, the oldest, and the Carmel main dam, the most recent of those built by the Aqueduct Commission, furnish a fair criterion for assuming the probable saturation of the outer embankment of the New Croton dam, provided that the core-wall and the embankment were built in accordance with the plans and specifications in every respect, and the foundation on level rock.



Top of Spillway.
Boyds Corners Dam – Reservoir E.
Completed April, 1873. First Filled and Available 1873.
Top of Spillway.
No.1
No.2
No.3
Slope 21.2' per 100'
Slope 21.0' per 100'
No.4
Middle Branch Dam – Reservoir G.
Completed Oct. 1878. First Filled and Available 1878.
Top of Spillway.
No.1
No.2
35.7' per 100'
No.3
40' per 100'
No.4
Bog Brook Dam No.1 – Reservoir I.
Completed Sept., 1893. First Filled and Available April 1892. (3/4 Full.)
No's 1, 2, 3 & 7.-Sta. 85' North of Angle, Tangents No's. 3 & 2.
No's 6, 7, 8 & 9.-Sta. 50' North of Masonry Dam.
No's 4, 5. - " 15' " " " "
No.2
No.4
No.1
No.6
No.5
No.8
No.3
No.9
No.7
8.1' per 100'
7.3' per 100'
9.8' per 100'
10.7' per 100'
Titicus Dam – Reservoir M.
Completed July 1895. First Filled and Available Jan. 1895. (3/4 Full.)
Maximum Section.
Top of Spillway.
No.1
No.2
No.3
No.4
Carmel Auxiliary Dam – Reservoir D.
Completed Jan., 1896. First Filled and Available Apr., 19, 1896. (Full.)
Top of Spillway.
No.10
No.11
No.12
Titicus Dam – Reservoir M.
Section 50 Feet South of South End of Spillway.
Top of Spillway.
No.1
No.2
No.3
Slope 35' per 100'
Carmel Main Dam – Reservoir D.
Completed Jan., 1896. First Filled and Available April 19, 1896. (Full.)
Top of Spillway.
No.1
No.9
No.10
No.11
No.12
No.13
No.14
Slope 17' per 100'
14.7' per 100'
10.8' per 100'
Amawalk Dam – Reservoir A.
Completed 1898. First Filled and Available 1897. (3/4 Full.)
Scale.
0' 50' 100' 150' 200'
THE ENGINEERING RECORD.

CROSS-SECTIONS OF EARTHEN DAMS IN CROTON VALLEY, SHOWING THE AMOUNT OF SATURATION.

The Titicus dam, it is true, appears to be absolutely impervious, where the core-wall is 100 feet high and founded on nearly level rock at the bottom of the valley, but from our examination of so much of the core-wall as has been built at the New Croton dam, which will be 200 feet high at one end and is built on a hill-side of rock, rising 55 feet in 100 feet, we are of the opinion that some percolation through it will unquestionably occur, and that to a degree in proportion to its height, not less than is found to occur in the Carmel and Bog Brook dams.

The slope of the surface of the saturated water in the bank is determined by the solidity of the embankment. The more compact the material of which the bank is built, the steeper will be the slope of the saturation. The evidence of the Middle Branch, Bog Brook and Carmel dams is to the effect that the bank below and adjoining the core-wall in the course of a few years becomes saturated up to 83 per cent. of the depth of the water in the reservoir, and that the slope of saturation in the best embankment made of the material found in the Croton Valley is about 35 feet per 100 feet, and that with less carefully selected and placed material the slope may be 20 feet per 100 feet.

Comparing all the data obtainable and our observations of the character of the material employed and the work already done, we are of the opinion that in the New Croton dam embankment the loss of head caused by the core-wall may be assumed to be 17 per cent. of the depth of water in the reservoir, or 21 feet, and that the slope of saturation may be assumed at 20 feet per 100 feet.

On this basis, which is a liberal one, the maximum height to which an earth embankment, with its top 20 feet above the water line and with outside slope of two to one, can be built with safety, is 70 feet.

From our observations, experiments and tests of the material used in the embankments already made and the manner in which it has been put in place, we are of the opinion that the saturation in the high embankment adjacent to the masonry dam would more nearly approach the Middle Branch rate than that of the Bog Brook and Carmel dams and that, at any rate, the 150 feet of bank adjoining the end of the masonry dam would in time become unstable and unsafe if built as designed.

The trouble might be overcome to some extent by flattening the slope of the banks and adding about 300,000 cubic yards of embankment, so as to bring the probable slope of saturation not less than 10 feet below the surface of the bank. This would extend the toe of the embankment some 250 feet further into the valley, would add largely to the cost and would disfigure the appearance of the dam. Or the lack of stability might be to a considerable extent overcome by facing the lower slope with a revetment of heavy block stone paving with a backing of broken stone. This, too, would disfigure the dam and add largely to the cost.

In either case the permanent stability of the bank would be still a matter of great doubt, for it must be borne in mind that this immense bank is founded partly on a rock surface sloping down toward the valley at the rate of 50 feet in 100 feet, and partly on the excavated face of a bank of the natural earth, which in turn rests on the same sloping rock surface. The permeabilty and character of this natural earth bank are unknown except where it has been cut into, and there it is found to contain a large proportion of the hard-pan already referred to, interspersed among beds of gravel and boulders. The thrust of the embankment at its toe is resisted by a mass of miscellaneous material, dumped in and wet, but not rammed or rolled, to a depth of from 100 to 150 feet above the underlying rock. The character of the first 50 feet in height of the embankment, which has been placed on the lower side of the dam, and its behavior under exposure to the weather, will be best understood from inspection of the accompanying photograph. [See engraving entitled "Fill at South End of Dam, Showing Effect of Weathering."]

Supposing, as we safely may, that an embankment 70 feet in height may be constructed on the plans and of the material demanded by the specifications for the New Croton dam, if founded on rock or on solid earth, with absolute assurance of its stability and permanency, an element of uncertainty is introduced when such an embankment is placed, as it is here proposed to do, on top and at the edge of an artificial bank of earth 100 feet high, built in detached sections, as this bank must necessarily be built, and sure to be saturated with water from a reservoir 125 feet deep behind it, and the ground water from a steep hill-side adjoining it. This uncertainty arises chiefly from the fact that the settlement of a bank thus constructed must be very irregular and the liability to cracking and deformation great, being built at different times and of various kinds of material. There is no way in which such irregular settlement can be avoided. It will take place largely during and after the filling of the reservoir with water, and there is no way in which cracks in the embankment, which may have once opened to permit the passage of water, can be closed. The percolation of water through the bank at any but the lowest velocity would endanger its stability beyond repair, and no amount of additional earth placed upon its slopes would suffice to make it permanently stable.

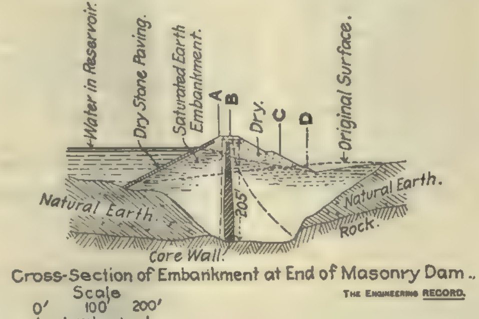
This doubt as to its permanent stability is sufficient to condemn this plan of construction for this important structure, on the permanency of which the safety of the water supply of New York depends.

The only alternative is the continuation of the masonry dam of its full section, for the remaining portion of the work. The extreme southerly end, about 140 feet long, south of the gatehouse controlling the inlet to the old aqueduct, where the top of the dam would be 30 feet above the natural surface, might be made an earth embankment. The additional expenditure required to change the 290 feet between the gatehouse and the present end of the masonry dam from earth to masonry would be about $400,000.

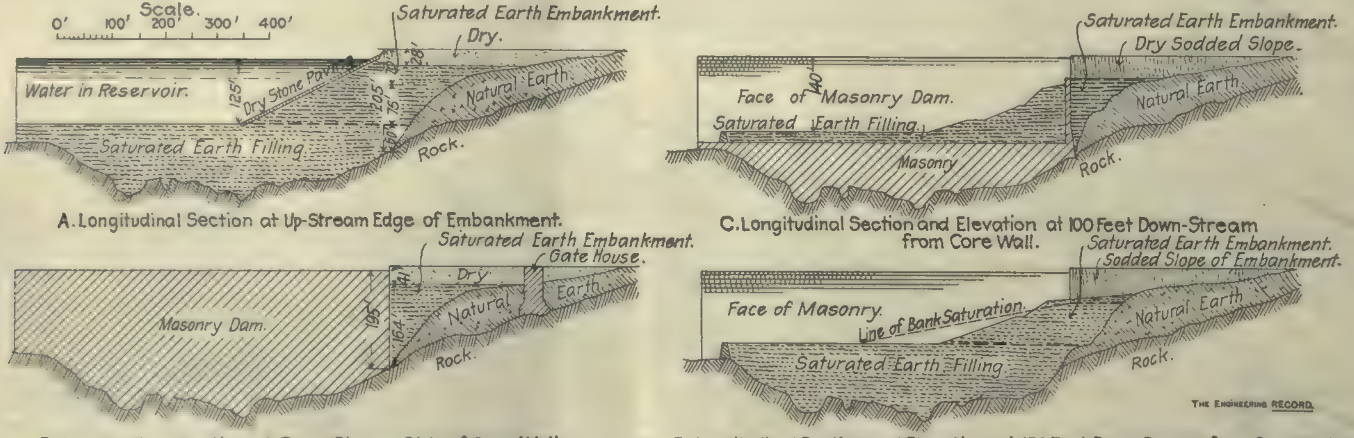
So far we have only considered the plans of this structure from an engineering point of view; that is to say, as regards the building of a structure which shall be reasonably secure against ordinary contingencies, at the least cost. There should, however, be precautions taken against extraordinary contingencies.

One such contingency which might arise is the occurrence of an extremely heavy rainstorm or cloudburst in the Croton Valley, or the failure of one of the large dams further up the valley, which might bring down a volume of water which the wasteway of the dam would be unable to carry off as rapidly as it came, and the dam would be overtopped, in which case the earthen embankment, as at present planned, with the top at the same elevation as the top of the masonry dam, would be carried away. In the original designs of the dam, it was proposed to build the masonry portion of it to the elevation of 210 feet above tide, or 10 feet above the ordinary high-water level of the reservoir, and the earthen embankment was to be built 10 feet higher, so that a wave of translation induced by a heavy landslide, the failure of the dams further up the stream, or a cloudburst, and which might easily rise to the top of the masonry, would have a vent over the masonry and not rise to the top of the earth embankment. It is true that the original plans, as shown on the drawings accompanying the contract, were defective in their provision against such a contingency, the earth and masonry dams being at the same elevation at their junction, the top of the core-wall being 10 feet lower than the top of the masonry dam and the earth embankment rising to its full height only at a distance of 100 feet from the junction. Preliminary plans for obviating this defect had been made, but had never been approved by the Aqueduct Commission, and when, a year ago, the adjustment of the top line of the dam was finally made, the possible effect of such a wave of translation was disregarded, and with the idea that a level crest for the whole length of the dam would present a better appearance when viewed from down the valley, the height of the whole length of the masonry dam was increased 6 feet and the height of the earthen dam diminished 4 feet, making the crest of the dam a level line from one end to the other at the elevation of 216 feet above tide level. The core-wall, too, was planned to be built 10 feet higher than before.

We consider that both the original and the present plans are injudiciously designed, in view of the possibility, remote though it may be, of such an excessive flood. If any portion of the dam is to be made an earthen embankment, it ought to be constructed at least 10 feet higher than the crest of the masonry portion of the dam, and the masonry dam should not in any case be built higher than was originally designed. Such a change destroys the harmony and fitness of the design, which, having been scientifically determined, should be rigidly adhered to.



Cross-Section of Embankment at End of Masonry Dam..



A. Longitudinal Section at Up-Stream Edge of Embankment.

C. Longitudinal Section and Elevation at 100 Feet Down-Stream from Core Wall.

B. Longitudinal Section at Down-Stream Side of Core Wall.

D. Longitudinal Section and Elevation at 150 Feet Down-Stream from Core Wall.

LONGITUDINAL SECTIONS OF NEW CROTON DAM ON LINES INDICATED IN THE CROSS-SECTION.

Another consideration which should be kept in view in the design and construction of this great work is rather æsthetic than of a purely structural character. We have here the most stupendous masonry structure of its class in the world. For nearly 1,000 feet of its length, no criticism as to its stability and permanency can be made. Then, solely from economical considerations, the design and the character of the structure are changed for a length of about 400 feet. This portion of the structure would not present an insignificant appearance in comparison with the main portion of the dam, if built in harmony with it, for it is, in itself, as it would appear above the surface, a higher and larger dam than any except a very few dams which exist elsewhere. The impression produced on the beholder by the present plan is that of a parsimonious makeshift not in harmony with the central portion of the dam nor with the massive spillway at the northern end, and would lead the general observer to inquire why so great an expenditure had been made on the ornamentation and architectural appearance of the central portion of the dam, instead of being applied to the creation of a massive homogeneous structure for the whole length of the dam, producing an impression of durability and stability which a composite arrangement of the kind proposed by either the original or the present plans does not inspire.

In our opinion, the absolute security of the dam against disaster, the architectural and æsthetic harmony of the structure and the general feeling of security in the public mind would be satisfied only by the substitution of a masonry structure, similar in design to the rest of the dam, for the earthen bank proposed by the present plans.

We therefore recommend that the plan of construction of the southerly end of the New Croton dam, from the end of the present masonry dam to the gatehouse controlling the inlet to the old aqueduct, be modified so as to be in conformity with the plans for the masonry dam as originally designed and now in course of construction.

Jerome Park Reservoir.—The Jerome Park Reservoir is an unfinished artificial basin intended for the storage and distribution of a part of the city water supply, extending from Kings Bridge Road between Jerome and Sedgwick Avenues northerly nearly to the south boundary of Van Cortlandt Park, a distance of about a mile, with an average width of about 1,500 feet, and having a storage capacity of 1,800,000,000 gallons of water.

The surface it occupies was quite irregular, and to convert it into a reservoir involved the excavation and removal of large quantities of earth and rock and the erection of long sections of retaining embankments where the surface of the ground on the limiting lines of the reservoir was below the elevation at which it is proposed to carry the water in it; and it is relative to the method that was adopted in building core-walls for certain of these earthen dams or reservoir embankments that you ask our advice.

The plans and specifications provide for lining the interior slopes of the embankment with a paving of stone or brick laid in concrete, and its bottom with a layer of concrete, on good earth compacted by rolling, with the intention of making the entire interior surface of the reservoir impermeable to water.

They further provide for the construction of cement masonry core-walls in all the reservoir embankments.

The data submitted to us clearly establish the fact that for the section of the reservoir embankment to which you have called our attention, extending across the south end of the reservoir and along its east side, a total distance of 2,850 feet, a core-wall has been built, of which over 1,200 linear feet are founded on earth, and the remainder on rock.

The profile of the rock surface under the entire length of this core-wall is very irregular and is overlaid with a stratum of sand, the upper surface of which is approximately horizontal and about 20 feet below the top of the core-wall masonry, and extends thence down to the surface of the rock.

The question at issue is whether it is essential to the stability of the embankment and the security of the reservoir against dangerous leaks that these walls should in all cases be founded on the underlying rock.

The reservoir is evidently in a basin of the rock surface, surrounded by a ridge of rock, in which there are apparently some depressions through which water may drain to the north, the south and the east. The largest and most important of these depressions is at the north end of the reservoir. To this our attention has not been called.

At the south end, adjacent to the Kings Bridge Road, at or near Station 76, there is an evident depression in the rock barrier, extending 20 feet below the bottom of the reservoir. The borings made indicate that this depression is filled with a fine sand, which is saturated with water, is stable when confined and cannot run unless exposed to flowing water with a free outlet.

Under the embankment, this depression is about 300 feet wide, and the core-wall built here does not extend down to the rock surface, being 30 feet above it at the deepest point.

The borings made in this vicinity indicate that about 100 feet south of the reservoir this depression is narrow, leaving a very contracted passage for the water which may tend to flow southward through the sand with which the depression is filled. The tests made show that the slope assumed by the water of saturation, whether undisturbed or when its surface is lowered by pumping from a pit inside of the reservoir, is northward and toward the reservoir for about 60 feet outside of the core-wall. From that point, the slope of the surface is toward the south. This change of direction was evident even after the water in the ground inside of the core-wall had been lowered 8 feet by pumping. The slope is very flat in each direction. The pumping for twenty-four hours from a pit inside the reservoir and 70 feet from the nearest test well seemed to lower the surface of the water, but not the slope at which it stood in the ground.

The plan of construction at this point proposes to make an embankment of selected earth, about 22 feet in height, on the natural surface, and to line the inner slope of this embankment with a pavement of brick and stone laid in mortar on concrete, and to cover the bottom of the reservoir with concrete laid on a surface of good earth well rolled. The embankment is to be 20 feet wide on top, with slopes of two to one.

Any breaks in the continuity of the reservoir lining can, at the worst, expose but a small area of the surface of the reservoir slopes and bottom to the action of the water it stores, and the character of the topography adjoining the reservoir boundary convinces us that no serious leaks need be apprehended under this section of core-wall founded on earth, and that none can possibly occur having a sufficient motion to threaten the stability of the embankment in which it stands. About 700 feet from the east end of this section of wall founded on earth, another depression in the rock surface begins, extending along Jerome Avenue 675 feet, where the wall is also founded on earth, its greatest depth under the wall foundation being 18 feet.

Along this section of wall founded on earth the rock outside of the reservoir is evidently, from all the borings which have been made, higher than it is under the embankment, and the natural surface of the ground nowhere within a distance of 500 feet outside of the core-wall is more than 8 feet below the water surface of the full reservoir. We did not consider it necessary to make any test borings along the line of this wall.

About 600 feet further north than this section, near Station 99, is another like depression in the rock surface, where, for a distance of about 250 feet, the core-wall is founded on earth, extending about 20 feet below the bottom of the masonry. On this section, the difficulties encountered in founding it indicate the presence there of a fine material which will run when exposed to flowing water.

The test pit and borings made near it show that the material in which this section of core-wall is founded consists of a stratum of very fine sand extending from a plane 6 or 8 feet below the natural surface of the ground down to the rock, similar to the thin strata of fine sand in some of the borings near the first section, tested at the Kings Bridge Road.

The topographical maps and the records of the borings in this vicinity, furnished us by your engineering department, indicate that the surface of the rock rises rapidly, outside this section of embankment, and that the earth surface adjacent to the foot of its outer slope is nowhere more than 8 feet below the water surface of the reservoir. The results of borings and pumping tests at Station 99 show that the slope of the ground water, both before being disturbed by pumping from a pit inside the reservoir and after pumping also, is toward the reservoir.

We found by numerous tests that all these fine sands are unstable when mechanically agitated in an excess of water, and that they all settle in a firm and compact mass under the water when the agitation ceases. They are quite unlike the true quicksands, whose particles are of impalpable fineness and which are "quick" or unstable under still water.

From the pumpage tests also we are convinced that there is no danger to be apprehended from any movement of these sands sufficient to affect the core-walls. The levels taken show the slope of saturation under the embankment at both Stations 76 and 99 to be in the direction of the reservoir and not away from it, as was supposed. It is evident that the ground water has not a free outlet to the south or east.

Only a small part of the embankment has been filled in along these core-walls, and they consequently produce a greater unbalanced pressure upon the fine saturated sand at their base than will exist there when the embankments are completed. No material settlement has thus far been observed in these walls, and we consider it as not within the range of possibility that the foundation will yield under the completed embankments or that any material amount of water will find its way through or under them, if they are built in compliance with the specifications.

It must be borne in mind that the percolation of water through this bank cannot be rapid enough to induce any movement of the material, and that the access of water to the material will be almost absolutely cut off by the concrete lining of the banks and bottom of the reservoir.

To preclude all possibility of the sliding or slipping of the inner bank in case of the water being lowered rapidly in the reservoir, we are of the opinion that the inner slope of the reservoir bank should be made two and a half horizontal to one vertical, and that at the intersection of this slope with the reservoir bottom, the interior lining of concrete should be made double the thickness that is provided for by the present plans.

We recommend that these modifications be made in the plans for the construction of the embankments on the south and east sides of the Jerome Park Reservoir.

Summary.—The two cases which we have had under consideration represent materially different conditions.

At the New Croton dam there is a reservoir of 125 feet depth of water, retained by an artificial embankment, the outer toe of which is 5 feet lower than the bottom of the reservoir and which rests on a filling of earth, 100 or more feet deep, which in turn rests on a steeply sloping rock surface. The percolation of water through this embankment to such an extent as may reasonably be expected under the existing conditions would be liable to induce sliding of the bank and its destruction. A large expenditure is warrantable to prevent the probability of such a contingency.

At the Jerome Park Reservoir there is a reservoir of 24.5 feet depth of water, retained by an embankment from 12 to 22 feet high, resting on natural earth 40 to 48 feet deep, which rests on rock which is nearly level transversely to the line of the embankment. Beyond the embankment the surface of the ground generally rises, but in a few instances falls away very gradually. There is no possible danger of sliding or sloughing of the bank. The utmost that can be anticipated is the seepage of a small amount of water through the embankment and the earth, and this would be carried off by the sewers in the adjacent avenues. A large expenditure to absolutely prevent such seepage would not be warranted nor advisable.

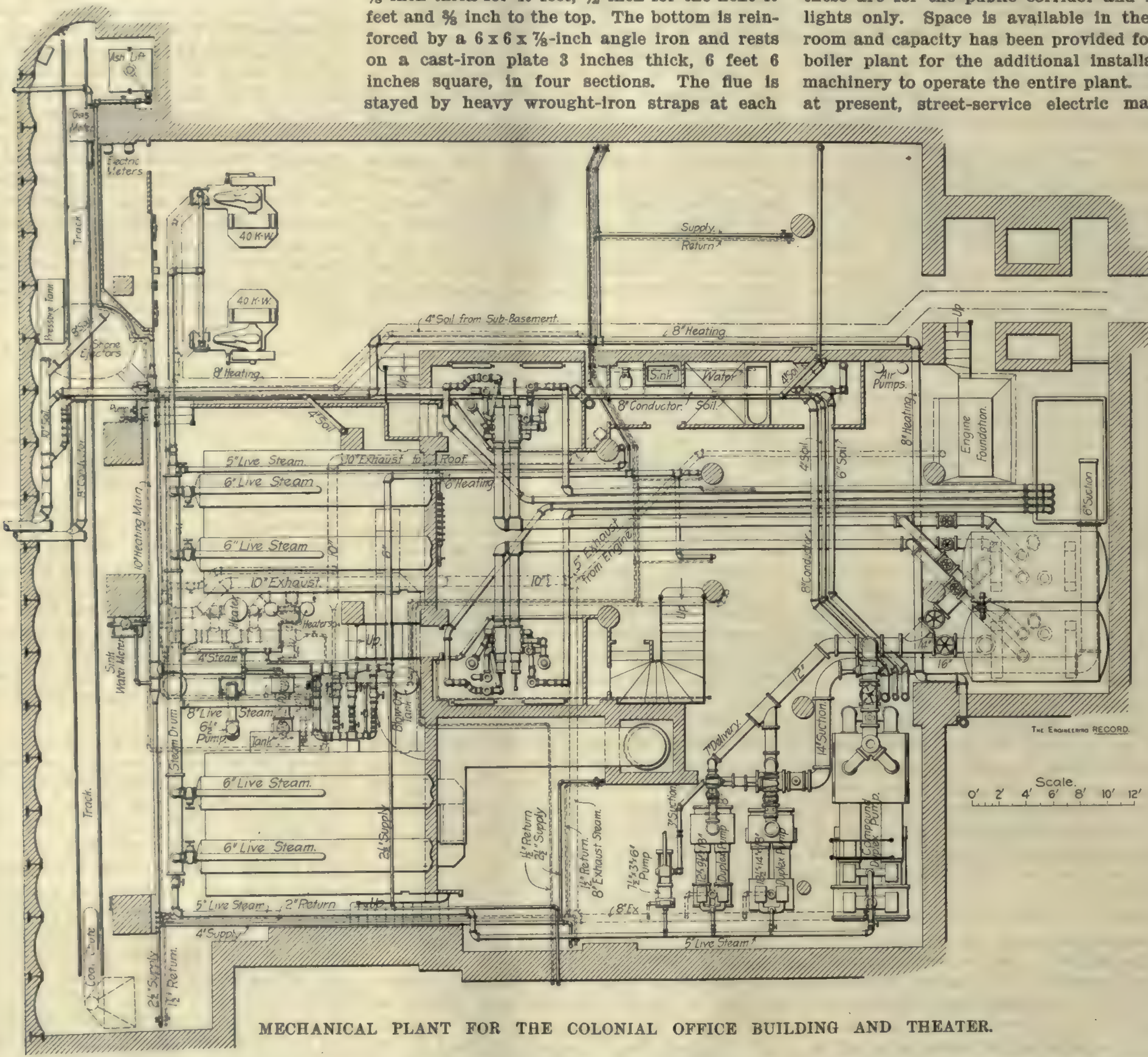
Power, Ventilation and Heating in the Colonial Building, Boston.

The Colonial Building, Boston, is a ten-story structure which, for the larger part, is used as an office building, but includes in its lower four stories and basement a theater seating in its audience space 1,662 people. The heating and ventilation of this portion of the building is, of course, quite interesting; and for the general mechanical purposes of the whole building there is in a sub-basement and a portion of the basement a steam plant of about 600 horse-power in water-tube boilers, two combined units of electric generators and steam engines, a hydraulic elevator equipment of the plunger type and a water supply and sprinkler fire-protection system.

The building is located on the site of the old Boston Public Library, occupying a front of 115 feet on Boylston Street and facing the Common. Its front facade rises 125 feet to a granite cornice and has the successive rows of windows characteristic of office buildings. It has three main entrances from Boylston Street, one, in the center, to the elevators serving the office portion of the structure, one, along the right side, leading to the ticket office and main parts of the theater proper, and the third, along the left side, giving access to the gallery. The auditorium of the theater consists of the main floor or parquet, a balcony and a gallery. It practically has no communication with the office building, extending from a wall about 75 feet back from Boylston Street to a line 90 feet farther back, behind which is the stage structure, which extends 45 feet farther to Van Rensselaer Place, giving to the building a total depth of 211 feet. There are stairways rising from the main theater and gallery corridors, connecting with the foyers.

The office building proper, that is, the ten-story structure, extends backward from the street front to the line of the front of the stage, that is, about 165 feet, and the ceiling of the theater auditorium, forming the fifth floor of the office building, is composed of heavy girders. The stage structure rises to a total height of about 90 feet above the street level. The office floor in plan above the fourth story is indented by three courts, to obtain as much illumination as practicable; and arranged around on all sides are 31 offices, with central corridors between the rows of rooms. There are four elevators rising through the building, and an interesting feature in this connection is that such is the framing of the building that two additional elevators can be put in, if found necessary. Details of the steel work were described in The Engineering Record of October 12.

A sub-basement plan in the accompanying drawings shows the arrangement of the mechanical plant. The front part of the basement contains two basement stories. The central part of the basement is on the level of the space underneath the parquet, and the fans of the combined plenum and exhaust air distribution system for the theater are located at that level, the plenum blower delivering into the space which was set apart solely for use as a plenum chamber. The rest of the plant is located in the sub-basement. This level of the building is carried out under the sidewalk to receive light, and a retaining wall was required, built of 15-inch vertical beams spaced along the front of the excavation, and carrying brick arches turned between them, the vertical beam work being braced to the floor construction at intervals.



MECHANICAL PLANT FOR THE COLONIAL OFFICE BUILDING AND THEATER.

The boilers, four in number, are located in the front part of the sub-basement, in a room with 17 feet 3 inches in clear height, set in two batteries with enough space between them for the feed pumps and heaters. The rest of the sub-basement front is occupied by the engines and generators. Back of the boilers and underneath the elevator walls is the elevating machinery, toward the rear of the sub-basement are the elevator pumps, and in the rear of the sub-basement are located the suction and pressure tanks for the elevators.

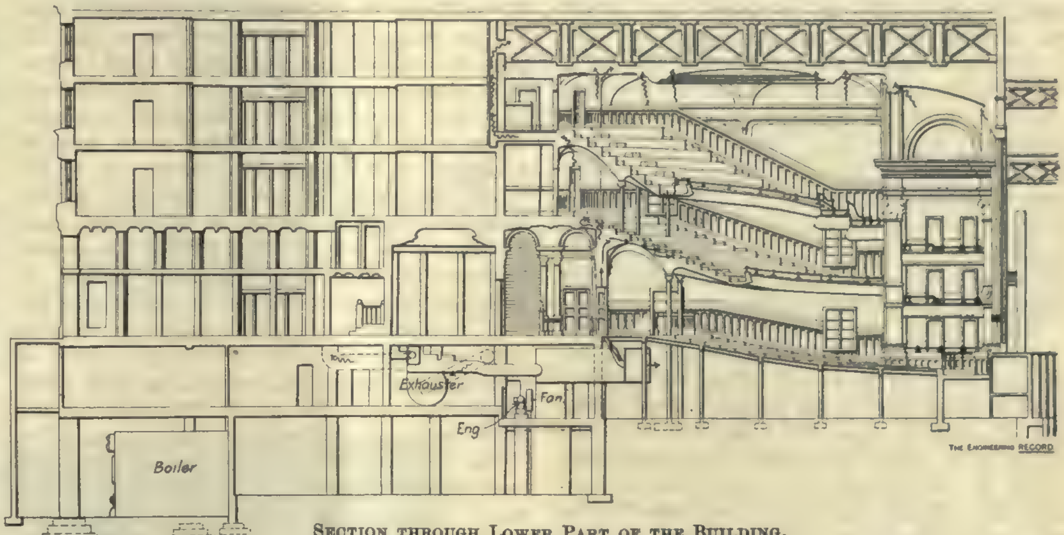
The boilers are Babcock & Wilcox water-tube boilers, provided with Bannister rocking grates; each is of about 150 horse-power. They are connected in the manner indicated by wrought-iron breeching to a wrought-iron chimney 165 feet in height, lined, for its lower 30 feet, with fire-brick set in kaolin. This section has a diameter of 58 inches, of ¾-inch iron; above the 30-foot level the diameter is 48 inches, and the iron ⅝-inch thick for 40 feet, ½ inch for the next 40 feet and ⅜ inch to the top. The bottom is reinforced by a 6 x 6 x ⅞-inch angle iron and rests on a cast-iron plate 3 inches thick, 6 feet 6 inches square, in four sections. The flue is stayed by heavy wrought-iron straps at each floor level. The boilers face toward the front and across the firing space runs a track, connecting at one end with a coal bunker and at the other with an ash hoist. The coal storage is a large vault underneath the main entrance to the theater, occupying a space in the basement story roughly 18 x 35 feet in plan, and terminating at its bottom into a wrought-iron chute dumping directly into the car. Coal is delivered to the building every morning from the sidewalk; the daily consumption is about 7 tons. The boilers are hand fired, and three are sufficient for the entire load of the building, leaving the fourth as a reserve. A steam pressure of 85 pounds is carried.

Each boiler is provided with a 6-inch connection, which feeds into the top of a steam drum supported overhead in front of the boilers, 14 inches in diameter. From one end of this is taken a 5-inch main for the elevator and other pumps, toward the rear of the basement, from the other end a 5-inch main for the electric lighting engines and a 5-inch main for the plenum-fan engine, and near the center a 4-inch line to the feed pumps and an 8-inch main for the auxiliary supply of live steam to the heating system. The connections for the latter purpose are quite interesting, as shown in the accompanying sub-basement plan.

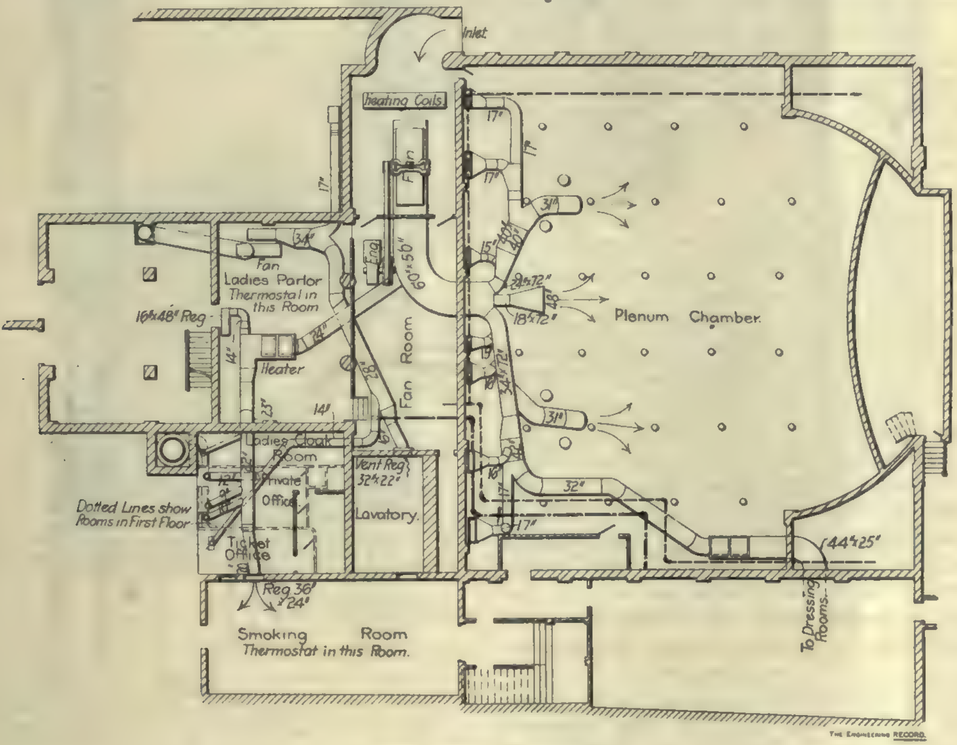
The dynamo and engine room, as stated, adjoins the boiler room. At present it contains two 40-kilowatt units, employing Thomson-Houston generators coupled to Ames engines; these are for the public corridor and lavatory lights only. Space is available in the engine room and capacity has been provided for in the boiler plant for the additional installation of machinery to operate the entire plant. Instead, at present, street-service electric mains are brought to the switchboard, which occupies the front end of the engine room, and feeders from these are carried to the theater and through the building for the offices.

The exhaust from the engines is carried in pipes in trenches, and is joined by that from the fan engine and the various pumps, passing at the front of the feed-pump space into a large pipe connecting with a 10-inch heating main, and with three Jacobs heaters, one of 600-horse-power for heating feed-water, and two, of 60 and 80 horse-power capacity, respectively, for heating water, the former for the office portion of the building and the latter for the theater. The feed-water heater has the usual by-pass connection, and the hot-water heaters have live steam connections and are fitted with Curtis automatic temperature regulators. The bowls and sinks throughout the building, it may be mentioned, are supplied with both hot and cold water, and the hot-water piping is of brass. The pressure-reducing valves feeding the heating system are located in the branches shown over the feed-pump room, being fed at one end from the 8-inch pipe which leaves the large steam drum nearby and connecting at the other into the main exhaust pipe mentioned. The exhaust steam is allowed exit to the atmosphere from this latter main pipe in a 10-inch pipe which extends up a shaft near one of the elevator wells, fitted with back-pressure valve.

The heating mains start from the exhaust main, one 10 inches in diameter extending across the front of the boilers and passing along the engine room, as shown, to a point near the pressure tanks, and another 6 inches in diameter which rises at a central point in the sub-basement. The system for the office portion is distinct from that for the theater; the two-pipe method is used throughout. The total amount of direct radiation in the whole building is 8,623 square feet, and of indirect radiation, 7,500 square feet; the steam requirements for which were calculated on the basis of 100 square feet of direct radiating surface per boiler horse-power and 25 square feet of indirect radiating surface per boiler horse-power. The heating returns are collected into a Whittier automatic float return tank in the boiler room, which is connected with a 8 x 5 x 12-inch Deane single-acting and a 7½ x 5 x 12-inch Deane duplex pump. The overhead piping and valves in the boiler room are reached from an overhead iron platform. Further mention will be made of the heating work in connection with the ventilating plant.



Section through Lower Part of the Building.



Plan of the Basement.

The elevators, as stated, are of the plunger type, manufactured by the Plunger Elevator Company, of Worcester, Mass. The cylinders for the plunger pistons were sunk to a depth of nearly 140 feet below sidewalk, the last 20 feet through solid rock. The pistons are of steel, 6½ inches in diameter, and two have a total travel of 125 feet, from the basement to the tenth floor. The machinery is calculated for a live load per elevator of 3,000 pounds, with provision in one case for 10,000 pounds for safe lifting. The pumping plant for this machinery comprises a compound pump of 16 and 20-inch steam cylinders, 30-inch water ends and 24-inch stroke, and two duplex pumps, one 14 x 18 x 18½ inches, and the other 9 x 12 x 18 inches in cylinder dimensions, all of the Deane make, besides a smaller pump for the higher pressure required for safe hoisting. As shown in the sub-basement plan, the water ends are all cross-connected so as to deliver to either of two pressure tanks, from either or both of which each pair of elevators may be operated. These tanks, which are cylindrical in form and made of 13/16-inch refined iron, with triple-riveted longitudinal seams and double-riveted girth seams, have each a capacity of 3,000 gallons. The suction or elevator discharge tank, as usual, is rectangular, utilizing thus all possible space, and is made of ⅜-inch iron, and has a capacity of 5,400 gallons.

The elevator plant is of sufficient capacity to take care of six elevators, which may ultimately be installed, besides leaving one pump as a reserve. An interesting feature of this part of the mechanical plant is that the floor of the pump room is raised 3½ feet above the concrete floor proper to allow the comparatively complicated system of piping to pass underneath, ready of access. The air for the pressure tank is furnished by a Westinghouse compressor. Included in the elevator equipment is a large elevator in the stage portion of the building, and the ash lift, but these were not considered in the calculations mentioned, as they were not likely to be used when the office building elevators were in operation.

In concluding the description of the mechanical apparatus in the sub-basement, brief mention may be made of the sewage and water systems. The boiler room is about 10 feet below sewer level, and all plumbing lines which could not be drained directly into the sewer are collected by gravity into a wrought-iron tank sunk in the front part of the sub-basement, with its bottom 40 feet below the sidewalk level. The sewage is then lifted by a Shone ejector operated with compressed air from the Westinghouse compressor. The water system includes a 3-inch fire line, a 4-inch sprinkler supply, a 4-inch house main for the offices and a 2-inch main for the theater. The distributing drum is located back of the inner battery of boilers, between the elevator wells.

The ventilating and heating system for the theater is indicated in an accompanying plan of the basement and a longitudinal sectional elevation through the lower four stories of the building. The upward system of air distribution, effected by plenum and exhaust fans, is in use. The air is received into the building at a basement area to the left of the auditorium, passes through heating coils into a centrifugal blower and is discharged largely into a plenum chamber underneath the parquet, into seven flues which connect with an enclosed space underneath the balcony floor, and into a duct which carries a supply to some dressing rooms. In the latter, as well as in a duct which is divided into a number of branches to various smaller rooms of the theater, there is an auxiliary heater, as will be mentioned later. The duct passing into the plenum space is 5 x 6 feet in size, and the air is discharged from this into the plenum space through three openings located to distribute the air equally over the entire space. From this chamber the air escapes into the auditorium through cast-iron gratings enclosing the chair legs. From the space under the balcony floor, the air emerges through openings in the face of the risers.

The exhaust of the air from the auditorium is accomplished through registers in the rear part of the ceiling of the balcony, through large registers in the rear part of the main ceiling, and through numerous perforations around the central ring of the main ceiling and in the top of the sounding board. These registers and openings are all connected, as indicated in the cross-section drawing, to the spaces between the large girders forming the auditorium ceiling. From these spaces the air is drawn into a room in the fourth story to the right of the auditorium, where it is taken by a centrifugal exhaust and discharged through a shaft of 50 square feet sectional area extending from this point to the roof. The openings from the girder spaces into the room are fitted with shutters to regulate the amount of air drawn from the various parts of the ceiling. The up-cast vent shaft, which passes through the office building, is built of double Mackite to be both fire and soundproof. Above the roof it is capped by a copper house with louvre openings for the escape of the air. The fan is a 180-inch full housing exhauster, operated by belt from a 16-horse-power electric motor.

The seating capacity of the theater is as follows: Orchestra, 618; balcony, 552; gallery, 370; boxes, etc., 122; total, 1,662. The plenum fan is a 10-foot Sturtevant centrifugal blower, arranged to be run at 140 revolutions per minute. At this speed it was assumed that 25 cubic feet of air would be furnished per person per minute, but it has not been found desirable to force in so much air and the fan has rarely been run for more than 50 revolutions per minute, this giving a satisfactory change of air. Tests were made with a delivery of 40,000 cubic feet of air per minute into the plenum chamber—25 cubic feet per person per minute for 1,600 persons—and it was found that there were complaints of draughts. When the supply was cut down to 16 or 18 cubic feet per capita per minute the complaints ceased.

With regard to warming the air, it was planned that the air could be pumped into the plenum chamber at about 65 degrees and the warmth given out by the audience itself would be sufficient to raise the temperature of the house to at least 70 degrees. This had been found to be an incorrect supposition and instead the plenum chamber is maintained at the same temperature as the auditorium; this is usually 72 degrees. The total surface of the heating coils at the air inlet into the building is 7,000 square feet.

So far as ventilation is concerned, Mr. C. H. Blackall, the architect of the building, says it is perfectly satisfactory, but he believes it would be better to close up the openings in the front part of the ceiling, so that all outlets could be distributed along the rear of the house over the highest part of the gallery, thus forcing the currents of air from the front of the house toward the rear and upward. It is his judgment that the system could be controlled more surely if the area of exhausts were kept slightly less than the area of inlets; in other words, it would be better to keep a slight plenum in the auditorium as well as in the plenum chamber underneath. This would obviate a difficulty which is sometimes now found, he says, when the curtain is down, a draught from the stage tending to pull the curtain out into the house. The total area of inlet space for fresh air amounts to 48 square feet; the total area of exhausts is 124 square feet; the exhaust fan is seldom run at more than one-third speed.

For the heating of the dressing rooms, a supplementary heater was installed, as already mentioned. It was found, however, that there is a great tendency in the dressing rooms to heat up too much and the heater was removed. The flue from the duct of this system feeds horizontal branches in each dressing-room corridor, from which air is blown into each room. In practice, about 10,000 cubic feet per minute are delivered, which is 30 cubic feet per capita for about the largest acting contingent usual. The escape of air from the dressing rooms takes place in general through an open panel at the bottom of each door to the corridor.

The other auxiliary or supplementary heater shown, which has a total of 180 square feet of heating surface, belongs to the air duct supplying the theater rooms in front of the auditorium. The exhaust of air from these rooms is effected through a system of exhaust flues and ducts connecting with an exhaust fan shown in the accompanying basement plan. The fan has a 4-foot blast wheel, 2 feet wide, and is direct-connected to a Sturtevant electric motor to run at 350 revolutions per minute; it discharges up a vertical shaft rising to the roof alongside one of the elevator wells. The smoking room is included in this system; air enters it at one end, near the ceiling, circulates about the room and is drawn out through a large register over a door leading to an adjoining lavatory. In addition to the exhaust fans, the air space surrounding the boiler smoke flue is utilized to carry off more or less vitiated air from two rooms adjoining it.

Direct radiation was installed in the theater auditorium, one radiator beside an outside window and one at each end of the musicians' pit. For the stage itself, 1,040 linear feet of 1¼-inch pipe was mounted in continuous lines around three sides of the stage, and indirect radiators have been provided in the basement to receive air from the floor and discharge same through a register in the stage floor, setting up an internal circulation of air in that part of the theater. Direct radiation is, of course, used throughout for warming the offices. There are, however, two outlets in each room for gas, in case any tenant should desire to use gas for heat; no provision has been made for lighting with gas. The Johnson thermostatic system of temperature regulation, controlling both dampers to air inlets and valves on steam connections, has been installed.

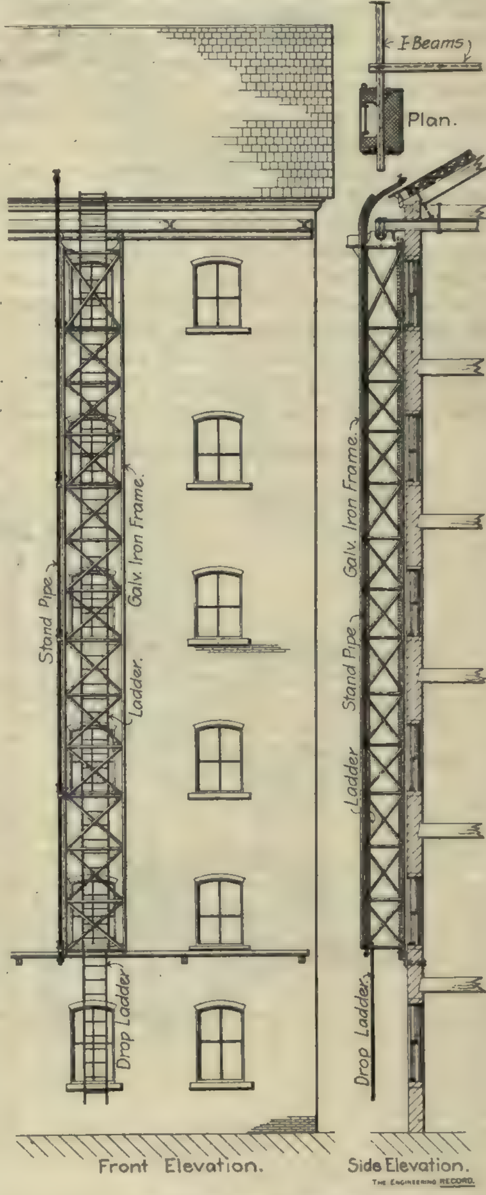
The foregoing description has been prepared from information furnished by Mr. C. H. Blackall, of Boston, the architect of the building, and from data in a general description of the structure, written by him, in the "American Architect." The building was erected for F. L. Ames Estate. The contractors for the ventilating heating and plumbing work were Messrs. Buerkel & Company, of Boston, who sublet the ventilating work to the B. F. Sturtevant Company of Boston.

The Management of Contact Beds is Discussed at length in the report for 1900 of the Rivers Department of Manchester, which has been experimenting with them for some years. Its conclusions are: (1) That a thoroughly satisfactory effluent can be obtained when the area of the secondary bed is one-half that of the primary beds. (2) That a non-putrefactive effluent can, as a rule, be obtained when the open septic tank effluent is submitted to one contact only. (3) That from the point of view of capacity, and to a less extent of chemical efficiency, it is not advisable to work primary beds for a prolonged period of time during winter months on four fillings per day. (4) The period of contact need not exceed one hour, thus allowing an increased period for aeration.

The Indicated Power of a Gas Engine is preferably derived from the gross mean pressure, Prof. Frederic W. Burstall, of Birmingham, Eng., believes, considering suction and back pressure as forming part of the mechanical losses, analogous to the case of the steam engine, in which auxiliary pumps are driven from the main engine. The indicated power as calculated by the Gas-Engine Research Committee of the Institution of Mechanical Engineers, for which Prof. Burstall recently submitted a second report, is, however, based on the net mean pressure on the piston, that is, subtracting from the gross pressure the average pressure during suction and exhaust. Although the number of missed explosions was small compared with the whole number, it was considered advisable to correct for the increased size of diagram which follows the missed explosion; such diagrams were allowed that weight in the whole number of diagrams which corresponded with the number of missed explosions.

A Movable Fire Escape and Standpipe.

A serious drawback to the usual form of stationary iron fire-escape now erected on buildings is that in case fire breaks out in one of the rooms opening on the escape, the flames coming out of the window cut off its use by the occupants on the floors above. Furthermore, it may be that a sudden fire fills the hallways with smoke and flame so that the occupants are unable to leave their apartments. To overcome these dangers, at the suggestion of Mr. C. B. Knott, the general superintendent of Mr. Henry M. Flagler's hotels, the consulting engineers, Messrs. Floy & Carpenter, of New York, designed a novel type of fire-escape for which they have applied for patents. The accompanying cut illustrates its general form. It consists simply of an iron ladder hung from wheels resting on an I-beam track, which is supported by steel beams built into the hotel structure just below the eaves and secured to the roof trusses. The wheels are geared to a differential pulley, the chain of which is long enough to reach to the bottom of the ladder. This allows a person standing at any height on the ladder to handle the chain and compel the entire fire-escape to travel along the I-beam track from window to window, the whole length of the building. The upper part of the frame is continued up and around the lower edge of the roof of the building, so as to be available for the use of any persons who may be on the roof. The iron frame also supports a standpipe, to the lower end of which a steamer hose may be connected and fire streams taken off from taps located at the different floor levels.

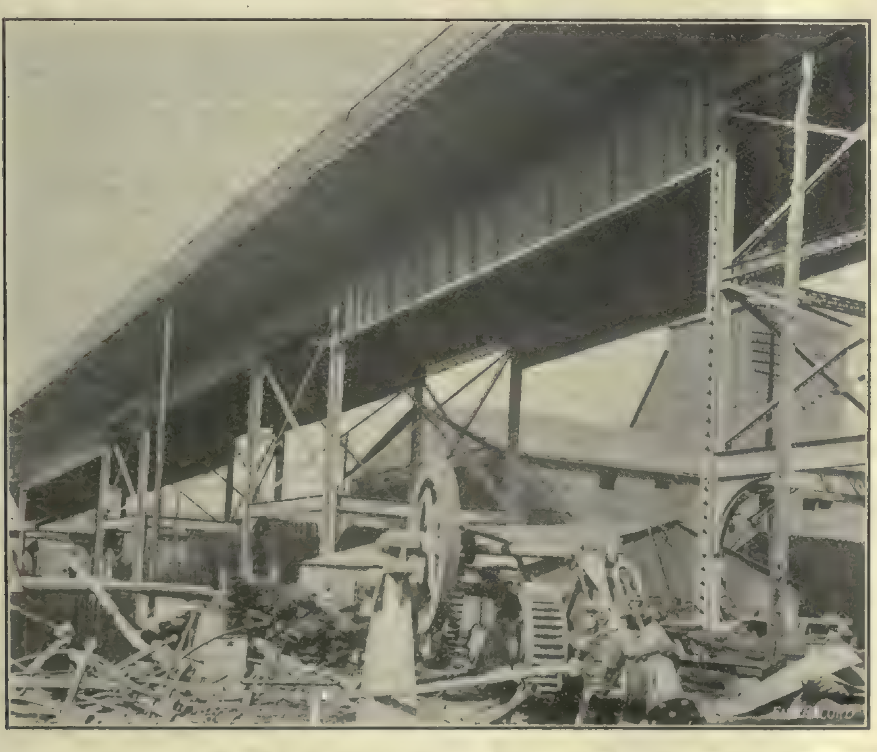


Movable Fire Escape.

A Fire Test of the Buckeye Bridge Floor.

The South Market Street bridge in Youngstown is a steel viaduct 1,610 feet long, carrying a 40-foot roadway and two 7-foot sidewalks over the Mahoning River. It was described in The Engineering Record of February 4, 1899, and is referred to again because a recent serious fire gave the flooring system a test deserving mention. As the bridge was designed and built by what is now the local branch of the American Bridge Company, and the flooring system is the Buckeye, made by the Youngstown Iron & Steel Roofing Company, the engineers of the city are taking considerable pride in the way the structure passed the test.

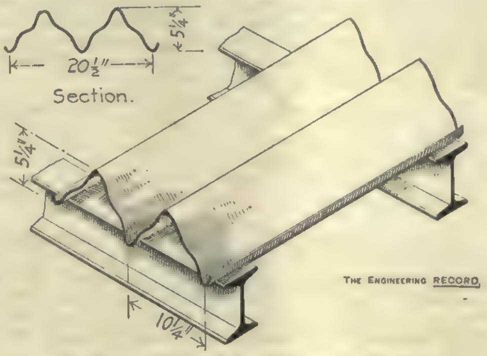
The line of the bridge crosses the property of the Wm. B. Pollock Company, whose extensive buildings were located below and on either side of the roadway. On July 15, these buildings caught fire and burned fiercely for three or four hours, giving the place the desolate appearance shown in the accompanying view. When the flames were extinguished, the bridge was examined by members of the engineering staff of the American Bridge Company and found to be undamaged to any appreciable extent, the greatest injury being the slight warping of one panel of the sidewalk railing, the third panel from the top in the accompanying cut.



The Market Street Bridge after the Fire.

This is the first test by fire of this floor system, although several bridge companies have made experiments to ascertain its strength. The floor consists of corrugated V-shaped galvanized steel troughs, of the dimensions given in the diagram, rolled from No. 16 sheets for the roadways of city bridges, No. 18 for the roadways of country bridges, and No. 20 for sidewalks. The troughs do not rest directly on the floorbeams, but on little chairs with a groove on top into which the point of the V fits, thus giving a better bearing than is possible in case the troughs are laid directly on the beams. Concrete is then filled into the troughs to stiffen the floor, which is finally surfaced in any way desired.

A section of No. 18 flooring of this sort, of a span of 3 feet 10 inches, with a good filling of concrete rising 3 inches above the top of the metal ridges, was once tested by piling pigs of iron on the top until there was no means of placing any more. The load amounted to 1,016 pounds per square foot, but produced no appreciable deflection. At another time a section of No. 16 flooring, of a span of 7 feet 10 inches, with the concrete filling rising only to the top of the troughs, was loaded with pigs of iron in the same manner until the weight amounted to 1,300 pounds per square foot. This was carried without injury.



Construction of the Floor Troughs.

A 4,500 Horse-Power Air-Cooled Condenser.

An air cooled condenser of 4,500 horse-power is to be installed in the plant of the Kalgoorlie Electric Power & Lighting Corporation, Ltd., according to "Revue Industrielle." The power installation includes three vertical compound steam engines, of which the consumption of steam is calculated to be 48,500 pounds per hour, developing about 4,500 horse-power. The condenser comprises surfaces of condensation composed of sheets of corrugated steel of 0.04 inch thickness put together two and two to form hollow corrugated plates, and mounted in groups, and 27 ventilating fans which discharge upon the surfaces of condensation 70,630,000 cubic feet of air per hour. The volume of apparatus is about 20,000 cubic feet—that is, 415 cubic feet to 1,000 pounds of steam condensed per hour. The relatively high temperature of the country has made it advisable to circulate a large volume, giving ventilators of large dimensions; under ordinary conditions, it is stated, the volume can be reduced to 280 cubic feet per 1,000 pounds of steam per hour. The steam is brought from the engines in a pipe 23.6 inches in diameter, is distributed through nine grease separators, and then enters the hollow plates. The water condensed is extracted by three air pumps provided with valves arranged to receive the water very hot, if necessary. Three other pumps draw the greasy water from the separators. The water from the condensers, though practically free from grease, is subjected to a filtration through wood charcoal. The greasy water from the separators is subjected to a prolonged filtration through charcoal filters, and finally through sponge filters. The price of water in 1900 was the equivalent of 1.825 cents per gallon, so high that the utilization of water from the grease separators, which furnish about 530 gallons of water per hour, is rendered advisable. The power required to operate the ventilators and the six pumps is about 120 horse-power. The vacuum obtained in the different periods of the year will correspond to an economy of more than 8 per cent., it is stated; the average vacuum at full load will be about 15.75 inches of mercury during the day and 20.47 inches during the night.

Trade Publications.

The Union Steam Specialty Co., Scranton, Pa., has issued a useful catalogue of steam specialties, particularly indicators, reducing wheels and planimeters, which are described in much detail. There are also illustrated notes in the book of the Lippincott steam separator, shaking and dumping grate bar, furnace blower, exhaust head, boiler tuber cleaner, steam pump, oil filters and feed-water heaters.

Mechanical ventilating apparatus of many types is described in the new catalogue of Howard & Morse, 45 Fulton St., New York. The Blackman ventilator wheels, both with pulleys and direct-connected to electric motors and to Solano steam engines, the National flat-blade fan, and various designs of cooling, drying, heating and ventilating plants, are fully illustrated.

The Emerson Pump Co., Mertz Bldg., Washington, has issued a handsomely illustrated pamphlet describing its steam vacuum pump for use in draining trenches, mines, coffer dams, quarries and like situations. It consists of a large cylinder, into which water is alternately admitted from the sump and discharged through a riser by the direct pressure of steam.

Machine grinding has recently been developed by the Norton Emery Wheel Co., Worcester, Mass., as a direct competitor of light and heavy lathe work. Powerful grinders have been designed for the company's shops, where it does job grinding for outside parties, and these machines are also on the market for those who prefer to do the work in their own shops. These machines, and a large line of emery wheels, stones and grinders of standard types are illustrated in the company's 164-page catalogue.

A handbook on the design and construction of dry kilns has been issued by the B. F. Sturtevant Co., Boston. The various types of steam hot-blast apparatus are first explained, and then follows a monograph on the process of drying, lumber drying, and different types of kilns.

Personal Notes.

Mr. L. F. Loree has been elected president of the Baltimore & Ohio Southwestern R. R.

Mr. D. W. Cox, of Fond du Lac, Wis., has been appointed surveyor of Fond du Lac County.

Mr. William Van Fossan has been engaged as city engineer of East Palestine, O., succeeding Mr. C. M. Stout.

Mr. J. Guy McCandless has been appointed director of public works of Pittsburg, to succeed Mr. E. M. Bigelow.

Mr. B. T. Wheeler has resigned the office of superintendent of streets of Boston, Mass., to re-enter the engineering staff of the N. Y., N. H. & H. R. R.

Gen. Henry M. Robert, Mr. H. C. Ripley and Mr. Alfred Noble have been appointed a committee to devise means for protecting Galveston from the sea.

Messrs. Edwin Burhorn, Barton H. Coffey and B. Franklin Hart have become associated as engineers and contractors, with offices at 62 Wall Street, New York.

Mr. Reginald Pelham Bolton has been awarded the Telford gold medal of the Institution of Civil Engineers for his recent paper on "The High Office Buildings of New York."

Mr. Edward E. Slick, chief engineer of the Edgar Thomson Steel Works, has been appointed chief engineer of the American Steel Hoop Co., with headquarters in Pittsburg.

Mr. E. H. Pfafflin, for many years connected with the engineering department of the Evansville & Terre Haute R. R., has been appointed superintendent of the system, succeeding Mr. A. C. Hone.

Mr. George R. Henderson has been appointed superintendent of motive power of the Santa Fe System. He is an ex-apprentice of the Pennsylvania R. R. shops, and was connected with the Chicago & Northwestern Ry. until recently.

Mr. F. J. Schnauber has been appointed city engineer of Syracuse, N. Y., succeeding Mr. C. A. Sweet. The new city engineer was graduated from Syracuse University in 1888, and, after serving for a short time on the New York elevated railways, entered the service of the city of Syracuse in the water department. Since that time he has been connected with the engineering work in that place, with one short intermission. Mr. Thomas F. De Laney has been appointed superintendent of the Syracuse Water Department, succeeding Mr. John H. Moffitt.

Mr. Philip J. Markmann has been appointed mechanical engineer of the department of works of the Louisiana Purchase Exposition. He is a graduate of the Stuttgart Polytechnic School, but has resided in this country since 1882. He was chief engineer of the Snead Iron Works, of Louisville, for a time, and was afterward superintendent for Adler & Sullivan, of Chicago. Seven years ago he opened an office in Chicago as structural and mechanical engineer, and it was his work in this capacity for the St. Louis Bank of Commerce, of which Mr. Isaac S. Taylor is architect, that secured for him his present engagement.

The following candidates for associate membership in the American Institute of Electrical Engineers were elected November 22: J. R. Cravath, Electrical World, Monadnock Block, Chicago; Gilbert Crossman, Western Electric Co., 463 West St., New York; G. B. Dusenberre, Westinghouse Electric & Manufacturing Co., Pittsburg; G. N. Eastman, Chicago Edison Co., Chicago; W. K. Freudenberger, Colorado Fuel & Iron Co., Pueblo, Colo.; R. B. Hamilton, Packard Electric Co., Ltd., St. Catharines, Ont.; Maurice Hoopes, J. G. White Co., 29 Broadway, New York; H. R. King, Western Electric Co., Chicago; R. C. Lanphier, Sangamo Electric Co., Springfield, Ill.; H. V. Ludvigsen, Straudvejen 119, Hellerup, Denmark; J. N. G. Nesbit, Warren Electric Manufacturing Co., Sandusky, O.; A. D. O'Brien, N. Y. & N. J. Telephone Co., New York; A. H. Pott, 81 Cornwall Gardens, S. W., London, Eng.; Arvid Reuterdahl, The Reuterdahl Electric Co., Providence, R. I.; A. F. Ruchgaber, Rapid Transit Subway Construction Co., New York; Capt. Edgar Russel, Signal Corps, U. S. A., Washington, D. C.; Edward Schildhauer, Chicago Edison Co., Chicago; Lambert Schmidt, Lambert Schmidt Tel. Mfg. Co., 32 Broadway, New York; T. H. Soren, General Electric Co., Schenectady, N. Y.; E. T. Tannatt, Oahu College Trustees, Honolulu, H. T.; W. VB. Van Dyck, 439 Manhattan Ave., New York; T. R. Weymouth, International Hydraulic Co., 40 Wall St., New York; E. O. Zwietusch, Zwietusch & Co., Salzufer 7, Charlottenburg, Germany.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Riverdale, Ill.—Bids are wanted Dec. 10 for a quarter million gallon power pump, a 15-H.-P. gasoline engine, an elevated steel tank, one or more driven wells and other material and labor necessary for a water-works system, not including pipe line, as advertised in The Engineering Record.

Scammon, Kan.—Engrs. Burns & McDonnell, of Kansas City, Mo., write that contracts for water-works have been awarded as follows: To W. W. Cook & Son, of Junction City, Kan., power plant, pump and distributing system, for $7,290; to Chicago Bridge & Iron Wks., Chicago, Ill., steel tower and tank, for $3,693.

Ft. Washington, Md.—See "Government Work."

Concord, N. C.—City Clk. W. C. Houston writes that it is proposed to construct water-works. I. E. Smith, City Engr.; G. W. Brown, Sec'y Water Bd.

Eagle Lake, Tex.—Ch. Engr. G. B. Meriwether writes that contracts are still to be let for the erection, fluming and grading necessary for an irrigation plant to be built for Wallace-Radford Canal Co. Probable cost of work, $150,000. Parties interested, J. A. Radford and Geo. C. Wallace.

Oklahoma, Okla. Ter.—City Clk. T. A. Blaise writes that it is proposed to construct a $25,000 reservoir. N. B. Spillman, Engr.; A. L. Welsh, Chmn. Bd. Water-Wks. Commrs.

New York, N. Y.—Bids are wanted Dec. 12 for furnishing, delivering and laying water mains in several streets in the Boroughs of Manhattan and the Bronx. Wm. Dalton, Commr. of Water Supply.

El Dorado Springs, Mo.—Burns & McDonnell, of Kansas City, Mo., have been engaged to prepare complete plans and specifications for water-works and sewerage.

Omaha, Neb.—See "Government Work."

Sault Ste. Marie, Mich.—City Engr. Jas. A. Lawrie writes that water-works extensions under construction will require 1,500 ft. of riveted steel or flanged cast iron pipe, 36 ins. in diameter, and placing of same, all still to be contracted for.

Crow Agency, Mont.—See "Government Work."

Batesville, Ind.—City Clk. Harry Schwier writes that quotations are wanted on 4 and 6-in. cast and wrought iron pipe, also on fire plugs.

Westerly, R. I.—The General Assembly has passed the act authorizing Westerly to issue $100,000 bonds for the extension of the water-works system through the village of Watch Hill.

Fairhaven, Mass.—Jos. K. Nye, Pres. of the Fairhaven Water Co., writes that it is expected to rebuild the steel tank which recently collapsed, but that no definite plans have been made.

Pleasantville, N. J.—C. Taylor Leland, 421 Chestnut St., Philadelphia, Pa., one of the incorporators of the Pleasantville Water Co., writes that the construction of water-works will be commenced within the next 30 days.

iagara Falls, N. Y.—The Board of Public Works has received a proposition from the Depew & Lake Erie Water Co., of which William B. Cutter is president, to purchase the municipal water plant, for which the company offers to pay $225,000.

Delhi, O.—The Cincinnati Board of Public Service is considering a proposition to extend the city water-works mains about 2½ miles west of the corporation line, in order to furnish Delhi with city water. Probable cost, $10,000.

Louisburg, N. C.—The Board of Commissioners will consider plans and estimates for the construction of water-works and sewerage systems, $30,000 bonds having been voted for these systems. Address, E. S. Green, Town Sec'y.

Bloomington, Ill.—City Engr. Elmer Folsom writes that the question as to the best means of securing an increased water supply has been referred to a special committee of the Council for investigation.

Scranton, Pa.—Press reports state that Scranton capitalists, headed by Chas. Robinson, Pres. Central Penn. Brewery Trust, propose to organize a company which will undertake to supply the towns of Lackawanna Valley, including Scranton, with water.

Winfield, N. Y.—Village Clk. A. C. Hackley writes that the contemplated addition to the present water system is for fire protection only.

Hagerstown, Md.—It is understood that the Washington County Water Co. will soon construct a new reservoir.

Rockford, Ill.—Supt. Calkins of the Water-works is said to be in favor of the installation of meters throughout the city.

Brazil, Ind.—The question of adding a standpipe to the water-works plant is said to be under consideration.

Vancouver, Wash.—Press reports state that extensive improvements will be made to the water-works plant.

Columbus, O.—Local press reports state that this city will install a uniform meter system and each consumer will be required to purchase a meter.

Joliet, Ill.—The City Council has accepted the contract with the Ingersoll-Sergeant Drill Co. for an air compressor for the water-works; cost, $16,500.

Kirkwood, Mo.—Local press reports state that the Board of Aldermen has accepted the proposition of J. B. Quigley, Pres. of the Missouri Light & Water Co., to furnish this city water from Missouri River; the supply delivered at the city limits, to cost $12 per 100,000 gal., the minimum amount to be used, and 12 cts. per 1,000 gal. used in addition. Two elections will have to be held before the contract goes into effect, one to vote on the isue of $25,000 bonds for the laying of mains, and the other to ratify the above action of the Board of Aldermen.

Toulon, Ill.—City Clk. Chas. S. McKee writes that water-works are under consideration, and a vote may be taken on the matter at the spring election.

Sarnia, Ont.—Town Clk. J. D. Stewart writes that plans for improvements to the water-works system have been prepared by C. W. Hubbell, of Dertoit, Mich. Estimated cost, $75,000. The hy-law approving the scheme and authorizing the borrowing of above amount will be voted upon by the electors Jan. 6, 1902. J. H. Jones, Town Engr.

West Bay City, Mich.—City Clk. Fred G. Sweeney writes that $25,000 bonds have been voted and sold for water-main extensions.

Cumberland, Md.—At a recent joint meeting of the Board of Water Commissioners and the Water Committce from the City Council, it was decided to replace the old pump at the water-works with a new one. J. C. Troutwine, of Philadelphia, Pa., has been engaged to superintend the work.

Green Island, N. Y.—A special election will be held to vote on the issue of $80,300 bonds for the construction of municipal water-works.

Lewistown, Mont.—Bonds to the amount of $50,000 have been voted for water-works and sewerage systems.

Lewiston, Idaho.—Bonds to the amount of $80,000 have been voted for the construction of new water-works. The Council proposes to establish a gravity system, bringing water from artesian wells 6 miles south of the city.

Cheyenne, Wyo.—The Uinta Alfalfa Irrigation Co. has filed articles of incorporation; capital stock, $60,000. The object of the company is said to be the construction of an irrigation ditch to extend about 18 miles from a point on the Black Forks River. David C. Patterson, Pres.; Wm. O. Gamble, Vice-Pres.; Oscar J. Pichard, Sec'y and Treas.

Covington, O.—Press reports state that it is proposed to issue $25,000 bonds for a system of municipal water-works.

Boswell, Ind.—Maurice O. Bish, of Knox, Ind., is stated to have received a 30-year franchise to operate a water plant and electric light system.

Long Branch, N. J.—The City Surveyor has been instructed to make a survey, with the aid of expert assistants, and to report to the Board of Commissioners on Dec. 2 the feasibility and approximate cost of establishing a municipal water plant.

Los Angeles, Cal.—The Edgmont Water Co., principal place of business Los Angeles, has filed articles of incorporation, with a capital stock of $500,000. The directors are: H. F. Bridges, D. W. Hudson, J. F. Anderson, Edward Mansell and S. F. Macfarlane, all of Los Angeles. The company proposes to do business in Los Angeles and Orange Counties.

Abingdon, Ill.—The Council is stated to have voted to put in a short line of water-works. A pumping station, reservoir, etc., are to be constructed immediately.

Williamsburg, Mass.—This town is again agitating the question of public water supply.

La Harpe, Kan.—Burns & McDonnell, of Kansas City, Mo., have been engaged to prepare plans and specifications for a water-works plant.

Somerset, Ky.—Incorporation articles have been filed by the Somerset Pipe Line Co. Capital, $500,000. Judge O. H. Waddle, of Somerset, is said to be at the head of the company.

Monessen, Pa.—The Dravo Contracting Co. is said to have received the contract for the water-works of the Pittsburgh Steel Co. at Monessen. Cost, $35,000.

Chicago, Ill.—Bids will be received by the Board of Local Improvements until Dec. 4 for water service pipes in 4 streets and for water supply pipes in portions of several streets. John A. May, Sec'y.

Guines, Cuba.—Press reports state that the Municipal Council of Guines has voted to award the contract for supplying water and electric light to the town to Hugh J. Reilly, of New York, for $250,000.

Traverse City, Mich.—The Water Committee has reported in favor of a 4,000,000-gal. pump for the water-works.

Sandusky, O.—Local press reports state that J. D. Cook, of Toledo, has been engaged by the city to examine into the condition of the pumping station and the general needs of the Water-Works Department.

Douglas, Wyo.—In a recent report on contemplated changes in the water system, State Engineer Fred. Bond recommends the construction of a filter gallery, increased pumping capacity, etc.

Seattle, Wash.—The City Engineer is preparing plans and specifications for the construction of a water main to the northern suburbs. Cost said to be about $70,000.

Butte, Mont.—The Red Rock Irrigation Co. has filed articles of incorporation. Capital stock, $250,000. The object of the company is to acquire and develop water power for the manufacture of light, power and heat, to store water for irrigation purposes, build reservoirs, flumes, etc. Incorporators: John M. Steward, John Lindsay, Jos. Williams and others, of Butte.

Boston, Mass.—The following bids were opened Nov. 21 by the Metropolitan Water Board, for Section I, central portion, Weston reservoir: Nawn & Brock, Boston, $59,588; Jones & Meehan, Boston, $64,971; Auguste Saucier, So. Framingham, Mass., $65,382; Beckwith & Quackenbush, Boston, $66,416; Bruno, Salomone & Petitti, E. Boston, $68,314; Long & Little, Leominster, Mass., $76,310; Brodhead Cont. Co., Wilkesbarre, Pa., $79,708; Metropolitan Cont. Co., Boston, $81,008; Cenedella Bros., Milford, Mass., $82,328; Troy Public Works Co., Utica, N. Y., $83,410; Maloney & Peterson, Springfield, Mass., $89,110. The contract was awarded to Nawn & Brock and their detail bid was as follows: Earth excavation, 230,000 cu. yds., 25 cts.; rock excavation, 200 cu. yds., $1.50; rip rap, 900 cu. yds., $1; furnishing and laying 18-in. sewer pipe for drains, 300 lin. ft., $2.50; furnishing and laying 20-in. sewer pipe for culvert, 55 lin. ft., $2.50.

Baltimore, Md.—Water Engr. Alfred M. Quick has laid before the Water Board drawings for a reservoir to be built at a cost of from $360,000 to $520,000, according to the location. Mr. Quick is to report on the proposed plan to raise Loch Raven dam.

Pasadena, Cal.—The City Council has adopted a resolution to issue $300,000 bonds for improvements, including water, sewers, paving, parks and public buildings.

New Orleans, La.—Superintendent Earl in a recent report to the Sewage & Water Board stated that a water purification and pumping station, for the city, designed to purify and deliver into the distributing system 40,000,000 gal. of water a day, will cost something over $1,500,000; estimated cost of operation, including interest on first cost, depreciation, repairs, etc., $300,000 per year.

Kansas City, Mo.—Separate bids will be received Dec. 2 for 3 mechanical stokers, to be set under 3 300-H.-P. boilers; also for 3 300-H.-P. 150-lb. steam pressure water tube, or internally-fired boilers, to be erected one at Quindaro Station and two at Turkey Creek Station, Kansas City Water Department. Harry B. Walker, Secy. Bd. Pub. Wks.

South McAlester, Ind. Ter.—City Clk. A. A. Powe writes that it is proposed to construct water-works, at a probable cost of $200,000. Franchise ordinance now pending in the City Council. M. J. Smith, South McAlester, Engr.

Enumclaw, Wash.—The Secretary of the Board of Trade writes that the construction of water-works and an electric light plant, at a probable cost of between $5,000 and $10,000, is contemplated.

Linden, N. J.—The question of constructing water-works and a sewerage system is under consideration. Jacob L. Bauer, Boro. Engr.; H. B. Hardenburg, Mayor.

Meadville, Pa.—City Engr. W. A. Doane writes that the following bids were opened Nov. 21 for a 4,000,000-gal. steam pump and boilers: Kilby Mfg. Co. pump, $22,650; 2 Scotch boilers, $10,500, or 2 Babcock & Wilcox, $7,350; Henry R. Worthington, Brooklyn, pump No. 1, $10,825; No. 2, $16,150; No. 3, $19,350; Rob't Wetheril & Co., Chester, Pa., pump, $13,850; 2 boilers, $4,350; 2 stacks, $60; Snow Steam Pump Works, Buffalo, pump No. 1, $18,384; No. 2, $23,455. Bids referred.

Washington, D. C.—W. A. McFarland, Supt. of the Water Dept., writes that the following bids for furnishing cast iron water pipe were opened Nov. 19 by the Commissioners, D. C.: *a*, 12-in., 453 tons; *b*, 4-in., 17.6 tons; *c*, 3-in., 6.6 tons; *d*, total: Camden Iron Works, Camden, N. J., *a* $24.70, *b* $24.20, *c* $24.70, *d* $11,987; M. J. Drummond & Co., New York, *a* $24.60, *b* $26.50, *c* $27.50, *d* $11,792; U. S. C. I. Pipe & Fdy. Co., New York, *a* $25.33, *b* $27.37, *c* $29.37, *d* $12,150; Warren Fdy. & Mach. Co., New York, *a* $25.50, *b* $25.50, *c* $25.50, *d* $12,169.

Boston, Mass.—The following bids were opened Nov. 21 by the Metropolitan Water Board for the construction of the open channel of the Weston Aqueduct and the Weston Reservoir. *Contract awarded:

Section 14, open channel and upper portion of reservoir:

Items and quantities.	Nawn & Brock,	Rowe & Perini, So. Framingham,	Jones & Meehan.	Bruno, Salomone & Petitti.	Troy Pub. Wks. Co.	Metropolitan Cont. Co.	Long & Little.	Brodhead Cont. Co.	Maloney & Peterson.	Cenedella Bros.
Earth excav., 230,000 cu. yds....	$.23	$.27	$.27	$.285	$.33	$.355	$.38	$.395	$.42	$.47
Rock excav., 500 cu. yds..........	1.50	2.00	3.00	1.50	2.00	2.00	2.00	2.00	3.00	2.00
Riprap, 200 cu. yds...............	1.00	.90	2.00	1.85	2.00	2.50	2.00	2.00	3.00	1.15
Slope paving, 70 cu. yds..........	2.00	1.40	2.50	2.25	5.00	3.50	3.75	4.00	5.00	2.60
Port. cement concrete mas.:										
1:2½:4½, 280 cu. yds............	5.50	5.50	8.00	8.00	8.00	7.00	7.00	7.00	6.00	9.00
1:3½:7, 100 cu. yds..............	5.00	5.00	6.00	6.50	7.00	6.00	6.50	6.00	7.00	7.00
Ashlar masonry, 40 cu. yds.....	18.00	19.00	25.00	40.00	20.00	20.00	30.00	20.00	14.00	16.00
Dimen. stone mas., 40 cu. yds....	30.00	50.00	25.00	50.00	35.00	35.00	50.00	40.00	30.00	25.00
Face dress. of pointed work, 750 sq. ft.	.40	.12	.50	.25	.50	.35	.60	.60	.50	.40
Laying 36-in. C. I. pipe, 240 lin. ft.	1.00	.40	1.50	3.00	2.00	2.00	6.00	1.75	1.00	3.00
Totals	*$58,490	$68,364	$69,750	$74,225	$83,645	$88,898	$96,763	$98,360	$103,805	$115,392

Section 2. Lower portion of reservoir, including dam and concrete draw:

Items and Quantities:	Nawn & Brock.	Beckwith & Quackenbush.	Long & Little.	Bruno, Salomone & Petitti.	Cenedella Bros.	Brodhead Cont. Co.	Troy Pub. Wks. Co.	Winston & Co., Clinton.	Taylor, Carr & Andrews Boston.
Clearing and grubbing, 40 acres......	$100.00	$100.00	$75.00	$100.00	$75.00	$90.00	$100.00	$75.00	$98.00
Earth excavation:									
From areas A on plans, 63,000 cu. yds.	.29	.29	.32	.34	.32	.44	.40	.43	.84
From areas B on plans, 114,000 cu. yds.	.34	.34	.39	.37	.45	.39	.40	.47	.84
For concrete drain, 4,500 cu. yds....	.80	.38	.45	.75	.74	.70	1.00	.70	.84
Rock excavation:									
In reservoir, 1,500 cu. yds...........	1.30	1.50	1.50	1.50	1.35	1.50	2.00	2.00	1.94
For drain and core wall, 500 cu. yds.	2.50	2.00	3.00	2.95	3.00	2.25	5.00	4.00	3.15
Clean'g surface of rock, 5,000 sq. yds.	.10	.30	.25	.10	.07	.25	.20	.25	.27
Riprap, 1,600 cu. yds....................	1.00	1.00	1.70	1.75	.85	1.80	2.00	2.00	2.10
Slope paving, 850 cu. yds..............	2.50	3.50	3.75	2.25	2.25	3.50	5.00	3.00	3.15
Port. cem. concrete mas.:									
1:2½:4, 1,200 cu. yds..................	5.50	6.00	6.50	8.00	8.75	8.00	8.00	9.00	7.50
1:2½:4½, 1,800 cu. yds................	5.00	5.70	6.00	7.50	7.80	7.00	7.00	6.00	7.00
Dim. stone mas., 10 cu. yds...........	40.00	40.00	45.00	35.00	25.00	45.00	50.00	50.00	40.00
Face dressing of pointed work, 100 sq. ft..	.50	.40	.70	.50	.40	.50	.50	.60	.50
Laying 6-in. C. I. pipe, 250 lin. ft.....	.75	.75	.50	1.00	1.00	.65	2.00	.50	.30
Totals	*$88,293	$90,153	$99,796	$103,663	$110,018	$112,273	$116,500	$121,105	$190,378

Paterson, N. J.—The Mount Prospect Water Co. has filed its certificate of incorporation; capital stock, $100,000. It is stated that the company intends to supply the boroughs and townships in Passaic, Bergen and Essex counties with water. Incorporators: Jacob N. Sandford, New York; John Hewson, of Waldwick; John G. Koeth, Ramsey, N. J., and others.

Harrisburg, Pa.—Ordinances are being prepared which will provide for an improved sewerage system, the erection of a filter plant, a commission to lay out and manage a system of public parks, and the improvement of the city streets. Reports on above proposed improvements have been made by expert engineers as follows: Jas. H. Fuertes, of New York, in regard to sewerage, recommends that Paxton Creek be retained in its present channel as an open stream for storm water overflow, that it be enlarged and deepened and that sewage now going into the creek be diverted into an intercepting sewer 5 ft. in diameter to empty into Susquehanna River, estimated cost $249,700; for the construction and reconstruction of certain sewers, $77,256. In regard to the improvement of the water supply, Mr. Fuertes recommends the construction of a filter plant having a daily capacity of 10,000,000 gals. using the present reservoir for sedimentation purposes and building a new 7,500,000-gal. reservoir for filtered water, estimated cost $279,000. Mr. Fuertes also recomends the erection of a low dam for the improvemet of the sanitary condition of the river front, estimated cost $550,000. Warren H. Manning, of Boston, recommends a system of parks, playgrounds, etc., including the acquisition of the entire river frontage. M. R. Sherrerd, of Newark, N. J., in a report upon street improvements, recommends macadam, granite block, asphalt and brick pavements for the various sections of the city.

SEWERAGE AND SEWAGE DISPOSAL.

Bristol, R. I.—The General Assembly has passed acts authorizing Bristol to construct a system of sewers and also to issue $47,000 bonds for this purpose.

Louisburg, N. C.—See "Water."

Longbeach, Cal.—Press reports state that steps will soon be taken, by the City Council, for the installation of a sewerage system.

El Dorado Springs, Mo.—See "Water."

Jersey City, N. J.—Bids are wanted Dec. 3 for 2,430 lin. ft. of 36 and 400 lin. ft. of 24-in. cast iron sewer; 1,292 lin. ft. of 24 and 30-in. brick sewer, oval or circular, and 950 lin. ft. of 18-in. vitrified pipe sewer, 4,000 cu. yds. rock excavation, 50 cu. yds. concrete, etc., on portions of several streets. Geo. T. Bouton, Clk. Bd. Street and Water Commrs.

Oakland, Cal.—The sum of $10,000 has been recommended appropriated for the construction of 3,000 ft. of sewer in Telegraph Ave.

Chico, Cal.—Sewer bonds to the amount of $45,000 are stated to have been sold.

Norfolk, Va.—See "Paving and Roadmaking."

Corona, Cal.—The City Trustees contemplate issuing $10,000 bonds for the construction of storm water ditches.

Hamilton, Ont.—The proposition to issue $35,000 bonds for the construction of Catharine St. and Birch Ave. sewers will be voted upon at the next municipal election.

Philadelphia, Pa.—Director of Public Works Haddock has reported that it would cost $270,000 to construct a sewer in Thompson St., Germantown Ave., Berkes St., and 9th St.

Norristown, Pa.—See "Paving & Roadmaking."

Bronxville, N. Y.—The report of Engineer Leavett shows the cost of sewering this village, with filter beds, pumps, etc., to be about $40,000. Plans have been sent to the State Board of Health for approval.

Sault Ste Marie, Mich.—City Engr. Jas. A. Lawrie writes that James E. Whalen, who has had the contract for constructing the trunk and intercepting sewer system, has abandoned said contract. City will re-let the work at the earliest possible moment.

McKeesport, Pa.—Local press reports state that $45,000 will shortly be expended for sewers in the 5th and 11th Wards.

Lewistown, Mont.—See "Water."

Iola, Kan.—The City Council has passed a resolution approving the plan of F. O. Marvin for the construction of a sewer system.

St. Louis, Mo.—Sewer improvement bills corresponding to charter amendments were passed Nov. 19 by the House and Council. There were 18 bills for establishment of district sewers and one joint district sewer.

Allegheny, Pa.—Ordinances have been passed for sewers on Buena Vista and Filbert Sts.

Auburn, N. Y.—Bids are wanted Dec. 2 for constructing vitrified tile sewers in portions of 2 streets. E. H. Herrling, City Clk.

New Philadelphia, O.—Adams Bros, of Zanesville, O., have received a $10,000 contract for sewer construction.

Oneida, N. Y.—The Board of Public Works has decided to build sewers in several streets; estimated cost, $3,000.

Birmingham, Ala.—The Board of Aldermen has passed an ordinance providing for curbing and sewers on Arlington Ave.

Milwaukee, Wis.—City Engr. Chas. J. Poetsch writes that the following bids were opened Nov. 19 for furnishing material and constructing the uncompleted portion of Section No. 2, Kinnickinnic River flushing works tunnel; prices are per lin. ft.: John Donahoe, $50; U. S. Construction Co., $59; R. W. Forrestal, Milwaukee, $49 (awarded); Jas. O'Donnell, $67; Chas. Forrestal, $62; John J. Crilley, $59.

Trenton, N. J.—Bids are wanted Dec. 3 for constructing sewers in portions of Warren and Market Sts. C. Edw. Murray, City Clk.

Williamsport, Pa.—Mayor Williams has signed an ordinance providing for the construction of a portion of Locust St. storm water sewer. The section to be constructed will be of brick and concrete, length 1,990 ft., cost $42,000.

Linden, N. J.—"See Water."

New York, N. Y.—Bids are wanted Dec. 11 for constructing sewers in portions of 4 streets in the Boro. of Bronx, also for sewers in portions of Narrows Ave. and 81st St., Boro. of Brooklyn. Jas. Kane, Commr. of Sewers.

Harrisburg, Pa.—See "Water."

Douglas, Wyo.—State Engineer Fred. Bond has submitted a report on the proposed sewer system; he estimates the total cost at $6,607, including 1,400 ft. of 8-in., 1,010 ft. of 7-in. and 6,180 ft. of 6-in. vitrified salt-glazed sewer pipe, also 15 manholes.

Sheraden, Pa.—The Council has approved the plans of the Borough Engineer for certain sewers.

Fort Lee, N. J.—The question of constructing a sewerage system is under consideration.

Pasadena, Cal.—See "Water."

Mason City, Ia.—The Council has under consideration a resolution providing for the construction of a pipe sewer in Willow Creek Sewer District.

Cudahy, Wis.—The Village Board has awarded the contract for the preparation of plans, making surveys, etc., for the proposed sewer system to Gustav Steinhagen, of Milwaukee.

Madison, N. J.—The Boro. Council has authorized the Sewerage Committee to employ an engineer to prepare plans, specifications and estimates for a complete sewer system and disposal plant.

Kansas City, Mo.—Bids are wanted Dec. 3 for constructing district sewers in Sewer District No. 198. Rob't W. Waddell, City Engr.

Portsmouth, O.—Bids are wanted Dec. 10 for furnishing labor and material and constructing pumping stations at the outlet of the 6th Ward sewer, and in District No. 1. Said stations to consist of one locomotive style firebox boiler of 120 H.-P. capacity; one centrifugal pump of capacity to handle 6,000 gals. of water per minute against a 20-ft. head; and an engine of sufficient power to operate said pump with direct connections at its maximum capacity; also a frame building to protect said pumping station. Bids will also be received for furnishing labor and material and constructing 650 lin. ft. main trunk double ring brick sewer; 650 lin. ft. main trunk double strength tile sewer; 340 lin. ft. 15-in. tile street corner connections, 8 catch-basins, etc., on Market St., and for 680 lin. ft. of 15-in. double strength tile sewers in portions of 3 streets. Frank L. Sikes, City Clk.

Burlington, Ia.—City Engr. Emmet Steece writes that the following bids have been received for the construction of Hawkeye sewer:

Bidders.	Stone mas., 1,296 cu. yds.	Earthwork, 5,200 cu. yds.	Concrete, 500 cu. yds.	Total.
Geo. Kreichbaum	$8.00	$1.00	$8.20	$19,660
C. Pistorious.....	8.25	1.05	8.50	20,394

BRIDGES.

New Brunswick, N. J.—Bids are wanted Dec. 10 for constructing the grading and masonry for the stone arch bridge over the Raritan River, New Brunswick, as advertised in The Engineering Record.

Tiverton, R. I.—The House has passed in concurrence a bill appointing a Commission of three to consider the advisability of constructing a stone bridge at Tiverton.

Buffalo, N. Y.—Bids will be received by John N. Partridge, Supt. of Pub. Wks., Albany, N. Y., until Dec. 5, for constructing a swing bridge at Ferry St., Buffalo. Appropriation, $30,000.

Rensselaer, Ind.—Bids are wanted by the County Commissioners until Dec. 3 for constructing 8 small county bridges.

Sullivan, Ind.—Bids will be received by the Board of County Commissioners until Dec. 4 for constructing 4 steel or wrought iron bridges. J. M. Lang, Co. Aud.

Topeka, Kan.—Bids are wanted Dec. 17 for constructing a 46-ft. low truss steel bridge in Monmouth Township. John M. Wright, Co. Clk.

Homestead, Pa.—See "Electric Railways."

Springlake, Mich.—Articles of incorporation have been filed by the Grand River Toll Bridge Co. to construct a toll bridge connecting Springlake and Grand Haven. Capital, $25,000.

Tribeshill, N. Y.—Local press reports state that the American Bridge Co. has secured the contract to construct a 585-ft. steel bridge across the ravine at Tribeshill, on the Fonda, Johnstown & Gloversville R. R. Co., for, approximately, $30,000.

Holyoke, Mass.—The City Engineer has prepared plans for an iron bridge at Sargeant St.. and estimates the cost at from $9,000 to $10,000.

New Orleans, La.—See "Railroads."

Hatfield, Mass.—At a recent Town Meeting it was voted to join with the Electric Railway Co. to construct a new bridge at Pine St. and to improve the adjacent highway, provided the cost to town does not exceed $3,000. The total cost of improvements will be about $10,000.

Omaha, Neb.—Press reports state that plans have been prepared by the Northern Pacific R. R. Co., for a larger viaduct at 13th St., which will replace present structure.

Muncie, Ind.—The contract for constructing a bridge across White River is reported to have been secured by the Indiana Bridge Co., for $7,110.

Monroeville, O.—It is stated that the Lake Shore & Michigan Southern Ry. Co. will construct a bridge across Huron River, at Monroeville.

St. Paul, Minn.—The Conference Committee has included in the budget $65,000 for repairing Third St. bridge and the construction of a new structure in the near future.

Alhambra, Cal.—The Board of Supervisors and Chief Engineer Phillsbury, of the Pasadena & Los Angeles Electric Ry. Co. are considering the building of a larger bridge, with better approaches, at E. Main St.

Danville, Pa.—It is stated that the Pennsylvania R. R. Co. will construct an iron bridge across Susquehanna River, connecting Riverside and Danville.

Anadarko, Okla. Ter.—Plans and specifications are being prepared by Surveyor C. H. Jones, for an iron bridge to cross Washita River near Anadarko. Address County Commissioners.

Providence, R. I.—An act has been passed by the House of Representatives, appointing as a committee the Mayor, Commissioner of Public Works and Joint Standing Committee on Railroads of the City Council, to consider the abolition of certain grade crossings at Grove, Dike and Acorn Sts., and to arrange plans and division of expense with the New York, New Haven & Hartford R. R. Co.

Hyattstown, Md.—It is stated that a steel bridge is to be constructed at Hyattstown.

Fall River, Mass.—City Engr. P. D. Borden writes that it is proposed to build a new bridge across Taunton River for carriages and foot travel, the present bridge to be used exclusively for railroad purposes.

Columbus, O.—A resolution has been adopted by the City Council, instructing the City Engineer to co-operate with the County Commissioners and the County Engineer, to remove the present bridge at Cleveland Ave. and construct a viaduct in its place.

Harrisburg, Pa.—Bids are wanted Dec. 27 for constructing the substructure and superstructure of proposed bridges across Sugar Creek in Bradford County. T. L. Eyre, Supt. Pub. Grounds & Buildings.

Cleveland, O.—Press reports state that the officials of the Lake Shore and Big Four Railroads contemplate the construction of a steel viaduct at Detroit St., to be about 3½ miles long, and to have an elevation of over 100 ft. in places.

Montpelier, Vt.—Plans have been submitted to the Mayor for a steel bridge to replace the Rialto structure.

Port Hastings, N. S.—Press reports state that the Strait of Canso Bridge Co., Ltd., has applied for a charter to construct a suspension bridge for railway tramway, vehicle and passenger purposes, across the Strait of Canso, from near Port Hastings to a point near Cape Porcupine, and to build railways connecting the bridge with through lines.

Memphis, Tenn.—Bids are wanted Dec. 20 for constructing an iron and wood bridge across Wolf River, on Germantown and Fisherville road. W. W. Barksdale, Supt. of Bridges.

Santa Monica, Cal.—On Nov. 19 the citizens voted in favor of issuing $25,000 bonds for constructing a stone bridge.

Somerville, Mass.—The Metropolitan Park Commissioners are considering plans for a bridge to connect Somerville and Medford.

Norristown, Pa.—It is reported that the Reading Co. has taken out a charter and organized the Norristown & Main Line Connecting R. R. Co. for the purpose of constructing approaches and bridge between the Reading main line, above Bridgeport, and the Norristown side of the Schuylkill River, near Swede St. According to press reports, plans for the proposed bridge have not been prepared, but a double track steel structure about 1,600 ft. long, to cross the river at an angle, is contemplated.

Carthage, Mo.—Plans are being prepared for stone arch bridges to cross Mill Race.

Bloomington, Ind.—The Commissioners of Monroe and Owen Counties have agreed to employ E. F. White, of Harrison Township, to prepare plans, specifications and estimates for a bridge to cross White River.

St. Louis, Mo.—Bids are wanted Dec. 6 for removing the present superstructure of Chouteau Ave. bridge across the tracks of St. Louis & San Francisco Ry. Co., and building a new superstructure in its place, including an extension of present abutments; bridge to be a plate girder structure having a 100-ft. span, 40-ft. roadway, with 2 20-ft. sidewalks and street railway tracks. Hiram Phillips, Pres. Bd. of Pub. Wks.

PAVING AND ROADMAKING.

Buffalo, N. Y.—Bids are wanted Dec. 6 for paving on portions of Bardol and Spiess Sts. R. G. Parsons, Sec'y Bd. Pub. Wks.

Milwaukee, Wis.—It is proposed to construct a speedway, to be known as Sherman Boulevard, along 43d St. for a distance of 1¼ miles.

Norwood, O.—An ordinance providing for the construction of Northside Ave., the proposed macadamized thoroughfare, which is to connect Avondale and Norwood, has been introduced in the Norwood Council. Cost about $12,000.

Toledo, O.—The Street Committee of the Council has approved a petition for repaving Jefferson St.; asphalt blocks will probably be used.

Albany, N. Y.—Albany County Supervisors have recommended the improvement of 21 miles of road, under the provision of the State Highway Law.

Tremont, O.—The contract for curbing, grading and macadamizing a portion of East State St. has been awarded to Florence D. Sullivan for $16,253.

Pasadena, Cal.—See "Water."

Louisville, Ky.—Roger McGrath, Sec'y Bd. of Pub. Wks., writes that the contract for asphalt paving on 3 streets has been awarded to the Ohio-Kentucky Asphalt Co., of Cincinnati, O., for $10,000.

Norfolk, Va.—City Engr. W. T. Brooke writes that the improvements, for which $480,000 bonds were recently voted, are asphalt and block paving, sewerage and drainage, and general street improvements in the Atlantic City Ward.

Norristown, Pa.—Boro. Engr. S. Cameron Corson writes that the Town Council has passed an ordinance providing for the issue of $150,000 bonds to be used for permanent pavements, sewers, etc. Above proposition to be submitted to a vote of the people in February.

Scranton, Pa.—The Director of Public Works recommends the purchase of a road roller and other street machinery.

Ft. Worth, Tex.—The Council proposes to improve the streets about the Union Station at a cost of $18,000. The Texas & Pacific Ry. is expected to bear part of the expense.

Brooklyn, N. Y.—Bids are wanted Dec. 6 for repaving with asphalt, on a concrete foundation, on portions of several streets. Jas. P. Keating, Commr. of Highways, N. Y. City.

Greenville, Tenn.—The question of issuing $40,000 bonds for building public roads is being considered.

Topeka, Kan.—The Streets & Walks Committee is considering the paving of a portion of East Tenth St. with vitrified brick on a sand foundation.

West Hoboken, N. J.—Press reports state that the contract to pave with asphalt, on a portion of Weehawken St., has been awarded to Raffy Capone, for $3,472.

Chattanooga, Tenn.—The Council has decided to improve Cedar St.

Harrisburg, Pa.—See "Water."

Brooklyn, N. Y.—Park Commissioner Geo. V. Brower reports that because of damage done to the tar pavement at the entrance of Prospect Park and approach to the Boulevard, it will be necessary to put down new pavement, at a cost of several thousands.

Brooklyn, N. Y.—Mayor Van Wyck has approved the ordinance providing for the regulating, grading and paving with asphalt of Third Ave., from 60th St. to the Shore Road, at a probable cost of $210,000.

POWER PLANTS, GAS AND ELECTRICITY.

New Orleans, La.—Bids are wanted by the Drainage Commission until Jan. 22 for the construction and erection of a generator, engine, boiler, pump, etc., as advertised in The Engineering Record.

New York, N. Y.—Bids are wanted Dec. 19 for supplying the electric current necessary to supply the electric lights of the City Prison for the year 1902; for gas for City Prison, etc., under the control of the Department of Correction; also for supplying gas on Blackwell's Island for the Correction Institutions. Francis J. Lantry, Commr. of Correction.

Brooklyn, N. Y.—Bids are wanted Dec. 19 for furnishing gas for Kings County Penitentiary. Francis J. Lantry, Commr. of Correction, N. Y. City.

Louisville, Ky.—E. H. Mark writes that the committee, of which he was chairman, has made its report on plans submitted by promoters and by persons having devices for the utilization of the power of Ohio Falls.

Elwood, Ind.—A company headed by W. A. DeHority is stated to have received a franchise to establish a steam and hot water heating system.

Harvey, Ill.—The Council is stated to have granted the Harvey Water & Light Co. a franchise for gas works.

Seabright, N. J.—The electric light plant is reported to have been damaged by fire on Nov. 23.

Buda, Ill.—J. A. Tornquish, of Altoona, Ia., is reported to have secured a franchise to establish an electric light plant at Buda.

Cincinnati, O.—Plans are stated to have been completed for extensive additions to the present electric generating plant of the Cincinnati Gas & Electric Co. on Plum and Charles Sts.

Stanton, Neb.—An electric light company is stated to have been formed, with F. A. Raabe as Pres., and has secured a 50-year franchise. It is expected that the city lights will be in place by Jan. 1.

Ashtabula, O.—The Ashtabula Gas Co. is reported to have reorganized and will enlarge its plant.

Duluth, Minn.—The Duluth Electric Co., of Duluth, has been incorporated, with a capital of $100,000, to convert water power into heat, light and power, and to carry on all business necessary for its production and distribution. Incorporators: A. W. Hartman and R. B. Knox, of Duluth, R. R. Dunn, of St. Paul, and others.

New Ulm, Minn.—It is reported that Chas. L. Pillsbury, of Minneapolis, has submitted plans for the municipal electric light plant, and bids will be taken shortly.

Burlington, Ia.—The Peoples' Gas & Electric Co. is stated to have been formed here, with a capital of $200.000, by B. E. Sunny, Geo. P. Townsend and others, all of Chicago, Ill.

Boswell, Ind.—See "Water."

Philadelphia, Pa.—Contracts for lighting Fairmount Park are reported to have been awarded, at $9.25 per light per month, the total cost being about $40,000. Awards for the various sections were made as follows: Wissahickon Electric Light Co., East Park and Wissahickon; the Manufacturers' Electric Co., Hunting Park; the Powelton Electric Light Co., all the Park territory west of the Schuylkill. The Welsbach Street Lighting Co. secured the contract for the naphtha lighting of Fairmount Park, at $2.45 per light per month.

San Antonio, Cal.—W. H. Sanders, of Pomona, at the request of the San Antonio Water Co., is stated to have made a survey of a portion of San Antonio Canon, to determine the feasibility and cost of a proposed electric power plant at that point. He estimates the total cost at $65,087.

Marquette, Mich.—A syndicate headed by W. A. Thompson and W. J. McDonald, of Chicago, and H. W. McCoy, of Peoria, Ill., is stated to have obtained control of the Marquette Gas Co. and will expend $80,000 in improvements.

Superior, Wis.—The Superior Water, Light & Power Co. is reported to be having plans prepared for the installation of new electrical apparatus for street and commercial lighting, to cost about $35,000.

Pond Creek, Okla. Ter.—The City Council is stated to have granted a franchise for an electric light plant to Mr. Lewis.

Guines, Cuba.—See "Water."

Genoa, Ill.—The Genoa Electric Light Co., of Genoa, has been incorporated, with a capital of $10,000, to operate a light, heat and power plant. Incorporators: Geo. Loptein and H. L. Canfield.

San Bernardino, Cal.—It is stated that the Edison Electric Co. has secured control of the plant of the San Bernardino Electric Co. and will improve the service. Geo. B. Ellis, Engr., Los Angeles.

Lansing, Mich.—The Lansing Gas Light Co. has purchased a site for works, but does not expect to build for at least two years.

San Francisco, Cal.—A press report states that a company has been organized by Chas. D. Lane and others to construct an electric system to supply power to San Francisco and the towns between the mountains and the bay. The water will be taken from Stanislaus River and conveyed in a canal 35 miles to Murphys and Vallecito. Calaveras County to furnish light and power for the mines in that vicinity.

Leesburg, Va.—Beverly Chichester is stated to have received an electric light franchise from the Council.

McKeesport, Pa.—A press reports states that at a meeting of the Council Nov. 22 bids for the street lighting contract were opened. The Monongahela Co. bid $70 a year per arc light, and the Altmeyer Light Co., of McKeesport, bid $68 per light. The contract of the Monongahela Co. expires in June. The contract was not awarded.

The Council is stated to have reconsidered its former action and decided to advertise the sale of $150,000 bonds to erect a municipal light plant.

New York, N. Y.—Bids will be received by the Department of Public Charities until Dec. 9 for furnishing gas. John W. Keller, Pres. Bd. Commrs.

Galion, O.—The Council has granted to Wm. L. Bloomer and Bloomer B. Gill, of Galion, a franchise for a steam heating-plant.

Cumberland, Md.—The Cumberland Electric Light Power Co. has been incorporated with a capital of $50,000, to install an electric light plant. Incorporators: Chas. W. Kilbourn, New Brunswick, N. J.; Arthur Leroy Fell, Washington, D. C.; Arthur L. Bosley, Baltimore, Md., and others.

Rockwood, Tenn.—The citizens are stated to have voted to issue $6,000 bonds for the purpose of finishing, installing and re-equipping the electric light plant.

Enumclaw, Wash.—See "Water."

Wellington, Kan.—The City Clerk writes that the citizens have voted in favor of issuing $15,000 bonds, to build and equip an electric light plant.

Butte, Mont.—See "Water."

New York, N. Y.—Bids are wanted Dec. 11 for furnishing, operating and maintaining electric lamps for the term of one year from Jan. 1, 1902, to Dec. 31, 1902, for lighting the streets, public buildings and parks, in the various boroughs; also for furnishing gas or other illuminating material for, and lighting, extinguishing, cleaning, repairing and maintaining the public lamps (and supplying gas, etc., for the new lamps when required), also furnishing burners and appliances of improved system of lighting, for the term of one year from Jan. 1, 1902, to Dec. 31, 1902, on the streets, public buildings, avenues, piers, parks and public places, in the various boroughs. Henry S. Kearny, Commr. of Pub. Bldgs., Lighting & Supplies.

ELECTRIC RAILWAYS.

North Tarrytown, N. Y.—A certificate is stated to have been filed by the Tarrytown, White Plains & Mamaroneck Ry. Co., of the extension of its lines to North Tarrytown through Courtland St. H. C. Reagen, Ch. Engr., White Plains.

Homestead, Pa.—It is stated that the Homestead & Mifflin St. Ry. Co. is to construct a line to Whitaker, in the direction of Duquesne, and another branch to Lincoln Place. A $20,000 viaduct across Munhall hollow will be constructed to reach Whitaker.

Shawano, Wis.—The Shawano & Green Bay Interurban Ry. Co. is stated to have been formed, with a capital of $100,000, to construct an electric railway in the counties of Shawano, Brown, Outagamie and Marathon. Incorporators: H. G. Dreier, L. Rollmann, and others.

East St. Louis, Ill.—The Council is stated to have granted the East St. Louis Electric R. R. Co. a franchise to make extensions and connections through various sections of the city. J. W. Taylor, Ch. Engr., St. Louis, Mo.

Indianapolis, Ind.—Controlling interest in the Indianapolis & Greenfield Rapid Transit Line is reported to have been purchased by Frank Maus Fauvre and other capitalists interested in the Indianapolis & Eastern Traction Co., which was incorporated last spring to build an electric line from this city to Richmond, and ultimately to Cincinnati. An extension will be constructed from Knightstown through Carthage to Rushville. The Central Co. of Indianapolis is stated to have received the contract for constructing the line between Greenfield and Knightstown.

Oakland, Cal.—The Oakland & San Jose R. R. Co. is stated to have been formed, with a capital of $2,500,000. It is stated that the company intends to extend the Haywards road to San Jose, and also build three branch roads, one from San Jose to Los Gatos, the other from San Jose to Saratoga, and a third from San Jose to Santa Clara, 83 miles in all. The motive power will be electricity. Incorporators: Frank M. Smith, F. C. Havens and others.

Schenectady, N. Y.—It is stated that the Schenectady Ry. Co. will extend its line to Troy, Scotia and other places. R. H. Fraser, Mgr., Schenectady.

Canon City, Colo.—The Florence Electric St. Ry. Co. is stated to have petitioned the City Council for a franchise through the city. R. L. Kelly, Ch. Engr., Florence, Colo.

Mechanicsville, N. Y.—It is stated that the Hudson Valley Ry. Co. will construct a line from Ballston to Mechanicsville. J. H. Armstrong, Ch. Engr., Glens Falls.

Eaton, O.—The County Commissioners are stated to have granted the Cincinnati, Hamilton, Richmond & Muncie Traction Co. permission to construct and operate its lines through Preble County.

Evansville, Ind.—August D. Jones, of Howell, John Conlin, of Mt. Vernon, and others are reported interested in the construction of an electric railway from Evansville to Mt. Vernon and New Harmony.

Cleveland, O.—The Eastern Ohio Traction Co. of Cleveland has been incorporated with a capital of $1,000 by F. A. Henry, Robt. Crosser and others, to construct a line from Cleveland to Leavittsburg, with branch lines from Fullertown to Castleton, Punderson to Cleveland, and from Steels Crossing to Middlefield.

Topeka, Kan.—D. R. Nelson, of Ft. Scott, is stated to have petitioned the County Commissioners for a franchise for an electric railway to connect Topeka with Lawrence and Kansas City.

Tribeshill, N. Y.—John N. Shannahan, Engr. of the Fonda, Johnstown & Gloversville R. R. Co., Gloversville, writes that the time for receiving bids for constructing a power station at Tribeshill has been extened to Dec. 5.

Logansport, Ind.—The Council has granted a 40-year franchise over several streets to the Wabash River Traction Co., work to begin May 1 and be completed within 18 months. D. A. Blakeslee, Pres., 58 Waverly Pl., New Haven, Conn.

Richmond, Va.—The Richmond Traction Co. (E. L. Bemiss, Pres.) will erect a large storage battery plant at some point near the center of the city. The Va. Electric Ry. & Development Co. is also interested.

Merrill, Wis.—It is stated that the Merrill Ry. & Lighting Co. will expend $40,000 in improvements. Water wheels and two 700-H.-P. dynamos will be added. E. S. King, Mgr., Merrill.

Lebanon, O.—The Council is stated to have granted a franchise to the Lebanon & Franklin Traction Co. S. E. Kemler, of Dayton, is one of the incorporators.

Martinsville, Ind.—The Council is stated to have granted a franchise to the Indianapolis & Martinsville Rapid Transit Co. Chas. Finley Smith, of Indianapolis, is one of the incorporators.

Galesburg, Ill.—The Galesburg & Oneida Electric Ry. Co. has been incorporated, with a capital of $10,000, to operate an electric railway and a light, heat, and power plant. Incorporators: F. W. Emery, A. N. Lindsey and H. C. Lucas.

Cicero, N. Y.—The Syracuse & South Bay Ry. Co. is stated to have secured permission to construct its road along a private right of way from North Syracuse to South Bay, a distance of 6 miles. Geo. D. Chapman, Pres., Syracuse.

Johnstown, Pa.—It is stated that the Johnstown Passenger Ry. Co. Line is to be extended through Somerset County to the town of Somerset, 35 miles, passing through Boswell and other points. A. H. Walker, Ch. Engr., Johnstown.

Newport, Ky.—Col. Berry and Mayor Nelson, of Newport, are reported interested in the construction of an electric railway from Newport to Alexandria.

Macomb, Ill.—The Macomb & Western Illinois R. R. Co. has been organized to construct an electric road from Macomb to Industry, and afterward to extend the line to Littleton, Rushville and Beardstown. W. A. Compton, Pres., Macomb.

Charlotte, Mich.—W. A. Tateum and C. H. Watkins, of Grand Rapids, representing the Central Michigan Traction Co., are stated to have petitioned the Council for a franchise.

Des Moines, Ia.—R. A. Elzy, of Marshalltown, is stated to have secured the contract for constructing the electric railway between Des Moines and Altoona for the Interurban Ry. Co.

Wellsville, O.—The Council is stated to have granted a franchise to the East Liverpool St. Ry. Co.

Kittanning, Pa.—H. B. Schall is reported to be securing right of way for a trolley line from Kittanning to Rural Valley, a distance of 12 miles.

Upper Sandusky, O.—The Council is stated to have granted the Tiffin & Southern R. R. Co. a franchise for an electric railway.

Sheboygan, Wis.—The Northwestern Interurban Electric Ry. Co. is stated to have been formed with a capital of $25,000, to construct and operate an electric line between Sheboygan and Manitowoc counties and in the cities of that name. Incorporators: C. A. A. McGee, H. F. Cochems and Wm. J. Scanlon. Principal office to be in Milwaukee.

Canisteo, N. Y.—L. D. Whiting, of Jasper, is reported interested in the construction of an electric railway between Canisteo and Woodhull.

Redondo, Cal.—The Los Angeles & Redondo Ry. Co. is stated to have petitioned the City Trustees for a franchise for a double-track electric railway. The motive power of the road is soon to be changed from steam to electricity. L. J. Perry, Sup't, Redondo.

Gallatin, Tenn.—Prof. A. T. Jackson, of White House, Tenn., is reported interested in the construction of an electric railway from Gallatin to Springfield.

Lancaster, O.—The Ohio Central Ry. Co. is stated to have received from the County Commissioners a franchise for an electric railway from Lancaster to the county line near Rushville.

Vermilion, O.—The Vermilion, Mansfield & Southern Ry Co. has been incorporated with a capital stock of $10,000, to construct and operate an electric railway between Mansfield and Vermilion. Incorporators: E. L. Coen, Geo. Fischer, and others.

Porto Rico.—President Roosevelt is reported to have signed the concession granted by the Executive Council of Porto Rico to the Port America Co., which is to build two lines of railroad in the island—one north and south from San Juan to Port America, and the other east and west from Aquadilla to Eucanada Honda.

Eaton, O.—The County Commissioners are stated to have granted the Hamilton, Eaton & Richmond Traction Co. a 50 years' franchise through Preble County.

Marion, O.—The Columbus, Marion, Tiffin & Toledo Electric Ry. Co. is stated to have been organized, with C. W. Stoltz, Pres.; H. B. Hane, Sec'y, both of Marion. The proposed road will run from Marion to Tiffin.

Sandusky, O.—The County Commissioners are stated to have granted J. C. Parker a franchise to construct an electric railway from this city to the county line via Castalia.

RAILROADS

New Orleans, La.—A charter is stated to have been granted to the New Orleans & Mississippi Midland R. R. Co., with a capital of $2,000,000. It is intended to cross Lake Pontchartrain and traverse the Ozone and Pine belts to Pontotoc, Miss., a distance of 340 miles. A bridge will be constructed across Lake Pontchartrain. Directors: Percy L. McCoy, New Orleans; C. S. E. Babbington, Covington, La.; Robt. P. Duncan, New York, N. Y., and others.

Pittsburg, Pa.—Local press reports state that within the next two weeks the Pittsburg, Carnegie & Western Ry. Co. expect to call for bids for the construction of the last section of that road, which is to connect the Wabash system with Pittsburg. Joseph Ramsey, Jr., Pres., St. Louis, Mo.

Amsterdam, N. Y.—The Council is stated to have granted a franchise to the Fonda, Johnstown & Gloversville R. R. Co. to extend its line over West Main St. J. N. Shannahan, Ch. Engr., Gloversville.

Milwaukee, Wis.—The report of the Committee on Track Depression, submitted to the Council on Nov. 18, is stated to have been accepted. It provides for a depression of the Chicago & North-Western tracks in the 18th ward, 16 ft. below grade, taking North Ave. as the basis. E. C. Carter, Ch. Engr., Chicago, Ill.

Sanilac Center. Mich.—The Sanilac Ry. Co. is reported organized, with a capital of $56,000, to construct a railroad from Carsonville to Sanilac Center, a distance of 7 miles.

Williamsburg, Va.—It is stated that the Jamestown, Williamsburg & Yorktown R. R. Co. will construct a railroad from Jamestown Island via Williamsburg to Yorktown. F. H. Geddy and H. N. Phillips are reported interested.

Mobile, Ala.—It is stated that the Mobile & West Alabama R. R. Co. will construct a railroad from Mobile to Florence through Tuskaloosa. Judge R. Anstelle, of Mobile, is reported to be a promotor of the road.

Chilhowee, Tenn.—A charter is stated to have been granted to the Little River Co., with a capital of $150,000, to construct a railroad from Chilhowee Gap, Blount County, up the Little River valley to the forks, and to Laurel Gap, with branch lines up Little River to the North Carolina line. Tully R. Cornick, of Knoxville, is one of the incorporators.

Port Hastings, N. S.—See "Bridges."

Middlesboro, Ky.—The Council is stated to have granted the American Association a right of way for the Mineral Springs R. R. This road will be at once built from here to Hartranft, Tenn., where the Southern will join it with a new road from Lafollette.

St. Joseph, Mo.—The Union Terminal Ry Co., of St. Joseph, has been incorporated, with a capital of $500,000, to construct a standard gauge railroad in Buchanan County about five miles in length. Incorporators: John Donovan and John E. Dolman, of St. Joseph, and others.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Ladysmith, Wis.—F. G. & C. A. Stanley, of Chippewa Falls, are stated to have secured the contract for erecting a $25,000 court house for Gates County.

New Bedford, Mass.—Leister & Co. are stated to have received the contract for erecting a public library here, for $41,250.

Titusville, Pa.—It is reported that C. M. Robinson, of Pittsburg, has prepared plans for a $30,000 edifice for the M. E. Congregation.

Columbus, O.—It is stated that the St. Matthews' Evangelist Lutheran Society will erect a $25,000 church. Architects, Richard & McCarty, 75 "The Ruggery."

Galveston, Tex.—Bids are wanted Dec. 5 for repairing and remodeling the City Hall. C. W. Bulger, Archt., 318 Levy Bldg.

Pensacola, Fla.—Bids will be received by the vestry of Christ Episcopal Church, until Jan. 15, for erecting a church. Address, H. G. De Silva, Sec'y Bldg. Com., Pensacola.

Mattoon, Ill.—W. R. Brown, 433 Wabash Ave., Chicago, is reported to have prepared plans for the First Presbyterian Church, to cost $20,000.

Sheriden, Pa.—The Catholic Society is reported to have plans for a $40,000 church to be erected at Lynwood and Ashland Aves.

Overbrook, Pa.—W. L. & W. F. Price, 731 Walnut St., Philadelphia, Pa., are stated to have prepared plans for a $20,000 edifice to be erected here for the Presbyterian Congregation.

Cleveland, O.—Matzinger & Allen are stated to have completed plans for a $45,000 church to be erected by the German Evangelist Lutheran Society. Carl M. Zorn, Pastor.

Philadelphia, Pa.—Meyer Guggenheim, of New York, N. Y., has given the Jewish Hospital Association $60,000 for a new building.

Clinton, Ia.—The First M. E. Society is reported to be preparing to erect a $30,000 church.

Paw Paw, Ill.—The Presbyterian Society is stated to have decided to erect a $15,000 church. Architects, Turnbull & Jones, McBride Blk., Elgin.

Landeck, O.—It is stated that the St. Johns Catholic Society will erect a $20,000 church. Address, Rev. Donimic Zimsimayer.

Boston, Mass.—The following bids were opened Nov. 22 by Supt. Paige, of the Public Buildings Department, for the proposed new municipal building, Ward 16, etc.: Bidders all of Boston:

Building—Morrill & Whiton Construction Co., $96,960; Miller & Bros., $103,100; Howard Bros., $101,300; Clark & Lee, $98,800.

Heating—Smith & Anthony, $17,904; A. B. Franklin, $15,837; A. A. Sanborn, $16,388; National Steam & Economizing Co., Springfield, Mass., $11,354.

Plumbing—D. L. Billings & Co., $6,493; T. F. Murphy & Co., $6,668; W. P. Jones, $6,975.

Billings, Mont.—The lowest bid received for the erection of a city hall is stated to have been submitted by Shackelton & Whiteway, of Butte, for $28,989.

New York, N. Y.—Bids will be received by the Department of Public Charities until Dec. 9 for furnishing building materials. John W. Keller, Pres. Bd. Commrs.

Brooklyn, N. Y.—Bids are wanted Dec. 9 for erecting an observation pavilion for the Kings County Hospital; also for repairing roofs of the Kings County Almshouses, Borough of Brooklyn. John W. Keller, Commr., Dept. Pub. Charities, N. Y. City.

Warren, O.—Bids are wanted by the Mesopotamia Township Trustees until Dec. 19 for erecting a town hall in Mesopotamia Township. E. P. Griffin, Chmn.

Jasper, Ark.—Bids are wanted Dec. 10 for erecting a court house and jail. W. S. Moore, Commr. of Pub. Bldgs.

Springfield, Ill.—Bids are wanted Dec. 19 for erecting a building for armory, arsenal and museum purposes. Samuel A. Bullard, architect. Jas. A. Rose, Sec. Bd. of Commissioners.

Pasadena, Cal.—See "Water."

New York, N. Y.—The following bids were opened Nov. 21 by the Department of Parks for the removal of rock from the site of New York Public Library: *a* Above level, 65 ft. 6 in (1,000 yds. estimated), 65 ft. 6 in. *b* Below level, 65 ft. 6 in. (1,000 yds estimated): Eugene Lentilhon, 489 5th Ave., *a*, $14 per cu. yd.; *d*, $5 per cu. yd. Norcross Bros., 160 5th Ave., *a*, $11.50; *b*,$12.50. F. Thilemann, Jr., 147 E. 125th St., *a*, $8; *b*, $12.

Albia, Ia.—Monroe County has voted $75,000 bonds for a new court house. Plans will soon be called for and bonds sold ready to commence work early in the spring.

Santa Monica, Cal.—The citizens are stated to have voted on Nov. 19 to issue $35,000 bonds to erect a city hall.

Chicago, Ill.—John E. Youngberg, 218 La Salle Street, is stated to have prepared plans for a edifice for the Disciples Congregation to be erected at 6427 Eggleston avenue, to cost about $25,000.

Sycamore, Ill.—Martin Carr 134 Van Buren Street is stated to have prepared plans for a $15,000 edifice for St. Mary's R. C. Church.

Troy, N. Y.—Bids are wanted Dec. 9 for construction, structural steel work and plumbing for the new drill hall and alterations for the State Armory at Troy. Chas. F. Roe, Maj.-Gen. Armory Commr., Albany; G. L. Heins, State Archt., Capitol, Albany.

BUSINESS BUILDINGS.

Butte, Mont.—Reed & Stem, Endicott Bldg., St. Paul, Minn., will make plans for a $100,000 passenger station at Butte, for the Northern Pacific Ry. Co.

Richmond, Va.—It is reported that the plans of J. K. Peebles, of Norfolk, have been adopted for the hotel to be built for Wm. H. Zimmerman at Broad and 7th Sts. Approximate cost, $200,000.

Wichita, Kan.—Thos. H. Griffith is stated to have purchased a site on Douglas Ave. for the erection of a $25,000 building, to be occupied by Letts & Spencer.

Wilkinsburg, Pa.—It is stated that Leopold Vilsack will erect an office building at Wood St. and Ross Ave., at a cost of $75,000.

Oskaloosa, Ia.—It is stated that a $40,000 Y. M. C. A. building is to be erected here.

New Orleans, La.—The Board of Administrators of Tulane University is stated to have decided to erect a 7-story, steel construction, fireproof office building, on Camp and Gravier Sts.

Milwaukee, Wis.—It is stated that the Milwaukee Electric Ry. & Light Co. will erect a $500,000 office and car barn at Sycamore and 2d Sts. John I. Beggs, Gen. Mgr.

Livingstone, Mont.—It is stated that the Northern Pacific R. R. Co. will erect a $75,000 depot on Park and 2d Sts. W. L. Darling, Ch. Engr., St. Paul, Minn.

Spokane, Wash.—John K. Dow, Peyton Bldg., is stated to have prepared plans for a 2-story Masonic temple to be erected on Riverside Ave. and Monroe St.

Cleveland, O.—The K. D. Box & Label Co. is stated to have decided to erect a 4-story building on Sterling Ave. and St. Clair St., at a cost of $25,000.

Portland, Ore.—It is stated that an annex will be erected to the Hotel Portland, to cost about $60,000.

New Castle, Pa.—The Knights of Pythias of this city are reported to have under consideration the erection of a temple, to cost about $40,000.

Seattle, Wash.—It is stated that W. P. Trimble will erect a $60,000 steel building on Pike St. and 2d Ave.

Sioux City, Ia.—Plans have been prepared by John W. Foster, c|o Armour & Co., Stock Yards, Chicago, Ill., for a $15,000 warehouse for Armour & Co., in Sioux City.

Dubuque, Ia.—Thos. T. Carkeek, Lincoln Bldg., has prepared plans for a 4-story factory to be built at Elm and 17th Sts., for the Ernsdorff Buggy Co. Cost, $18,000.

Grand Rapids, Mich.—It is stated that Wm. T. Powers proposes to rebuild the opera house, which was recently burned, at a loss of $150,000.

Worcester, Mass.—It is stated that the Odd Fellows' Home will be enlarged at a probable cost of $28,000. Herbert B. Belcher, Chmm, Com.

North Adams, Mass.—N. C. Bond, of North Adams, is stated to be preparing plans for a 5-story brick business building to be erected on Main St., for the Kimball Estate.

Wilmington, Del.—The wharf warehouse of the Chas. Warner & Co. is stated to have been destroyed by fire on Nov. 23.

Fredericksburg, Va.—The Richmond, Fredericksburg & Potomac R. R. Co. is stated to have decided to erect a depot and make other improvements at this place. T. L. Courtney, Supt., Richmond, Va.

Paris, Ky.—Paris Lodge, B. P. O. E., No. 373, is stated to have accepted the plans of Architect Rowe, of Lexington, for an $18,000 lodge building to be erected on Main St. and Bank Row.

East St. Louis, Ill.—The contract for erecting a building for the Nelson Morris plant is stated to have been awarded to Peter Reiman, of East St. Louis.

Alton, Ill.—It is stated that plans have been prepared for a $25,000 depot for the Chicago & Alton R. R. Co. S. M. Felton, president, Chicago.

Atlanta, Ga.—The plans of Bleckley & Tyler, Eng., Am. Building, are stated to have been accepted for a clubhouse for the Atlanta Athletic club to be erected on Auburn Ave.

Rapid City, S. D.—It is stated that the Tremont, Elkhorn & Missouri Valley Ry Co. will erect a two-story brick and stone depot on Rapid and Eighth Sts. E. C. Carter, Ch. Engr., 22 Fifth Ave., Chicago.

Detroit, Mich.—A. C. Varney & Co., Newberry Building, are stated to be preparing plans for a three-story brick business block, for Geo. Peck, to be erected on Miami Ave. and Wilcox St., to cost $17,000.

Buffalo, N. Y.—Local press reports state that bids will be received until Dec. 2 for erecting the Y. M. C. A. building on Mohawk, Genesee and Pearl Sts.

Chicago, Ill.—Fritz Foltz, 69 Dearborn St., is stated to have prepared plans for a two-story warehouse to be erected at Fulton and Halstead Sts., for the Scully Steel & Iron Co., to cost $30,000.

A stable and wagon-house will be erected on State St. near 19th, for The Hub, plans of S. N. Crowen, 85 Dearborn St. It will be 3 stories high, 50 x 116 ft., and cost $20,000.

New York, N. Y.—York & Sawyer, 156 5th Ave., are stated to have prepared plans for a 2-story fireproof building for the Society of the Sons of the Revolution, to cost about $100,000.

NEW YORK CITY.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

Mercer St and Waverly Pl, br and stone mercantile bldg; c, $175,000; o and mason, Philip Goerlitz; a, Alfred Zucker; carpenter, Christian Benjes.

Ave A and 68th St, br warehouse; c, $80,000; o, Alfred M Rau; a, Louis Kora.

Amsterdam Ave and 79th St, br and stone hotel; c, $300,000; o, Thos F Doherty; a, Hy Anderson.

B'way and 77th St, br and stone hotel; c, $600,000; o, Albert Saxe; a, Stein, Cohen & Roth.

DWELLINGS.

Baltimore, Md.—Hodges & Leach are stated to have prepared plans for an 11 story apartment house to be erected on Eutaw Pl. and Laurens St., for the Eutaw Pl. Apartment Co., to cost about $300,000.

Detroit, Mich.—A. C. Varney & Co., Newberry Building, are stated to be preparing plans for a house of 6 flats for Mrs. Susan M. Swales, to be erected on Palmer Ave. and John R. St., to cost $17,000.

Louisville, Ky.—Kenneth McDonald, 349 W. Main St., is stated to be preparing plans for an apartment house to be erected on 3d St. and B'way for Harry Weissinger, to cost about $250,000.

Chicago, Ill.—Bishop & Co., 189 La Salle St., are stated to have prepared plans for a 3 story apartment building, 40 x 125 ft., to be erected at 6447-49 Yale Ave., for John B. Ryan, at a cost of $23,000.

Wilson & Marshall have prepared plans for a 3 story brick and stone residence to be erected on Drexel Boulevard and 48th St. for Chas. A. Stonehill, to cost $60,000.

Kley & Gauger are stated to have prepared plans for a 3-story flat, 88 x 98 ft., to be erected on Flournoy St. and S. 40th Ave.; cost, $40,000.

Thos. McCall, 167 Dearborn St., is preparing plans for a 3-story apartment house, 75 x 90 ft., to be built for John Jeffrey on Kimbark Ave., near 51st.; cost, $30,000.

L. M. Mitchell, 145 La Salle St., is completing plans for a double apartment house, which Frank P. Burkett will build at 4131-4139 Indiana Ave.; cost, $48,000.

Two apartment houses have been designed by Andrew Sandegren, 185 Dearborn St., one 3 stories high, 107 x 73 ft., to be built at St. Lawrence Ave. and 50th Pl. for C. O. Swenson, at a cost of $45,000; the other, a 4-story building, 37 x 73 ft., to be built at 4549-4551 Oakenwald Ave., for Chas. F. Hellgren, at a cost of $25,000.

SCHOOLS.

New York, N. Y.—Bids are wanted Dec. 9 for erecting school No. 188. Rich'l H. Adams, Chmn. Com. on Bldgs., Bd. Educ.

Brooklyn, N. Y.—Bids are wanted Dec. 9 for erecting school No. 139. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Butte, Mont.—Sheridan & Demick are stated to have received the contract for erecting the new Meaderville School for $33,690.

Cambridge, Mass.—Guy Lowell, Tremont Bldg., Boston, is stated to have prepared plans for a new building for Harvard University, to be erected on Kirkland and Oxford Sts., to cost about $100,000.

Philadelphia, Pa.—The contract for heating the annex to the Boys' High School is stated to have been awarded to Cuff & Co., for $8,500.

Menomonie, Wis.—The Dunn County Commissioners are stated to have decided to erect an agricultural college and teachers' training school combined, at a cost of $20,000.

Hamilton, O.—Geo. Barkman, Second Nat'l Bank Bldg., is stated to have been selected by the School Board to prepare plans for a $35,000 school for the 1st Ward.

Racine, Wis.—The plans of Guilbert & Rugh are stated to have been accepted for a $30,000 school for the 2d Ward.

Jersey City, N. J.—Bids are wanted Dec. 5 for alterations to annex of Public School No. 1. Jas. J. Wiseman, Clk. Bd. Educ.

Dedham, Mass.—Separate bids are wanted Dec. 4 for erecting, ventilating and heating apparatus, plumbing and electrical work in a grammar school on Cedar St., Oakdale District. Chas. H. Shriver, Chmn. Bldg. Com.

Homestead, Pa.—J. W. Eckles, of New Castle, is stated to have been selected to prepare plans for a $40,000 school for West Homestead.

STREET CLEANING AND GARBAGE DISPOSAL.

Natchez, Miss.—This city is figuring on a garbage disposal plant for a 25,000 population. W. G. Benbrook, Mayor.

Canton, O.—Bids were opened Nov. 16 for the erection of garbage disposal works, as follows: Dixon Garbage Crematory Co., Toledo, $19,985; American Incinerating Co., Toledo, $17,400.

Jersey City, N. J.—The contract for street cleaning for one year has been awarded to Henry Byrne, of Jersey City. For bids received Nov. 19, see The Engineering Record of Nov. 23.

Newark, N. J.—The present 10-year contract for the disposal of city garbage will expire in June next and local press reports state that under a new contract the city will probably demand a dual system, requiring the cremation of garbage and the separate collection of ashes.

Rochester, N. Y.—Local press reports state that the contract for collecting the garbage of the city next year is to be let next month by the present Board of Contract.

Philadelphia, Pa.—The following bids were opened Nov. 26 by Wm. C. Haddock, Dir. of Pub Wks. for street cleaning during the year 1902, bidders: A, David McMahon; B, Frank McCullough; C, Edwin H. Vare; D, Peoples Bros.; E, James Curran:

Bidders.	Dis. 1.	Dis. 2.	Dis. 3.	Dis. 4.	Dis. 5.	Dis. 6.	Entire City.
A..	$145,000	$195,000	$70,000	$185,000	$138,000	$34,000	$680,000
B..	....	....	55,699	....	$25,794	......	....
C..	125,000	180,000	......	....	....	......	675,000
D..	....	....	76,000	192,000	142,000	36,000	....
E..	146,000	196,000	72,000	184,000	145,000	33.450	777,450

Additional bids received were as follows: Daniel Dooley, Dist. 3, $65,000; Richard P. Bennis, Dist. 6, $28,890. For the removal of garbage for the entire city during 1902, Cranford Co. bid $538,000; American Product Co., $489,900, and J. G. Porter, $520,000. *Frank McCullough claims that this bid should have been for Dist. 6.

GOVERNMENT WORK.

Washington, D. C.—Bids are wanted at the U. S. Engineer Office, until Dec. 27, for furnishing elevator enclosures, automatic elevator door-openers, etc., for the new building for Government Printing Office. Separate bids will be received at the same time for hardwood and tile or mosaic floors for said building, as advertised in The Engineering Record.

Philadelphia, Pa.—The following bids were opened Nov. 23 at Bureau of Yards and Docks, Navy Dep't., Washington, D. C., for furnishing and installing a steam heating system in a workshop and boiler-house building at League Island Navy Yard, Pa.: *a*, for steam plant and heating complete, according to plans and specifications; *b*, for heating system, bays 1 to 9 inclusive; *c*, for heating system, bays 10 to 14, to include boiler, etc.; *d*, alternate bid: Evans, Almirall & Co., New York City, *d*, $7,975. Harris & Alger, Camden, N. J., *a*, 5,619; *b*, $2,147; *c*, $3,619. R. P. Ford, Rochester, N. Y., *a*, $7,900. Cook Heating & Power Co., New York City, *a*, $6,951. S. Faith & Co., Philadelphia, Pa., *a*. $6,145; *b*, $2.780; *c*, $3,395. Frank Dobson, New York City, *a*, $7,590; *b*, $3,226; *c*, $4,415. E. Rutzler, New York City, *a*, $8,312; *b*, $4,158; *c*, $4,154.

San Juan, Porto Rico.—Bids are wanted Dec. 28 for constructing 2 coaling towers with necessary coal handling machinery at the Naval Station, San Juan, P. R. Estimated cost, $20,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

San Francisco, Cal.—The following bids were opened Nov. 23 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing and installing 3 200-H.-P. boilers at the Navy Yard, Mare Island, Cal.: Risdon Iron & Locomotive Wks., San Francisco, $26,825 and $22,305; C. C. Moore, San Francisco, $30,788 and $26,677.

Charleston, S. C.—Capt. David Price, Q. M., U. S. Army Post, Sullivan's Island, Charleston Harbor, opened the following bids Nov. 22 for constructing Administration Building and single barracks at above post: Plumbing only—A. J. Riley, Charleston, S. C., $3,455. Entire work—Henry Mont, Pensacola, Fla., $39,760; W. R. Bonsal & Co., Hamlet, N. C., $52,840; Randall Bros., Atlanta, Ga., $44,437; James H. Coster, Baltimore, Md., $43,800.

Omaha, Neb.—The following bids for furnishing and setting a pump and boiler house in connection with water-works at Ft. Robinson, Neb., were opened Nov. 20 by Maj. John W. Pullman, Ch. Q. M., U. S. A.; J. J. Hanighen, Omaha, Neb., $3,724; M. P. Keefe, Cheyenne, Wyo., $3,960.

Bremerton, Wash.—Bids are wanted Dec. 28 for furnishing and installing 2 275-H.-P. boilers and accessories; also until Jan. 4 for erecting a 3-story brick and steel fireproof building, about 60 x 200 ft., at the Navy Yard, Bremerton. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Washington, Md.—Bids are wanted Dec. 9 for constructing a permanent pumping station, 140,000-gal. reservoir, and 60,000-gal. steel tank and trestle, and connecting same with distributing mains at Ft. Washington. Capt. Abe S. Bickham, Q. M., 419 N. Washington St., Alexandria, Va.

Crow Agency, Mont.—Bids will be received by W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C., until Dec. 16, for furnishing material and labor and erecting a dormitory, and constructing water and sewer system at Pryor Creek, Crow Agency; also for furnishing and delivering at Crow Agency 2 100-ft. 6-in. cast iron pipe, to weigh not less than 53 lbs. to the foot; 2 45-degree bends; 8 lbs. pig lead for each joint and 6 740-ft., 6-in. spiral riveted pipe, asphalted, No. 20, B. W. G., to weigh not less than 3 lbs. to the ft., thickness .035, and a sufficient number of Roots' bolted joints or equal. J. E. Edwards, U. S. Indian Agent, Crow Agency, Mont.

White Earth, Minn.—Bids will be received by W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C., until Dec. 17, for furnishing material and erecting a brick or frame employees' quarters, at the White Earth Agency, Minn. Address, U. S. Indian Agent, White Earth Agency.

Baltimore, Md.—Bids are wanted at the Treasury Dept., Washington, D. C., until Jan. 8 for the foundations, superstructure and roofing of the U. S. Custom House at Baltimore, as advertised in The Engineering Record.

Baltimore, Md.—Bids will be received until Dec. 21 for constructing a boiler for the lighthouse tender Jessamine, Lighthouse Depot, Lazaretto Point, Baltimore, as advertised in The Engineering Record.

MISCELLANEOUS.

Tallulah, La.—Bids will be received by the Board of Commissioners of the Fifth Louisiana Levee District, office of the Board of State Engineers, Cotton Exchange Bldg., New Orleans, until Dec. 16. for $175,000 bonds. A. T. Lane, Sec'y, Tallulah.

La Crosse, Wis.—Local press reports state that bids will be received until Dec. 5 for furnishing rock to be used on all bridge and road improvements in the county. Address, the County Clerk.

San Juan, Porto Rico.—The city officials are reported to have awarded an issue of municipal bonds, to the value of $600 000, to J. M. Ceballos & Co., of New York City.

Pasadena, Cal.—See "Water."

Sault Ste. Marie, Mich.—Plans for widening St. Mary's Falls canal are now on file in the office of General Supt. Ripley of the canal. It is estimated that the project will cost $750,000.

Abbeville, La.—Bids are wanted by the Abbeville Canal Co. for grading on 5 miles of irrigational canal, containing approximately 90,000 cu. yds. earthwork. F. T. Foote, Engr., Abbeville.

Albert Lea, Minn.—The County Commissioners are reported to have appointed J. W. Davenport, of Taylorville, Ill., engineer in charge of the construction of the proposed ditch in the Townships of Riceland, Moscow and Geneva. Probable length of ditch, 9 miles; cost, $75,000.

Galveston, Tex.—The Board of City Commissioners has, according to local press reports, appointed Alfred Noble, of Chicago; Gen. H. M. Robert, and H. C. Ripley as a board of engineers to devise plans for the protection of Galveston from the sea.

Jersey City, N. J.—The Board of Finance has appropriated $35,000 for the new Lafayette Park and $30,000 for the extension of Columbia Park in Greenville.

New York, N. Y.—The contract for building the approaches to the Soldiers' and Sailors' Memorial Arch, has been awarded to Thomas Dwyer, New York City, for $59,400.

Harney County, Ore.—Press reports state that the French-Glenn Livestock Co., F. C. Lusk, Gen. Mgr., Chico, Cal., proposes to dig a ditch 60 ft. wide and 9 ft. deep, along the Donner and Blitzen River, for a distance of 30 miles, in Harney County, Ore. Estimated cost, $50,000.

Port Allen, La.—A. D. Barrow, Sec'y Atchafalaya Levee Board, writes that the contract for constructing 5 miles (approximately 400,000 yds.) of levee on the Atchafalaya river, has been awarded to Dameron & White, Hennen Bldg., New Orleans, at 19.25 cts. per yd.; total $77,000.

Webb, N. Y.—Bids will be received by John N. Partridge, Supt. of Pub. Wks., Albany, N. Y., until Dec. 5, for constructing a dam on Beaver River, near Stillwell, in the town of Webb. Appropriation, $87,000.

New Orleans, La.—The following bids were opened Nov. 19 by the Dock Board, for a steel shed, 60 ft. wide and 500 or more ft. long, with composition roof; prices are per 100 lin. ft.: Stewart Iron Wks., Cincinnati, O., $2,980; Penn Bridge Co., Beaver Falls, Pa., $2,469; L. Schreiber Sons Co., Cincinnati, O., $2,450; American Bridge Co., New York, $1,741.

Santiago, Cuba.—Gov.-Gen. Wood has, according to press reports, ordered the construction of a sea wall one mile in length; cost, $50,000.

Portland, Ore.—Bids will be received by the Port of Portland Commissioners, 666 Worcester Bldg., until Dec. 14, for steel trusses for a hydraulic dredge; also until the same time for 4 boilers for a hydraulic dredge.

NEW INDUSTRIAL PLANTS.

R. J. Gatling, 3650 Lindell Boulevard, St. Louis, Mo., has organized a company to make motor plows and other farm implements. The location of the plant has not been decided.

The C. W. Leatherbee Lumber Co., 520 Albany St., Boston, Mass., will erect a 2-story, 100 x 150-ft. brick mill to be equipped with a 550-H.-P. steam power plant and lighted by electricity.

The John Ernsdorff & Sons Co., cor. Jones & Main Sts., Dubuque, Ia., will erect a 5-story and basement, 80 x 120-ft. carriage factory, in which an engine of about 20 H.-P. will probably be installed.

J. E. Hellams, Sullivans Isle, S. C., wants prices on a 30-H.-P. boiler, a 25-H.-P. engine and other equipment for a stave factory.

The Rockingham Creamery Co., Harrisonburg, Va., is figuring on installing a 10-ton ice machine.

The Bagdad, Fla., Sash Factory Co. will erect a 50 x 100-ft. main building with two 30 x 50-ft. L-shaped buildings, and install wood-working machinery. No power plant is needed.

The Central Asphalt & Refining Co., 189 La Salle St., Chicago, will erect a cooperage plant on the Neches River, near Port Arthur, Tex. The power plant will be of 100-H.-P. capacity.

D. N. Powers, Marlboro, Mass., will erect a 115 x 32-ft. coal elevator of wood with slate roof, to cost about $10,000.

The Shepler Water Motor Co., Box 425, Clarksburg, W. Va., will when fully organized, be in the market for equipment for plant for making water wheels, pulleys, shafting, gearing, etc.

Charles Clarage. Kalamazoo, Mich., is in the market for cupola and cranes.

The Elkhart, Ind., Bridge Co. is erecting a 64 x 225-ft. main building and a 24 x 42-ft. office building. Electric or steam plant of 50-H.-P. will be installed.

The Battle Creek, Mich., Oil & Varnish Co. is erecting two buildings covering 3,800 sq. ft., and will install a temporary steam plant equipped with an engine of about 50 H.-P. and two 35-H.-P. boilers. Four buildings of the following dimensions will be erected next spring: 75 x 250 ft., 2 stories; 75 x 150 ft.; 50 x 100 ft., and 50 x 125 ft.

The Brown Furniture Co., Salisbury, N. C., will erect two 2-story, 50 x 100-ft. buildings and install engines and boilers of about 80 to 100 H.-P. J. S. Brown, vice-pres.

The Jones-Earl Shoe Co., Racine, Wis., contemplates erecting a new plant next spring, size not yet determined.

The Consolidated Pump Co., Toledo, O., will erect an 80 x 250-ft. and other smaller brick buildings, and is considering the advisability of using electric power.

John Leggett & Sons, 34 and 36 North Fourth St., Troy, N. Y., will erect a 2-story 114 x 58-ft. factory at Glens Falls. Power and heat will be furnished by a 40-H.-P. boiler, but it has not been decided whether to use a steam engine or dynamo.

The Harris Mfg. Co., Fort Valley, Ga., is in the market for a 125-H.-P. boiler, 75-H.-P. engine, pressed brick iron siding, roofing, and equipment for a 100 to 125-bbl. flour mill.

The Elgin, Ill., Wind Power & Pump Co. is building a 5-story, 66 x 56-ft. brick addition for making steel towers and tanks.

The Haughton Elevator & Machine Co., Toledo, O., is erecting a 75 x 120-ft. machine shop. The power will be supplied from the present plant, but the company will be in the market for traveling crane, hot-blast heating system and machine tools.

The Myles Salt Co., Ltd., P. O. Box 1384, New Orleans, La., will build a salt plant at Weeks Island, La., having a capacity of 500 tons in 10 hours.

The Wm. Tinkham Co., Harrisville, R. I., will equip its new mill for worsted goods for 100-H.-P. transmission, supplied from its own plant.

BUSINESS NOTES.

In addition to its shops at Pottsville, the Berlin Construction Co. is building a 140 x 400-ft. shop at East Berlin, Conn., which will be operated entirely by electricity from the plant of the N. Y., N. H. & H. R. R. Co.

The Ball Engine Co., Erie, Pa., reports receiving the following orders: A 300 and an 80-H.-P. direct-connected engine for the Columbia Plate Glass Co., Blairsville, Pa.; a 175-H.-P. engine for the Wills Creek Coal Co., Byesville, O.; a 500-H.-P. cross-compound direct-connected engine for the Jacksonville, Ill., Gas Light & Coke Co., and a direct-connected engine for the Indiana Elevator, Chicago.

The York, Pa., Mfg. Co. reports receiving the following orders: A 6-ton ice-making plant for the United Ice Companies of Asbury Park, N. J.; 7½-ton refrigerating machine to Frazar & Co., New York, for export to Japan; 50-ton can ice-making plant and piping for 170,000 cu. ft. of space for storage for the Union Market Co., Philadelphia; 15-ton freezing system for the Houston, Tex., Packing Co.; 7½-ton refrigerating machine for the Hammond, La., Ice Co.; 35-ton ice-making machine for J. W. Taylor, Corinth, Miss.; 30-ton brine tank system for the Henco Brewery, Spokane, Wash.; 20-ton can ice-making plant for the Kentwood, La., Ice & Bottling Works; 50-ton ice-making plant for the Galveston, Tex.. Red Snapper Co.; 10-ton ice-making plant for the City Ice & Bottling Works, Georgetown, Tex.; 25-ton ice plant for J. M. Pickrell & A. A. Holbrook, Winchester, Ky.; 220-ton double-pipe brine cooler for the Anheuser-Busch Brewing Assn., St. Louis., and a 10-ton ice-making plant for the Lockhart, Tex., water-works.

Mr. John A. Fish, manager of the wholesale boiler department of the Walker & Pratt Mfg. Co., recently made a somewhat extended trip throughout the country to introduce the new boilers of his firm, but as he could call on only a few parties in each district, he has prepared a catalogue of these products for general distribution to the trade.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Dec. 2.	Boilers etc., Kansas City. Mo	Nov. 30
Dec. 4.	Sale of pumping works, Chicago, Ill Adv., Eng. Record, Oct. 12.	Oct. 12
Dec. 4.	Pipes, Chicago, Ill	Nov. 30
Dec. 9.	Ft. Washington, Md	Nov. 30
Dec. 9.	Pipe, Atlantic City, N. J Adv., Eng. Record, Nov. 23, 30.	Nov. 23
Dec. 10.	Riverdale, Ill Adv., Eng. Record, Nov. 30.	Nov. 30
Dec 10.	Wilmington, O	Nov. 9
Dec. 11.	Topeka, Kan	Nov 23
Dec. 12.	Hattiesburg, Miss	Nov. 23
Dec. 12.	New York, N. Y	Nov. 30
Dec. 16.	Crow Agency, Mont	Nov. 30
Dec. 16.	Trinidad, Colo	Nov. 23
Dec 17.	New York, N. Y	Oct. 19
Dec. 18.	Philadelphia, Pa	Nov. 16
Dec 21.	Tunnel, etc., Cincinnati, O Adv., Eng. Record, Nov. 23, 30.	Nov. 23
Dec. —	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. —	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
——	Louisburg, N. C	Nov. 30
	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 2.	Auburn, N. Y	Nov. 30
Dec. 3.	Trenton, N. J	Nov. 30
Dec. 3.	Jersey City, N. J	Nov. 30
Dec. 3.	Kansas City Mo	Nov. 30
Dec. 5.	Ft. Wayne, Ind	Nov. 23
Dec. 6.	Chicago, Ill Adv., Eng. Record, Nov. 16.	Nov. 16
Dec. 10.	Portsmouth, O	Nov. 30
Dec. 11.	New York, N. Y	Nov 30
——	Louisburg, N. C	Nov. 30
	BRIDGES.	
Dec. 3.	Rhinelander, Wis	Nov. 23
Dec. 3.	Rensselaer, Ind	Nov. 30
Dec. 4.	Sullivan, Ind	Nov. 30
Dec. 5.	Buffalo, N. Y	Nov. 30
Dec. 6.	Brooklyn, N. Y	Nov. 23
Dec. 6.	St. Louis, Mo	Nov. 30
Dec. 7.	Greenfield, Ind	Nov. 16
Dec. 7.	Cincinnati, O	Nov. 16
Dec. 10.	New Brunswick, N. J Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 12.	Saginaw, Mich	Nov. 9
Dec. 13.	Covington, Ind	Nov. 23
Dec. 14.	Vincennes, Ind	Nov. 23
Dec. 14.	Melan arch bridge, Des Moines, Ia Adv., Eng. Record, Nov 9, 16.	Nov. 9
Dec. 14.	Steel bridge, Des Moines, Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 16.	Boise, Idaho	Nov. 16
Dec. 17.	Topeka, Kan	Nov. 30
Dec. 20.	Memphis, Tenn	Nov. 30
Dec. 27.	Harrisburg, Pa	Nov. 30
Jan. 8.	Victoria, B. C Adv., Eng. Record, Nov. 16 to 30.	Nov. 16
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Dec. 3.	Jeffersonville, Ind	Nov. 2
Dec. 3.	Trenton, N. J	Nov. 16
Dec. 3	Buffalo, N. Y	Nov. 23
Dec. 3.	Beaumont, Tex	Nov. 23
Dec 4.	Petersburg, Ind	Nov. 23
Dec. 5.	Sullivan, Ind	Nov. 16
Dec. 6.	Cincinnati, O	Nov. 16
Dec. 6.	Brooklyn, N. Y	Nov. 30
Dec. 6.	Buffalo, N. Y	Nov. 30
Dec. 14.	Cincinnati, O	Nov. 23
Dec. 14.	Newport News, Va	Nov. 23
	POWER, GAS AND ELECTRICITY.	
Dec. 7.	Seattle, Wash	Nov. 23
Dec. 9.	New York, N. Y	Nov. 30
Dec. 10.	Wilmington, O	Nov. 9
Dec. 11.	New York N. Y	Nov. 30
Dec. 19.	New York, N. Y	Nov. 30
Dec. 19.	Brooklyn, N. Y	Nov. 30
Dec. 23.	Franchise, San Leandro, Cal	Nov. 23
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
Jan. 22.	New Orleans, La Adv., Eng. Record, Nov. 30.	Nov. 30
	GOVERNMENT WORK.	
Dec. 3.	Wiring, etc., Clinton, Ia Adv., Eng. Record, Oct. 19, 26.	Oct. 19
Dec. 3.	Coaling plant, Stanley Point, Manila Bay, P. I	June 15
Dec. 4.	Tampa, Fla	Nov. 9
Dec. 7.	Quay wall, San Francisco, Cal	Nov. 9
Dec. 9.	Ft. Washington, Md	Nov. 30
Dec. 11.	Milwaukee, Wis Adv., Eng. Record, Nov. 2, 9.	Nov. 2
Dec. 12.	Mobile, Ala	Nov. 16
Dec. 15.	Crow Agency, Mont	Nov. 30
Dec. 16	Light House, Baltimore, Md Adv., Eng. Record Nov. 23.	Nov. 23
Dec. 16.	Metal Work for Lighthouse, Baltimore, Md. Adv., Eng Record, Nov. 23.	Nov. 23
Dec. 16.	Cincinnati, O Adv., Eng. Record, Nov. 23, 30.	Nov. 23
Dec. 17.	Creston, Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 17	White Earth, Minn	Nov. 30
Dec. 21.	Washington, D. C	Nov. 9
Dec. 21.	Baltimore, Md Adv., Eng Record, Nov. 30.	Nov. 30
Dec. 27.	Hardwood floors, Washington, D. C Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 27.	Elevator enclosures, etc., Washington, D. C Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 28.	San Juan, Porto Rico	Nov. 30
Dec. 28.	Bremerton, Wash	Nov. 30
Jan. 4.	Bremerton, Wash	Nov. 30
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23 to 30.	Nov. 23
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 8.	Baltimore, Md Adv., Eng. Record, Nov. 30.	Nov. 30
Jan. 14.	Portland, Ore	Nov. 23
	BUILDINGS.	
Dec. 2.	Business buildings, Buffalo, N. Y	Nov. 30
Dec. 3.	Church, Richford, Vt	Nov. 16
Dec. 3.	Fireproofing Capitol, St. Paul, Minn	Nov. 23
Dec. 4.	Public Building, New York, N. Y	Nov. 23
Dec. 4.	Public Buildings, Baltimore, Md	Nov. 23
Dec. 4.	School, Dedham, Mass	Nov. 30
Dec. 5.	Repairing City Hall, Galveston, Tex	Nov. 30
Dec. 5.	School Improvments, Jersey City, N. J	Nov. 30
Dec. 5.	Library, Green Bay, Wis	Nov. 23
Dec. 6.	School, Norman, Oklahoma Ter	Nov. 23
Dec. 9.	Building material, New York N. Y.	Nov. 30
Dec. 9.	Armory improvements, Troy, N. Y	Nov. 30
Dec. 9.	Observation Pavilion, Brooklyn, N. Y	Nov. 30
Dec. 9.	School, New York, N. Y	Nov. 30
Dec. 9.	School, Brooklyn, N. Y	Nov. 30
Dec. 10.	Courthouse, Jasper, Ark	Nov. 30
Dec. 11.	Business Building, Mason City, Ia	Nov. 23
Dec. 11.	City Hall, Bridgeport, Conn	Nov. 23
Dec. 11.	Hospital, Polk, Pa	Nov. 23
Dec. 12.	School, Pittsburg, Kan	Nov. 23
Dec. 16.	School, San Marcos, Tex	Nov. 23
Dec. 16.	Jail, Boise, Idaho	Nov. 23
Dec. 16.	School, Columbus, O	Nov. 23
Dec. 17.	Library, Mankato, Minn	Nov. 23
Dec. 19.	Town Hall, Warren, O	Nov. 30
Dec. 19.	Public building, Springfield, Ill	Nov. 30
Dec. 20.	Court house, Des Moines, Ia Adv., Eng. Record, Nov. 16, 30.	Nov. 16
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
Jan. 15.	Church, Pensacola Fla	Nov. 30
Feb. 1.	Library, Muncie, Ind	Nov. 23
	MISCELLANEOUS.	
Dec. 5.	Rock, La Crosse, Wis	Nov. 30
Dec. 5.	Elec. ry. power station, Tribeshill, N. Y.	Nov. 30
Dec. 5.	Dam, Webb, N. Y	Nov. 30
Dec. 7.	Electric Railway franchise, Ventura, Cal.	Nov. 23
Dec. 9.	Garbage building, Newport News, Va	Nov. 23
Dec. 9.	Electric railway, Van Wert, O	Nov. 23
Dec. 11.	Garbage disposal, Cincinnati, O	Nov. 23
Dec. 12.	Garbage Crematory, Dallas, Tex	Nov. 23
Dec. 14.	Trusses, etc. for dredge, Portland, Ore	Nov. 30
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Jan. 6.	Library, Niagara Falls, N. Y.	Nov. 23
Mar 31.	El. Rys., Rockhampton, Australia	Nov. 2
——	Drainage work, Buenos Aires, Argentine Republic	Nov. 23
——	Pier, Natal, South Africa	Nov. 23
——	Canal work, Abbeville, La	Nov. 30

THE ENGINEERING RECORD.

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Limiting Heights of Earth Dams.

The necessity of impounding large volumes of water carries with it the further imperative necessity of considering with great care the nature of the dams and embankments required to hold such volumes of water securely in place. Enough disasters resulting from wrecked earth dams and embankments have already occurred to demonstrate the conclusion that the subject is open to further study. In such cases as that of the new Croton dam and other unusually high structures of that class, the solidity and security of the masonry dam founded upon rock commends itself so strongly to civil engineers that the suggestion of an earth dam for the performance of the same duty is scarcely even considered by engineers of repute. At the same time there is undoubtedly a growing feeling that under proper design and treatment an impounding structure of earth may be carried to considerably greater heights than those for which it is commonly employed. Whether a core wall of masonry is more advisable than one of a suitable composition of clay puddle will be answered differently by different engineers, but that it is absolutely essential to secure impervious walls of some character reaching down from the elevation of the water surface at least to a firm, impermeable stratum is almost universally recognized. Generally speaking, a stratum to any extent pervious underneath an earth dam or embankment of sensible height is considered distinctly unsatisfactory, unless the sub-stratum outside of the embankment is so placed as to counteract the effect of a limited amount of percolation or seepage.

It has ordinarily been assumed, either implicitly or explicitly, that suitable puddled material put in place in embankments and properly compacted with grooved rollers or equivalent treatment would be essentially impervious to water. While this at first sight appears reasonable, it is obvious that comparatively little material can be safely assumed to be absolutely impervious. It is by no means impossible to secure such material, but as a matter of fact it seldom is secured, even in the construction of embankments desired to be practically water-tight. It is common experience among engineers who have had to do with water pressures against the best grades of masonry that in many places water in some way finds small passages through the best of such material. These passages may be hair cracks so small as to be capillary in character, yet water is a persistent searcher for even the most minute means of escape, and those cracks usually exist to some extent even in the best of masonry dams. These minute seepages through masonry do not in any way prejudice the work or tend toward failure in the slightest degree, but they show how difficult it is to make even a high grade of masonry actually water-tight.

When it is a case, therefore, of earth dams or embankments, it certainly seems most rational to expect seepage to an appreciable extent. This problem has seldom received much attention. The jet boring furnishes a most effective means to determine just what is taking place in the interior of an earth bank pressed on either side by a considerable depth of impounded water. It is a little singular that more observations of this character have not in the past been made in order to disclose information of crucial importance in the design of earth dams and embankments. It is a matter of considerable interest, therefore, to observe the results of the observations made by the board of three engineers appointed by the Croton Aqueduct Commissioners of New York City to examine and report upon the plans for the earth portion of the Croton dam and the retaining embankments of the Jerome Park reservoir, which report was printed in The Engineering Record last week. This board consisted of Messrs. J. James R. Croes, Edwin F. Smith and Elnathan Sweet, all members of the American Society of Civil Engineers. In order to determine whether the earth structures with masonry cores contemplated in the plans put before them were permanently stable and secure, they proceeded to examine the interior of the earth embankments which have for a considerable number of years been in use in the Croton watershed. The jet pipes, after piercing the material of the embankments, became small, deep wells into which the embankment water, if present, could find its way and show by its depth at the various points selected its subsurface slope. With but one exception, that of the Titicus dam, every embankment was found to be saturated in its lower portions. The subsurface water slopes varied from 40 per cent. down to 17 per cent. The core wall evidently checked the percolation of water through the embankment, but did not effectually stop it, except in the Titicus case. It would be interesting to know in just what respects the character of the masonry and puddle material in that dam varied from those in the other structures examined. The slopes indicated by the preceding percentages are much flatter than the exterior surface slopes of the embankments, but the slope of the water surface begins at the core wall at a considerable distance below its top. Obviously, if the saturated material below the slope of the water extends entirely to the outer toe of the embankment slope, there may be some question of stability of the unsaturated material above it—i.e., the latter may slide upon the former. The flatter the saturated slope, the less liable is the material to slide.

These results are in the highest degree important, for they demonstrate conclusively that there are few, if any, earth embankments which are not largely saturated by the seepage of water through them, even when a core wall of good quality runs through their center. Furthermore, they indicate what may be approximately the limit of height of the earth dam in a given locality and for given dimensions. In the first place, they emphasize the wisdom of flat exterior slopes in order that as much material as possible may be unsaturated. Again, if it can be approximately assumed at what elevation the water of saturation will stand on the down-stream side of the core, then for a given slope of saturation the height of the dam should not greatly exceed that which, with a given surface slope of earth, will permit the saturated material to appear at the toe of the embankment.

With good materials well selected and put in place with care, there appears to be no reason why earth dams or embankments may not be employed to impound water as deep as 100 feet or more. Indeed, the problem becomes one of economy and suitability of design in view of the local conditions encountered. While it is true that the saturation of the lower limit of the surface slope of an embankment does not necessarily mean immediate instability, it certainly is not desirable and should be avoided. On the whole, the conclusions to be drawn from these investigations seem to point to the necessity of increased care in the selection of material for earth dams and in the necessity for the core wall, whether of masonry or other material, to be as nearly absolutely impervious to water as possible; the latter feature is one which plays an important part in the safety and efficiency of an embankment structure of earth.

The recommendation of the board to abandon the earth parts of the new Croton dam and extend the masonry structure at the south end is certainly one of clear wisdom.

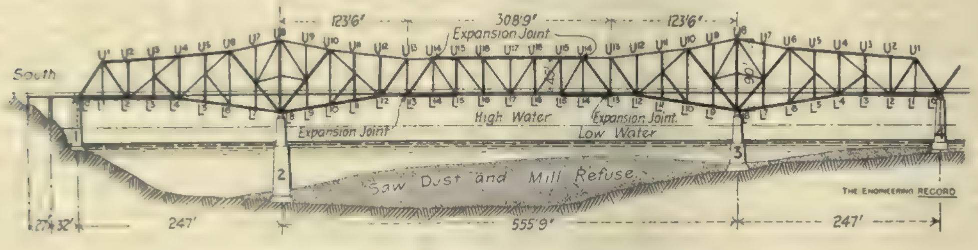
Standard Specifications for Cast-Iron Pipe.

There will come up for discussion at the meeting next week of the New England Water-Works Association, a report by Messrs. Freeman C. Coffin, F. F. Forbes and Dexter Brackett recommending the adoption of a set of standard specifications for cast-iron pipe. This report has been issued in pamphlet form by Mr. Charles W. Sherman, editor of the association's "Journal," and all who are interested in the manufacture of cast-iron pipe, whether members of the organization or not, are invited to take part in the discussion, which will be held at Young's Hotel, Boston, at two o'clock, Wednesday next. Every carefully considered set of standards like this merits thorough consideration, and The Engineering Record urges its readers interested in the pipe industry to be represented at the meeting, for it is only by the harmonious cooperation of buyers and foundrymen that the best results can be obtained. In making this statement, however, there is no intention of implying that foundrymen will oppose the proposed standards, for the contrary will doubtless be the case; in fact, many foundries already have patterns conforming to the committee's recommendations, which are substantially those of the Metropolitan Water Board. In all its recommendations, the committee has sought to allow sufficient latitude for individual preferences as to weights and thicknesses, while eliminating the great number of useless varieties in the shapes of bells and spigots, the curves of specials, and the like. The main conditions governing the designs recommended are stated substantially as follows:

For sizes from 4 to 18 inches, inclusive, the inside diameter of pipes of a given nominal size shall be varied in accordance with the varying thickness used for different pressures or conditions, and the outside diameter for all classes or weights shall be uniform. For sizes larger than 18 inches, there shall be three sizes for the outside diameter of each nominal diameter. It is feared that if one outside diameter were adopted for all classes in the larger sizes of pipes, it would cause so much difficulty in connecting future pipe to that already laid, and in making repairs, that it would be a serious obstacle to the adoption of the standard. It is also believed that the use of more than one outside diameter will not cause so much trouble in the larger sizes as in the smaller ones.

There is undoubtedly considerable variation in present practice in the depth of bells. The committee is of the opinion that good results are secured with all depths used, and that an exact depth of bell is not an essential matter to any engineer. To simplify the casting of pipe, it recommends the adoption of the depths employed by the Metropolitan Water Board.

In the classification of cast-iron pipe for different pressures and conditions is to be found a more serious divergence of opinion and practice than in any other branch of the subject. The committee has not deemed it advisable to recommend the adoption of standard weights for stated pressures for the reason that the thickness or weight of the pipe to be used depends in many cases upon other conditions in addition to the static pressure. In pipes of the smaller sizes the thickness required depends upon the strength needed to withstand handling and the strains due to the settlement of earth, and other causes, rather than upon the internal pressure. For this reason heavier pipes are required in city streets, where they are subjected to settlement from frequent excavations, than in country towns, where they remain undisturbed.



Reference Diagram of Interprovincial Cantileler Bridge.

Other conditions beside the pressure must also be considered in determining the thickness of the large sizes of pipe; for example, large pipes in public streets, where they may be subject to heavy loads, or in places where the depth of earth covering is great, should be made thicker than where laid in locations specially reserved for their use. The static head or pressure can be closely estimated, but the water hammer, effect of traffic over the pipe, settlement under it, tuberculation within it, electrolysis outside of it, and age everywhere, can, with present knowledge, be given no mathematical value. These conditions must, however, be taken into consideration in determining the thickness of pipe to be used in any given case.

It is probable that no formula exists which is a scientific expression of all these requirements—perhaps no such rational formula can be devised, certainly not until more definite data are secured for the various strains, both internal and external, which are sustained by pipes in use. It was finally decided to devise a table of thicknesses and weights based upon some logical formula, and to give the different weights an arbitrary classification denoted by a symbol such as a letter of the alphabet, in which the variation in weights from one class to another should not be so great that one would be unable to select pipes that would approximate his own practice and of sufficient range to cover all except the most extreme cases.

The thicknesses recommended were computed by the well-known formula used in determining the thickness of pipe on the Metropolitan Water-Works; class A being for a static head of 50 feet, class B for 100 feet, etc., each class advancing by 50 feet. This formula provides factors for the deterioration of the pipe by time and other conditions, for the internal strain due to the static head and to water hammer, but, as has been previously stated, other conditions must also be considered.

In general design, the special castings recommended, are of the pattern now used by the Metropolitan Water-Works. A number of foundries have the patterns for these castings, and they are already in a fair way to become a standard. The committee is of the opinion that it would be difficult to improve upon these patterns. They are designed with the purpose of putting as little metal into the special castings (where it costs about twice as much as it does in straight pipe) as is consistent with strength and convenience in laying. As the specifications allow a margin for excess or deficiency in weight of six per cent., abnormal excess of weight (a serious fault in many castings) is avoided, and the purchaser can estimate with reasonable accuracy the cost of the castings in advance.

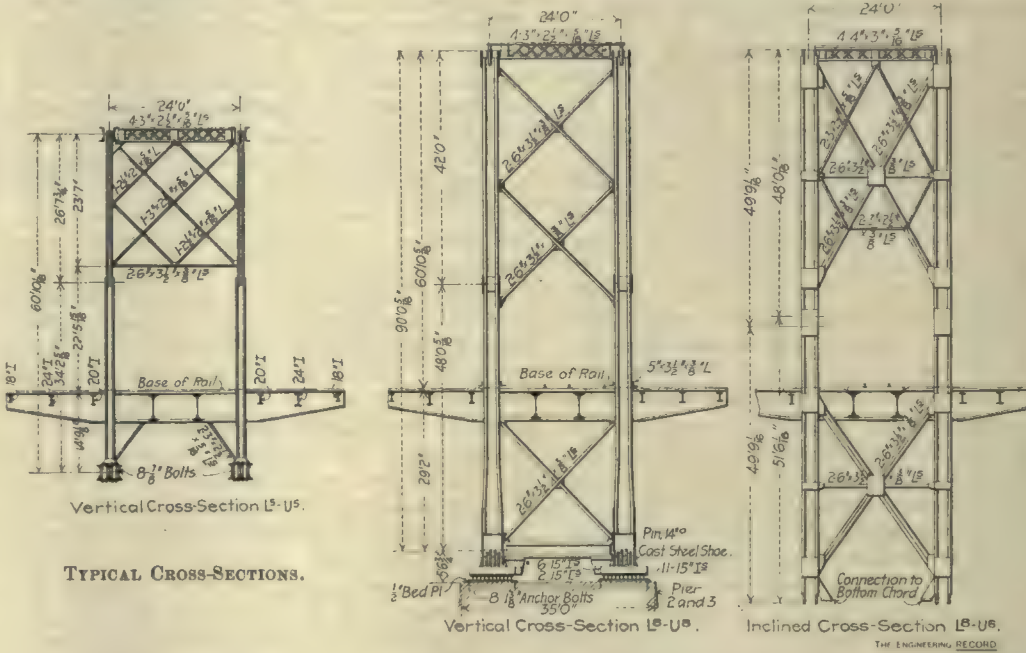
The outside diameter and the openings of the bell or socket are the same as those of the pipes of the same size. There is but one class of special castings for all classes of pipe below 20 inches. It is hoped that the vexing occurrence of the necessity for chipping spigots of special castings to enable them to enter the pipe bells, which has heretofore been much too common, will be avoided by this uniformity.

The superintendent, engineer and contractor will find the specifications prepared on these lines of much use. The trouble caused in pipe laying by inability to make proper joints owing to the variations in shapes of bells and spigots, the delays in obtaining deliveries of material, and other evils attendant on the present chaos in patterns, will be largely avoided. The manufacturer will also find that he can run up his stock when business conditions warrant it, just as the rail mills have been able to run off rails since the sections of the American Society of Civil Engineers were approved some years ago. In every way the adoption of the report throughout the country will be an advantage, and the committee which made it and the association which took the matter up deserve the thanks of all who use or make cast-iron pipes.

The Interprovincial Bridge at Ottawa.—I.

The railroad and highway bridge across the Ottawa River at Nepean Point is about 2,287 feet in length, and connects the cities of Ottawa, in the Province of Ontario, and Hull, in the Province of Quebec, Canada. At the north end it has a plate-girder approach and two pin-connected end spans, and at the south end two short plate-girder spans connecting it with the steep, rocky hill, above and beyond which is the city of Ottawa. The remainder of the structure consists of a pin-connected through-truss cantilever, 1,053¾ feet long between centers of anchorages, and 555¾ feet long between centers of main piers. The anchor arms are each 247 feet and the cantilever arms 123½ feet, and the suspended center span is 308¾ feet long. The bridge has a clearance of 45 feet above the high-water level, and the trusses are 24 feet apart on centers, 90 feet deep over the main piers, and 45 feet deep in the center of the span. Elevation and cross-section diagrams of the superstructure, and details of the design and construction of the difficult piers, were published in The Engineering Record on March 10, 1900.

The floor platform has a total width of about 67 feet, and carries on the center line a single track of the Ottawa & Gatineau Railway, on each side of which the space between the trusses is occupied by a sidewalk. The floorbeams are cantilevered 21 feet 7 inches beyond each truss, to support electric street car lines next the trusses and 13-foot roadways beyond them.



Vertical Cross-Section L5-U5.

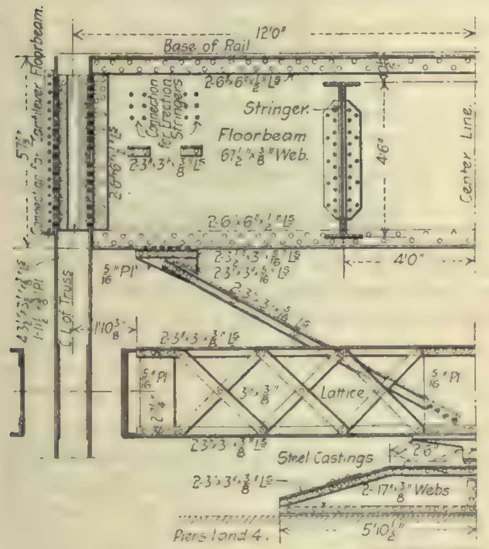
Vertical Cross-Section L8-U8.

Inclined Cross-Section L8-U8.

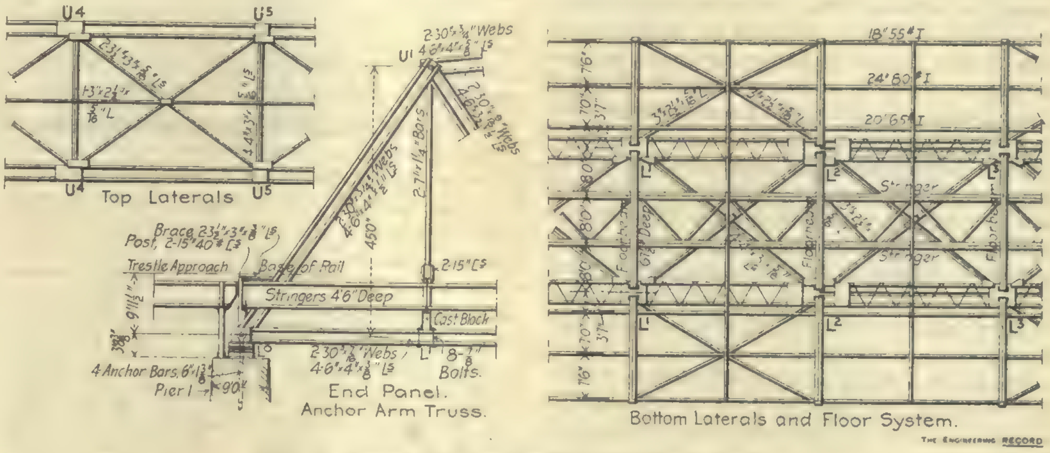
Typical Cross-Sections.

The cantilever span is of interest on account of its important dimensions, rather unusual proportions, and some peculiar details. In order to economize masonry, the supports on top of the main piers were placed as low as possible, and the bottom chords were sloped up in both directions from these points. On the cantilever arms this angle was fixed by the requirements of grade and clearance. On the anchor arms it was changed a little to increase the distance between the chords and the rail base, but the difference was so slight that the arms are not apparently unsymmetrical.

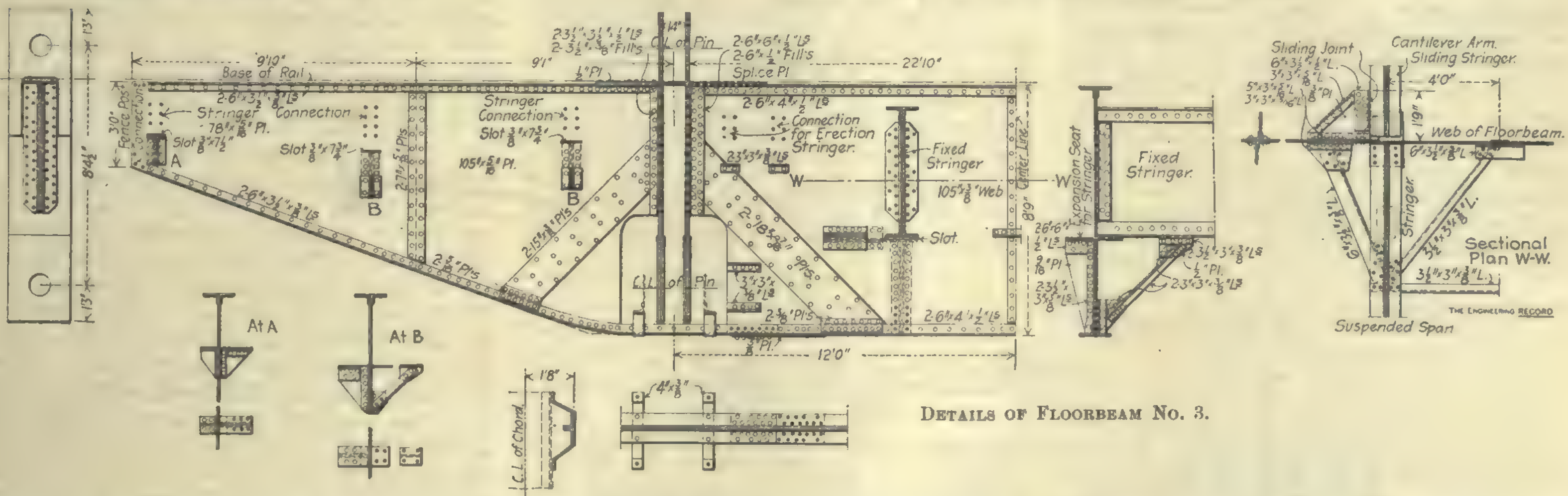
The bridge is designed in accordance with the Dominion Government specifications of 1896, and is proportioned for the following loading: On the railroad track, two 161,000-pound locomotives, coupled, with the centers of their respective sets of drivers 60 feet apart, and each set having four axle loads of 36,000 pounds, 4½ feet apart on centers, followed by a train load of 3,000 pounds per lineal foot. On each 8-foot roadway, 40 pounds per square foot for stresses in trusses, and, for stresses in the floor system, a 26,000 pound road roller, with 13,000 pounds on the front axle and 6,500 pounds on each of the two wheels of the rear axle, which is 11 feet 2 inches from the front axle. On each 5-foot sidewalk, for truss stresses, 20 pounds per square foot, and for stresses in the floor system 70 pounds per square foot. A wind pressure of 30 pounds per square foot was assumed on vertical surfaces of the structure and on a moving train 10 feet high, the stresses from the latter being provided for wholly in the lower-chord lateral system, which is the principal one.



LATERAL CONNECTION AT MAIN PIER.



END OF ANCHOR ARM AND PANELS OF LATERAL SYSTEMS.



DETAILS OF FLOORBEAM NO. 3.

The trusses are divided into panels of a uniform length of 30 feet 10½ inches, except in the middle of the suspended span, where one panel is ½ inch longer. All diagonals and eyebars are pin-connected, a feature which locates main pins from 6 to 9 inches in diameter at every panel point of the top chord, except at U_3, where the only web member is a flange-connected vertical strut, and locates bottom-chord pins at alternate panel points. Except in the end panels, all diagonal members are made with a pin connection in the middle of their length, and the other principal connections of the truss members and secondary members have bolted flanges or riveted angles or gusset plates. In the suspended center span the trusses are cambered by increasing the panel lengths of the top chords ⅜ inch each; in the anchor and cantilever arms the lengths of all members are corrected to correspond with the extensions and compressions under dead and live load.

In the cantilever and anchor-arm trusses the compression member top chords and all the bottom chords are made of pairs of built channels, latticed together top and bottom with zigzag angles. The top chord is 30 inches wide out to out, and its maximum section is made of two 30 x ¾-inch web plates and four 6 x 4 x ⅝-inch angles. The two anchor-end panels of the bottom chord have two 30 x 7/16-inch web plates and four 6 x 4 x ⅜-inch angles; the remainder has a center web, and in the anchor arm has a maximum cross-section of two 30 x ¾-inch web plates and four 6 x 4 x ½-inch angles in the outside webs, and one 30 x 1 1/16-inch plate and four 6 x 4 x 9/16-inch angles in the center web. It is made in single panel lengths, field-spliced about 20 inches from each panel point, with web and flange covers.

In the anchor arm most of the pins are 8 inches in diameter, except the one in the main pier pedestal, which is 14 inches; in the channel arm they vary from 6 inches at L_{10} to 9½ inches at L_{13}, where the suspended center-span strut is connected. The bottom chord flange tie-plates at panel points have their ends stiffened by transverse angles, and are proportioned to distribute increments of stress between the webs according to their respective sectional areas. They also receive the bottom lateral connection plates and transmit the stresses from their diagonals to the chords. The maximum top chord section consists of six 10 x 1¾-inch and two 10 x 1-inch eyebars.

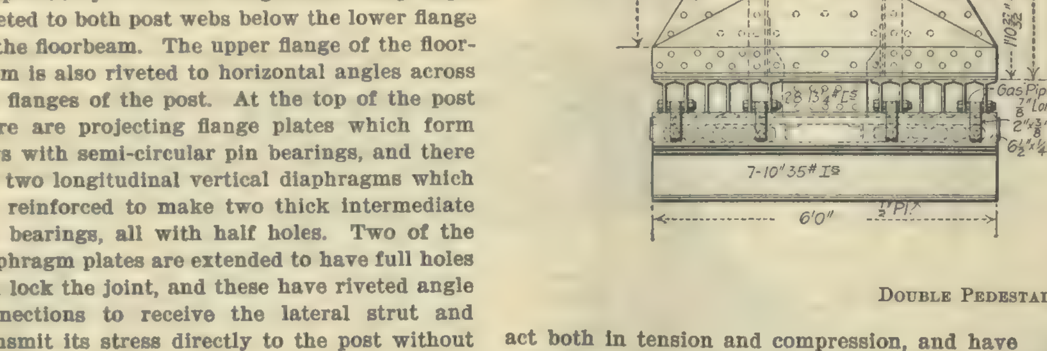
The upper part of diagonal U_6 L_4 has four 10 x 1½-inch eyebars; the other main ties have similar, but smaller, cross-sections. Post U_3 L_3 is made of two built channels, latticed, and has two 24 x 11/16-inch web plates and four 4 x 4 x ½-inch angles. The other vertical posts are made of pairs of rolled channels, latticed. Inclined post U_{13} L_{13} is made of two built channels, latticed, and has two 30 x ¾-inch web plates and four 6 x 4 x 9/16-inch flange angles. Posts U_1 L_0 and U_1 L_2 are similar, with slightly thinner materials. The sub-inclined posts are made with two built channels, latticed, and each have two 18 x ⅜-inch web plates and four 3 x 3 x ⅜-inch angles.

The main inclined posts U_8 L_8 are designed to carry the top lateral stresses to the main piers and are also made with two built channels latticed. They are made in two sections, each nearly 50 feet long, and field-riveted together with web splices. The lower section has two 36 x 11/16-inch web plates and four 6 x 6 x 9/16-inch angles, the upper section being slightly lighter. The top lateral connection plate is riveted to this inclined post, which is made very heavy and stiffened by reinforcement angles to transmit the lateral stress to its foot, where it is connected to the bottom transverse strut by solid-web transverse gusset plates. The pairs of inclined posts are connected together by heavy portal bracing above the track, and by sway bracing below the track, all the members being made of double pairs of angles back to back, latticed together to make I-shaped cross-sections, and connected to the posts with gusset plates on both flanges. The post webs and flange cover plates are made continuous at the middle connection, and the latter are slotted to receive the pin-connected members there; the other members are flange-riveted to the inclined post at this point. All of the truss members except the main vertical posts have their webs in planes parallel to the axis of the bridge. The longest truss member is top-chord section U_1 U_3, which was shipped from the shops in the full length of 63½ feet. The heaviest single member was the lower section of post U_8 L_8, which weighed 34,000 pounds.

Each main vertical post is made with two built I-beams latticed together, and eight 6 x 3½ x ½-inch angles and two 32 x 11/16-inch web plates. It was built in three sections, spliced together by double web and flange covers, those of the lower joint being shop-riveted to make a member with a shipping length of about 49 feet over all. Five of the six plates in the upper splice were shop-riveted to the lower section of the post and field-riveted to the upper section, the single remaining plate being field-riveted to the lower and shop-riveted to the upper section. The webs of this post alone are transverse to the axis of the bridge, and in the 15-foot lower section they are spread from the normal distance of 25⅝ inches apart to 39¼ inches apart on the center line of the pedestal pin, which they engage with half holes, there being no possibility of an upward lift at that point. This divergence of the jaws allows the pin bearings to be made on the outside of the lower chord, and increases the transverse resistance to flexure of the column.

The floorbeam at this panel point is made, as elsewhere, in three sections, shipped separately from the shops, but the two cantilever sections are field-riveted directly to the middle section through the flanges of their end vertical web stiffeners, instead of being spliced across the vertical post, as elsewhere. They thus form a continuous floorbeam 67 feet 2 inches long, which rests on a wide horizontal shelf plate supported by a vertical longitudinal diaphragm riveted to both post webs below the lower flange of the floorbeam. The upper flange of the floorbeam is also riveted to horizontal angles across the flanges of the post. At the top of the post there are projecting flange plates which form jaws with semi-circular pin bearings, and there are two longitudinal vertical diaphragms which are reinforced to make two thick intermediate pin bearings, all with half holes. Two of the diaphragm plates are extended to have full holes and lock the joint, and these have riveted angle connections to receive the lateral strut and transmit its stress directly to the post without passing through the pin.

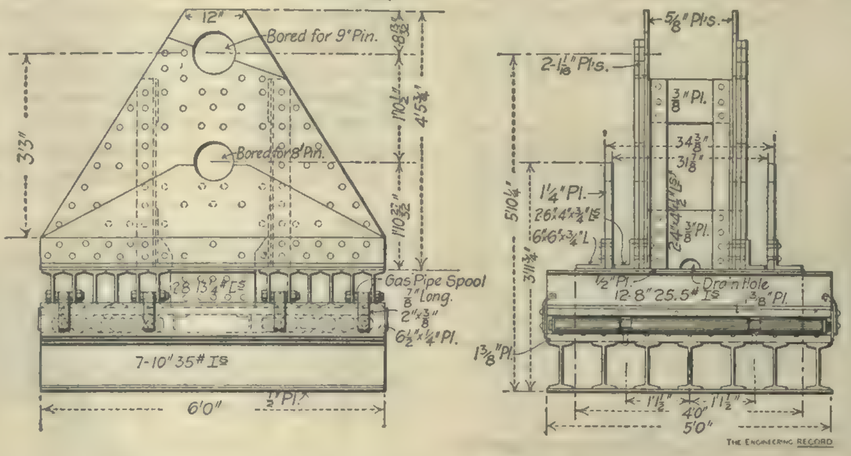
At every top-chord panel point there is a lateral strut with an I-shaped cross-section, which is composed of two pairs of angles riveted together back to back and latticed. They have a uniform depth of 30 inches, and are riveted to horizontal connection plates field-riveted to the top and bottom flanges of the riveted top chords or to connection angles on the tops of the vertical posts, where the top chord is composed of eye-bars. The ends are braced by transverse vertical diagonal plates or diaphragms, riveted to the post webs, and forming knee-braces. The upper parts of all pairs of vertical and inclined posts are also connected by a parallel lower strut and diagonal lattice angles like portal bracing, which are field-riveted to angle connections on the post webs at points where the latter are reinforced by center diaphragms.



Pedestal and Grillage at Piers Nos. 2 and 3.

In all the panels between top lateral struts, except the second panel on each side of the main vertical post, there is X-bracing of pairs of tension angles riveted together back to back, which are riveted to connection plates in the centers of the panels, and are stayed there by a continuous longitudinal member composed of a pair of angles connecting them to the middle points of the transverse struts. The omission of X-bracing in the two panels at the tops of the main inclined posts compels the lateral stresses to go down through these posts to the main piers, where the connections are designed to transmit them to the masonry. The diagonal angles are from 3 x 2½ to 3 x 3½ inches, and the center longitudinals are single or double angles of somewhat smaller sections.

The bottom lateral system consists of X-bracing in the lower-chord panels, and is composed of I-shaped diagonal members, 30 inches deep, which are made of two pairs of angles riveted together back to back, and field-riveted to connection plates on the top and bottom flanges of the lower chords. At their intersection one member is continuous, and the other is cut to clear on both sides, and its separate pieces are spliced by top and bottom flange pieces riveted to the continuous member also. The diagonals act both in tension and compression, and have no transverse struts at panel points. The lateral stresses from the floor system and train loads are transferred to the bottom lateral system through the knee-braces at the ends of the floorbeams. The railroad stringers are braced together by zigzag angles in the planes of their top flanges, and the cantilever ends of the floorbeams have X-brace angles in alternate panels, as shown in the diagram of the floor system.



Double Pedestal on Pier No. 4.

The 67-foot 2-inch floorbeams are made in three sections each, the middle section having a ⅜ x 67½-inch web and four parallel 6 x 6 x 11/16-inch flange angles. The end sections have a 5/16-inch web and four 6 x 3½ x ⅜-inch flange angles, the upper ones being horizontal and the lower ones inclined upward and outward. The lengths of the sections vary with the thickness of the vertical posts, but are approximately 23 feet for the center and 20½ feet for the end sections, all of which are field-riveted to the vertical post webs through their vertical end web-stiffener angles. The post webs are stiffened by vertical transverse diaphragm plates between the floorbeam sections. The ends of the floorbeam sections were all faced for bearings against the vertical posts, and cast-iron compression blocks were fitted between the post webs, below the diaphragms, opposite the lower flange bearings of the floorbeams. The top flanges of the center and end sections of each floorbeam are spliced by field-riveted cover-plates passing through slots in the webs of the vertical posts, and having 50 per cent. more cross-section than is required for the calculated flange tension.

At the ends of the middle sections of the floorbeams there are open holes in the webs for field-connection bolts of two pairs of temporary stringers to sustain the erection traveler, and in the top flange above these connections the number of rivets is doubled to allow for local concentrated stress from the traveler loads. The railroad track stringers are 4½ feet deep and 8 feet apart on centers, have ⅜-inch webs and four 6 x 6 x ½-inch flange angles. The roadway stringers are I-beams, as noted in the floor plan, and all of them are stayed in the middle of each panel by a 3 x 3-inch transverse horizontal angle reaching across the bridge, and riveted to their top flanges. All stringers are web-connected in the usual manner to the floorbeams, except at the expansion joints, where they slide longitudinally on supporting shelves, as shown in the detail of connections, and mentioned further in the description of the transmission of lateral stresses.

The connecting center span has two 308¾-foot pin-connected through Pratt trusses, 45 feet deep, which are suspended from the extremities of the 123½-foot cantilever arms by four vertical 10 x 1⅜-inch eyebars at each point U_{13}. The top chord is made of two built channels latticed top and bottom, 24 inches apart between webs, and has in the center panels two 30 x ¾-inch web plates and four 6 x 4 x 11/16-inch angles. The maximum section of bottom chord has four 8 x 1 7/16-inch and two 8 x 1-inch eyebars; the end main ties are each composed of four 8 x 1¼-inch eyebars, and the inclined end posts, 54.7 feet long on centers, are like the top-chord sections, and nearly as heavy as their maximum sections. There are no eyebars in the stiff bottom chords of the two end panels, which are made of pairs of built channels, latticed top and bottom, and have two 24 x ½-inch webs and four 4 x 4 x ½-inch angles.

The inclined bottom chord of the cantilever arm terminates at L_{13}, and is connected with the bottom chord of the center span by a horizontal strut, L_{12} L_{13}, made like the bottom-chord sections, with two 30 x ½-inch webs and four 6 x 4 x ⅜-inch angles. Similarly, the top-chord hip joint is connected with the end of the cantilever arm with a corresponding horizontal strut, U_{13} U_{14}, made with two 18 x ½-inch web plates and four 3½ x 3½ x ⅜-inch angles. Each of these struts has a slotted hole to allow for longitudinal temperature displacements of the end chord pins of the center truss. The floor system, sway bracing, and top and bottom lateral systems correspond with those of the cantilever trusses. The top lateral stresses are not carried down the inclined end posts to the lower chords of the cantilever trusses, as is usual, but are carried into the top lateral system of the cantilevers and thence down the main inclined posts to the main piers, so as to distribute the wind stresses more evenly, and to avoid increased lateral stress at the sliding joint, L_{13}.

The upper lateral diagonals are riveted to the end section of top chord of the suspended span at U_{14}, and at this point the top chord is fitted to slide longitudinally with finished bearings between the jaws of the horizontal strut, U_{13} U_{14}, which transfers the longitudinal components of the stress to the cantilever arm. The transverse strut and the diagonals extending toward the main pier are riveted to the longitudinal strut at U_{14}, and the system is thus made continuous to the point U_{10}. The end of the lower chord of the suspended span has an expansion connection at L_{13} with the horizontal longitudinal strut, L_{13} L_{12}, which connects it to the end of the lower chord of the cantilever arm. The end lateral diagonal in the suspended span is riveted to its lower chord at L_{13}, and also has there a rigid connection to the floorbeam web. The transverse component of the lateral stress is thus taken through the floorbeam web to horizontal brackets which engage the outsides of the lower flanges of the stringers in L_{12} L_{13}. These stringers slide longitudinally on shelf supports on this floorbeam, but have their bottom flanges just beyond it riveted to a transverse strut which transfers the lateral stress back to the end of strut L_{12} L_{13}, which is riveted to the same connection plate which receives the lateral diagonal from the end of the cantilever arm, thus making the bottom lateral system continuous at this point. As the bottom laterals work in both tension and compression, it is believed that this arrangement distributes the stress evenly on both sides of the bridge and slightly reduces the compressive wind strains in the chords.

The cantilever trusses take bearing over the main piers on heavy cast-steel shoes, with one transverse and six longitudinal webs, as shown in the detail elevations. Each shoe has a 4½ x 5½-foot base bolted to an 8-foot 4-inch grillage of 15-inch I-beams, which are seated on a 9 x 9-foot cross grillage of 15-inch I-beams, which have a ½-inch bed plate and a ⅛-inch lead filler on top of the masonry, and are bolted to the masonry with eight 1⅜-inch anchor bolts. The middle beam in the upper grillage is replaced by a pair of channels which project toward the center of the pier and have riveted between their webs a vertical plate having an upper horizontal flange field-riveted to the lateral connection plate and transmitting the stress through the grillages to the pier independently of the cast-steel shoe.

At pier No. 1, the end of the anchor arm is supported on an ordinary roller shoe, and the lateral stress is transferred from the connection plates riveted to the end of the bottom chord, through the notched rollers, the ribs on the bed plates and the webs of the grillage beams, to six 1⅜-inch anchor bolts in the masonry. At pier No. 4, the end of the anchor arm is received on a special rolling shoe which has two pins and supports one end of an adjacent fixed truss. Here the horizontal lateral stresses have to be transferred through a considerable distance to the masonry, and a special system of sway bracing, shown in the accompanying detail drawing, is used. The lateral diagonals in the fixed span are connected to the bottom flanges of the floorbeams, and from the end floorbeam are carried down through transverse vertical diagonals to a horizontal transverse strut between the ends of the anchor arm bottom chords, which also receives the stresses from the anchor arm laterals. All the horizontal forces are thus concentrated in this strut and transmitted from it to the masonry through the longitudinal sliding joint in the center, which permits free temperature movements. A casting, with a tongue 9 inches wide and 25½ inches long, is bolted to the under side of the strut and engages the jaws of a corresponding casting bolted between the webs of a riveted steel-plate box, which is filled with cement and secured to the masonry with fourteen 1⅜-inch anchor bolts.

At this pier half the weight of the adjacent fixed span helps provide anchorage for the cantilever and the load on the double shoe is heavy. The base of the shoe is riveted to two sets of grillage beams, one over each nest of rollers, between which there is clearance for the vertical anchorage bars, which go down to the reaction beams through slots in the base and bed plates. The grillage is strengthened laterally, and the flexure in the beam webs from the roller friction is reduced, by four longitudinal channels, which are riveted between them in the middle of the shoe.

At panel points 12 and 13, where the distance between the bottom chord and rail base is small, special floorbeams are used, which are notched to clear the bottom chord and have their webs reinforced by double diagonal plates. The top flange of the floorbeam is spliced through the vertical posts with riveted plates in the regular manner, and the bottom flange angles are continuous under the bottom chord, and are braced to it by bent plates riveted to the flanges of the latter. The stringers of the suspended span are riveted in the usual way to the web of floorbeam 13, and have knee-braces to its lower flanges. On the opposite side of the floorbeam web there are bracket shelves for the support of the sliding ends of the cantilever arm stringers, and a horizontal plate riveted to the top of each bracket passes through a slot in the floorbeam web and is riveted to the bottom flange of the fixed stringer to take up the tension in the top of the bracket.

The anchorage at pier No. 1 is much heavier than at pier No. 4, and for each truss consists of four 1⅜-inch eyebars which have bottom pins engaged by U-bolts with nuts on the ends which take bearing on cast-iron saddles. The saddles bear across the bottom flanges of six transverse 15-inch I-beams under the ends of two 30-inch longitudinal plate girders 33 feet long, which have a platform of transverse 15-inch I-beams 8 feet long, on which the pier masonry is built. The plate girders are seated at both ends and in the middle on the masonry of the lower part of the pier, and space is left under the cast-iron saddles and around the eyebars for adjustment, inspection and painting. Each eyebar shaft is provided with ladder steps, and is accessible at the bottom by a horizontal tunnel in the pier masonry. The U-bolt nuts have adjustment to allow for inaccuracy in the position of the grillage and to put sufficient initial tension on the eyebars to prevent movements in the shoes due to the considerable variations in the reaction.

The floor platform is at a uniform height across the full width of the bridge. The sidewalks are between the railroad track, and the street car tracks, one on each side of the center line, extend through the trusses and are enclosed on one side by a 4-foot tight board fence, which screens them from the railroad track. On the other side there is only a timber curb between the walk and the trolley track. The carriage road is carried on the extremity of the cantilever floorbeams and is enclosed by a very strong fence erected in the outer line of the floor platform. The posts are 6-inch channels 5 feet high and 15 feet apart, firmly braced to the floorbeams and stringers, and the fence rails are three lines of 6-inch channels, making a framework which is calculated to withstand a horizontal force of 2,000 pounds applied at any point.

(To be Continued.)

The Nassau County Steel-Concrete Court House.

The new Nassau County court house at Mineola, Long Island, N. Y., is a monolithic steel-concrete building, T-shaped in plan, having a 176 x 37-foot main part and a 60 x 52-foot extension. It is two stories in height throughout, and the front is built in five panels, with an entrance portico in the center. The two end panels project a little beyond the face of those between them and are surmounted by hipped roofs; the remainder of the roofs are pitched from the center ridge lines except over the middle of the building, where there is a circular dome about 25 feet in internal diameter. This rises from the cornice of the main walls to a total height of about 62 feet above the water table, and is 17 feet higher than the top of the pitched roof. The building is symmetrical about the central transverse line shown in the accompanying roof plan.

The foundations, walls, columns, floors, roof, dome and ceilings are made entirely of monolithic reinforced concrete, which is continuous, except where interrupted for the structural openings and at places where shrinkage joints are introduced. The ceiling of the court room, which occupies the whole of the second story of the extension, is an elliptical vault of 49 feet clear span. The ceilings of the first and second story rooms are smooth flat surfaces covering the lower sides of the floorbeams and girders, the ceiling of the rotunda is deeply paneled by the beam and girder ribs, and the dome ceiling is similar. The interior surfaces are all plastered on the concrete and finished snow white, except in the rotunda, where there are alabaster effects. The body of the exterior walls is trap rock concrete, having a blue tint and dressed with a six-point bush hammer to give a cut-stone effect. All the quoins, the cornices, columns and carved work are made or faced with marble concrete, which is very white, and is finished by pointing with a pneumatic tool.

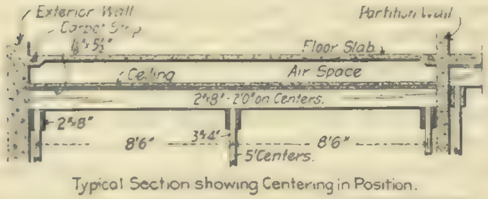
The floors are all calculated for a net load of 150 pounds per square foot, and are made of 1 : 2 : 3 concrete 2½ inches thick, in panels from 20 to 30 inches wide and up to 28 feet in length. These panels are arranged in the first and second floors, as shown in the part plan of the second floor, except that in the first floor the beams under the rotunda are parallel and similar to those in the side wings, and that in the pavilions at the ends of the side wings the beams are transverse to those in the middle panels of the wings. In this drawing the floorbeams and girders, which would really be invisible in plan, are shown by full lines, and the twisted iron reinforcing rods are shown by dotted lines.

There is a 14½-foot circular light well in the center of the rotunda floor, under the dome, and the platform around it is paneled and reinforced on the under side, as indicated in the plan and by the vertical radial cross-section at PP. Around the well hole there is a 10¾-inch by 20⅝-inch annular floor girder, reinforced by a single circular ¾-inch bar, top and bottom. There is a second double circular girder 31 feet 4 inches in diameter on the center line, which has a hollow rectangular cross-section reinforced only by single ½-inch bars in each side of the lower flange. The floor slab, 3½ inches thick, is made in about 8 x 10-foot panels with ¼-inch bars 3 inches apart, bedded in the lower part of the concrete, and is supported, as shown in the cross-section at VV, on radial concrete beams which are 10¾ inches wide and 20⅝ inches deep, and have three ¾-inch rods in the upper part and two ½-inch rods in the lower part.

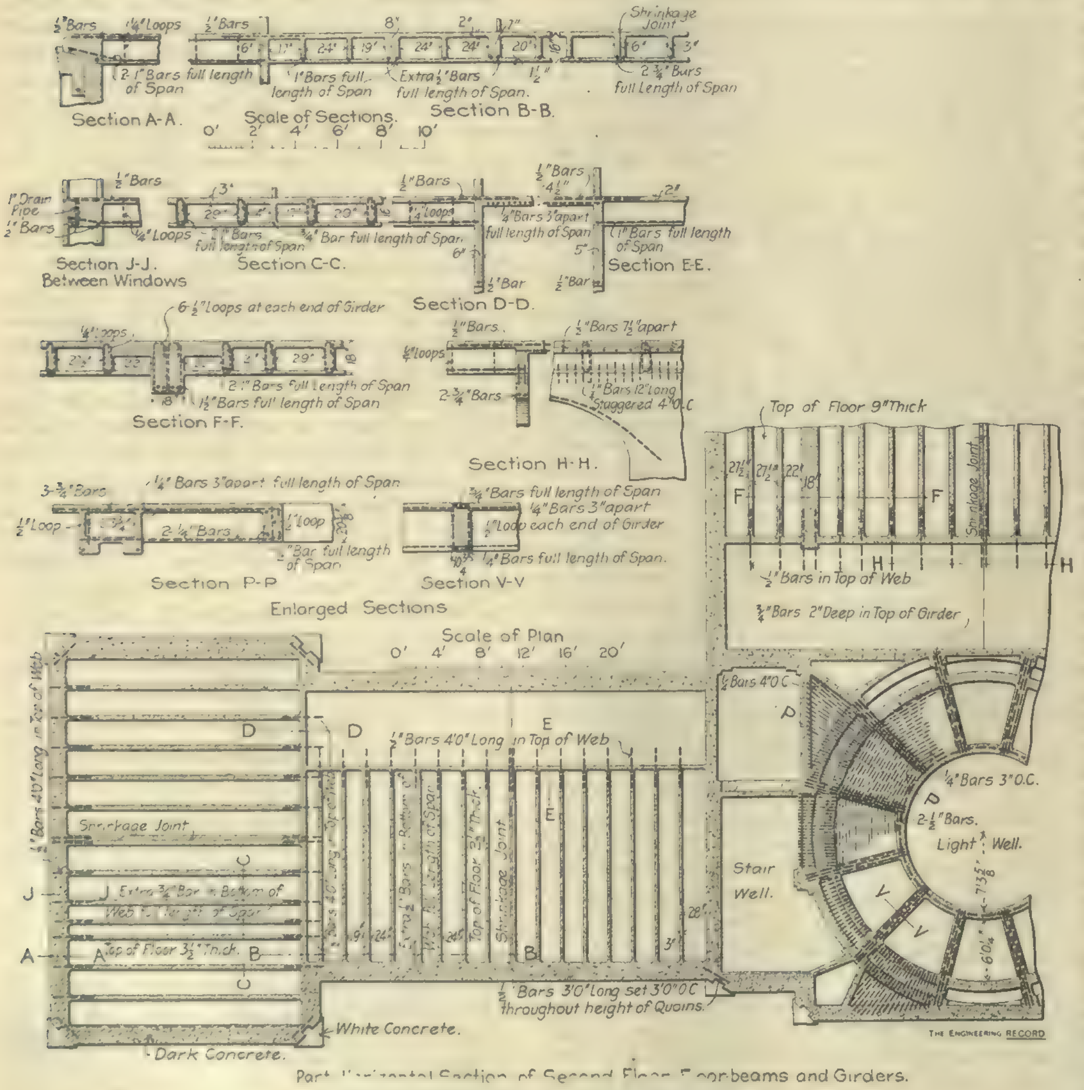
The construction of the regular floor panels is illustrated by cross-section BB, which shows one of the double floorbeams providing shrinkage joints in the middle of each wing, and two ordinary single beams. The floor slab is 2 inches thick and the ceiling slab is 1½ inches thick, both being made of concrete only, without reinforcement rods, and forming, with the floorbeams, a closed cellular structure. In the rear of the wings there is a section of the floor about 8 feet wide, which is made in a single solid slab 4½ inches thick, reinforced with ¼-inch bottom rods 3 inches apart, as shown by cross-section EE, which also shows the short horizontal rods bedded in the slab and anchoring it to the paneled roof.

In the ends of the wings the transverse floor panels are 22 feet long, and the construction is much heavier, with a 3-inch slab and 5-inch floorbeam having two ¾-inch tension bars in each, suspended by ¼-inch loops 2 feet apart, as shown in cross-section CC. The corresponding longitudinal sections AA and JJ are through the same panels of floor at right angles to section CC, and show the method of building the floor into the wall at a window-head and between windows, respectively. In panels between windows the wall is made with two 2-inch and 3-inch vertical inner and outer slabs separated by a 15-inch air space, and is tied by ½-inch longitudinal horizontal rods. Neither these rods nor the rods in the bottoms of the floorbeams nor the air spaces in the walls are indicated in the general plan. Nearly all the exterior walls are hollow, except at floor level; they contain vent and heating ducts, and are made of 1 : 2 : 4 concrete. The section HH gives a part elevation of the arch door and partition between the main building and the extension, and shows the short vertical bars in the top of all partitions to lock them to the floor above, similar rods being used to lock them to the floors below.

The first floor is similar to the second floor, except that in some of the rooms beveled wooden carpet strips are bedded in the concrete around the edges, as shown in the typical section, which also indicates the arrangement of the centering on which the ceiling concrete is laid and the beam forms are set.



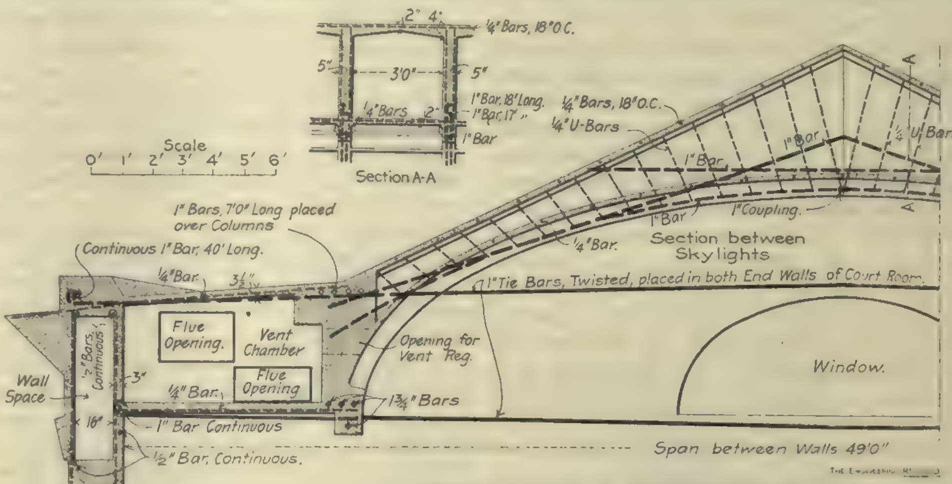
Typical Section showing Centering in Position.


½" Bars
¼" Loops
2-1" Bars full length of Span
Section A-A.
½" Bars
1" Bars full length of Span
Extra ½" Bars full length of Span.
Shrinkage Joint
2-¾" Bars full Length of Span
Section B-B.
Scale of Sections.
0' 2' 4' 6' 8' 10'
1" Drain Pipe
½" Bars
¼" Loops
Section J-J. Between Windows
1" Bars full length of Span
¾" Bar full length of Span
Section C-C.
¼" Loops
¼" Bars 3" apart full length of Span
½" Bar
Section D-D.
½" Bars 4½"
1" Bars full length of Span
Section E-E.
6-½" Loops at each end of Girder
¼" Loops
2-1" Bars full Length of Span
1½" Bars full length of Span
Section F-F.
½" Bars.
½" Bars 7½" apart
¼" Loops
2-¾" Bars
¼" Bars 12" Long Staggered 4' O.C.
Section H-H.
3-¾" Bars
¼" Bars 3" apart full length of Span
½" Loop
2-¼" Bars
½" Loop
½" Bar full length of Span
Section P-P
¾" Bars full length of Span
¼" Bars 3" apart
½" Loop each end of Girder
¼" Bars full length of Span.
Section V-V
Enlarged Sections
Scale of Plan
0' 4' 8' 12' 16' 20'
Top of Floor 9" Thick
Shrinkage Joint
½" Bars in Top of Web
¾" Bars 2" Deep in Top of Girder
½" Bars 4'0" Long in Top of Web
1" Bars 4'0" Long in Top of Web
Shrinkage Joint
Extra ¾" Bar in Bottom of Web full length of Span
Top of Floor 3½" Thick.
Top of Floor 2½" Thick.
½" Bars 4'0" O.C.
Stair Well.
¼" Bars 3" O.C.
2-½" Bars.
Light Well.
½" Bars 3'0" Long set 3'0" O.C. throughout height of Quoins.
White Concrete.
Dark Concrete.
THE ENGINEERING RECORD

Part Horizontal Section of Second Floor Floorbeams and Girders.

CONSTRUCTION OF THE SECOND FLOOR.

The construction of the pitched roofs is like that of the floors, except that it is lighter and there is no ceiling slab connecting the under sides of the beams. The roof is made in two sections, with a shrinkage joint at the ridge, as indicated in section GG, which is a typical cross-section of the roof of the main wings; the hipped roof over the end pavilions is similar but much steeper. The 2¼ x 8¼-inch rafters are about 2 feet apart in the clear, and are reinforced by single ¾-inch bars in the lower parts, which project through the double ridge-beam and tie the sides of the roof together across the shrinkage joint.



SECTION OF PART OF COURT ROOM ROOF.

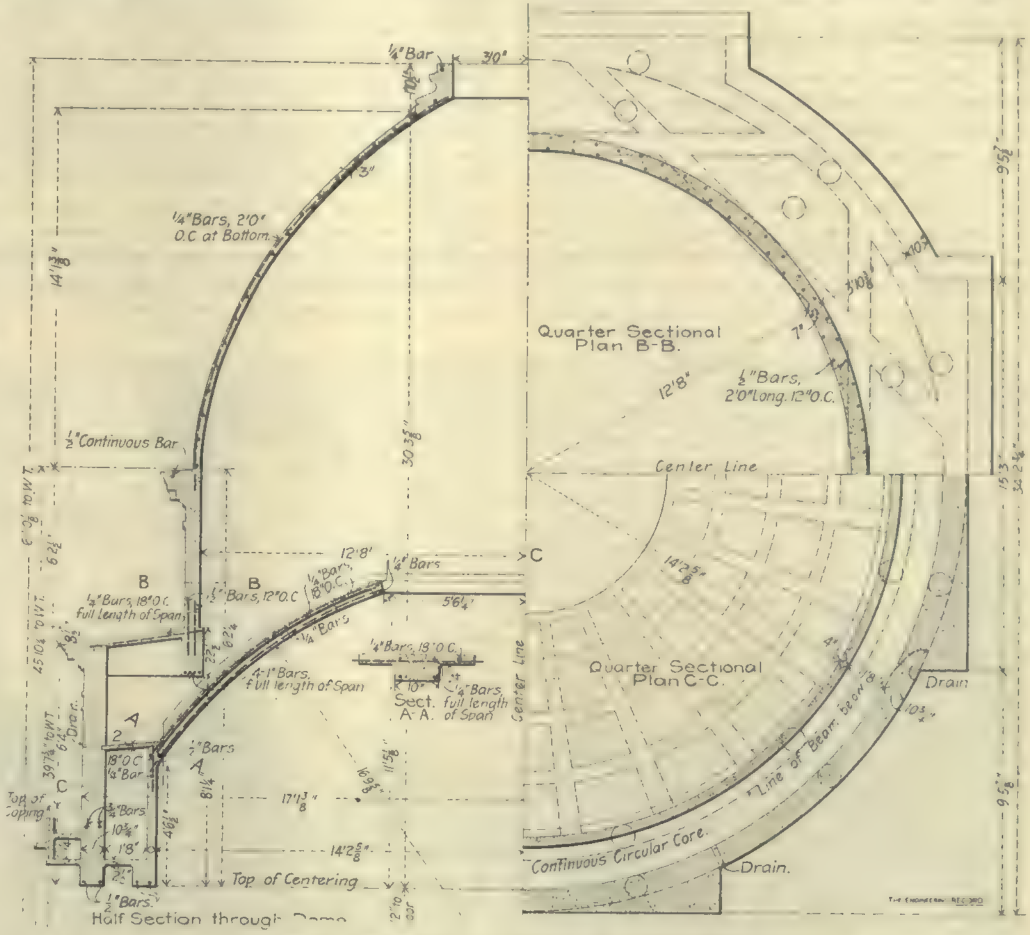
In the center of the roof panel, one of the rafters is made double to afford a transverse shrinkage joint. In the roof panels adjacent to a scuttle, the 1½-inch slab is reinforced by ¼-inch transverse bars 12 inches apart, which are omitted elsewhere. There are ¾-inch adjustable horizontal tie rods, hooked over continuous longitudinal 1-inch bars about 2½ feet apart at the eaves level. The gutter is made continuous with the roof slab, but separate from the top of the wall, on which it rests with a horizontal bearing and to which it is locked by a row of bricks on edge, which form a sort of spline between the contact surfaces. Over the extension there is a double pitched roof rising from a flat roof to which it is connected, as shown in the cross-section at JJ.

Over the rotunda there is a ceiling dome which is a segment of a sphere. It has a 11-foot circular skylight in the top, and its 2-inch shell is reinforced with radial and circular ¼-inch bars, the latter about 18 inches apart. It is paneled with inside radial and circular ribs, the former having a bottom width of 10 inches and depth of 6 inches and being reinforced with four ¼-inch rods. The dome is supported on a 4-inch cylindrical wall or drum 4½ feet high, which has a 10¾ x 12-inch bottom ring or girder, reinforced by two ½-inch circular bars and supported on twelve columns. Concentric with this cylindrical wall is another one 10¾ inches thick and 9 feet high, which is also supported on twelve columns and forms the outer wall of the upper part of the rotunda. A flat annular roof, 3½ inches thick and reinforced with ¼-inch bars 18 inches apart, extends about 3 feet inward from the top of the wall, and is stiffened by 10 x 22½-inch girder ribs on the under side, each of which has four 1-inch tension bars. These carry most of the weight of the roof dome drum, 7 inches thick and 6 feet high. The oblique ribs under the circular annular roof are tangent at eight points to the drum wall on center lines and carry part of its weight directly to the inner row of columns and to the large circular girder, while the rest of its weight is supported by the cantilever action of the annular roof.

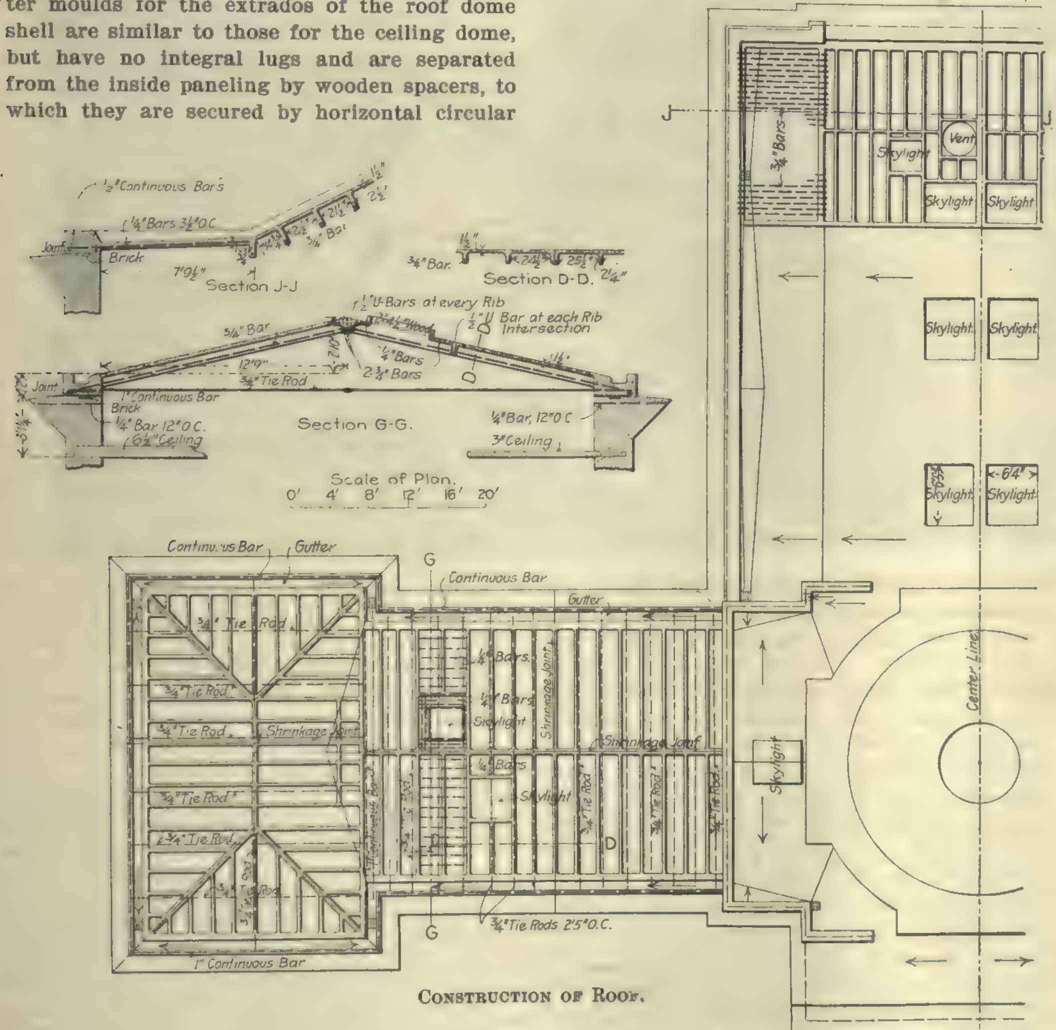
The roof dome has a solid shell 3 inches thick, without ribs, and is reinforced by ¼-inch radial and circular horizontal rods. The horizontal rods are 12 inches apart and are made in segmental sections; the radial rods are in vertical planes 12 inches apart at the bottom of the dome. They are set ¾ inch from the outside surface of the dome shell up to a point 7 feet from the top, where they cross over to within ¾-inch of the inner surface and maintain that position up to the top of the dome. All rods lap 18 inches at joints, and are well wired together at these places and at intersections.

For the erection of the ceiling dome, a circular working floor was built at the height of the column tops, supported on light vertical studs, and on it were built the moulds shown in the half sections. Three horizontal scarf-board rings were set to hold the vertical paneling for the inner surface of the drum, and from this was blocked and braced the paneling for its outer surface and for both vertical surfaces of the outside concentric cylindrical wall. Radial scarf boards in vertical planes were supported on 3 x 4-inch studs to carry a continuous surface of horizontal courses of paneling, on which 3 x 4-inch circular horizontal pieces cut to horizontal radius were set and received the continuous planed curve of the intrados. The extrados of the dome shell was formed against sectional plaster moulds spaced and supported from the inside paneling by separator lugs. The plaster moulds were reinforced with wire netting, and were made in horizontal strips 18 inches wide, with a lug cast on each corner.

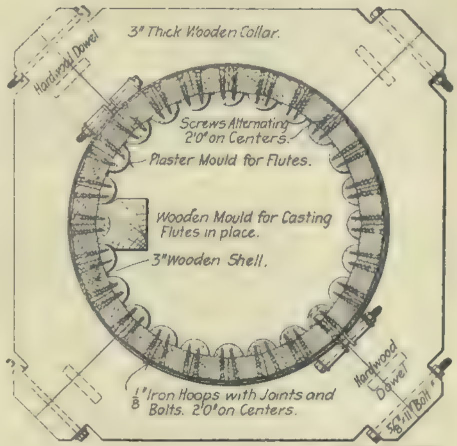
After the ceiling dome had set, the upper drum and roof dome were built in similar moulds supported at the circumference on the concrete structure and at the center on vertical studs set in the central light well. As the intrados of the roof dome is not exposed to view it is made on straight paneling, which gives the horizontal section a polygonal instead of a circular outline, but makes the vertical section curved. This enables a single set of horizontal paneling boards, nailed directly to the radial scarf boards, to suffice for the mould for the intrados. The plaster moulds for the extrados of the roof dome shell are similar to those for the ceiling dome, but have no integral lugs and are separated from the inside paneling by wooden spacers, to which they are secured by horizontal circular wires on the outside. These blocks are removed as the concrete is built up to them. The horizontal joints of the mould-blocks are covered by 2-inch iron straps. Spacing blocks are nailed to the inner paneling, as snown in the detail section, to locate the radial rods.



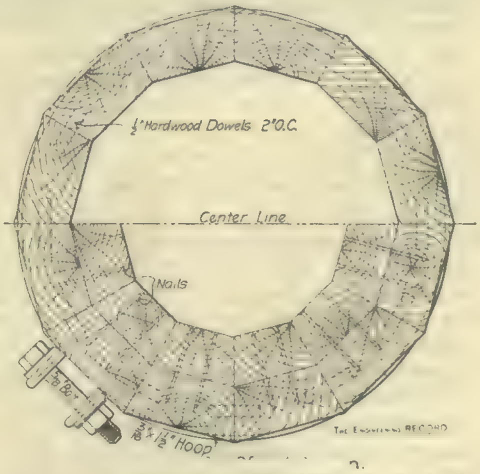
Plans and Sections of Parts of Double Dome.



Construction of Roof.


3" Thick Wooden Collar.
Hardwood Dowel
Screws Alternating 2'0"on Centers.
Plaster Mould for Flutes.
Wooden Mould for Casting Flutes in place.
3"Wooden Shell.
⅛"Iron Hoops with Joints and Bolts. 2'0"on Centers.
Hardwood Dowel
⅝" Bolt
The Engineering Record

Mould for Fluted Column.



Moulds for Columns.

Over the court room, the vaulted ceiling has a 2-inch shell, which is connected to the 2-inch roof slab by 5-inch transverse ribs, 3 feet apart in the clear, which project 6 inches below the ceiling soffit, as shown in the half cross-section of the roof, which also shows the arrangement of the vent ducts above the furred-down side ceiling. The twelve-sided columns in the court room are made in wooden stave moulds doweled and hooped together with adjustable iron straps, as shown in the detail elevation and cross-section. The fluted portico columns have nominally circular perimeters, but they are really polygonal in cross section, with very short plane faces corresponding to the 24 flat staves of the wooden moulds, shown in the accompanying detail cross-section. The staves are fastened together by hardwood dowels and iron straps with riveted bearings for the bolts, and by heavy square wooden collars with corner bolts and dowels in each of the four sections. The flutes are moulded by plaster of paris fillets secured by screws at the angles of the staves. When the moulds are stripped off, the screws are loosened and the fillets are temporarily left in the concrete to protect the sharp edges of the flutes.

The building contains about 70,000 cubic feet of concrete and 80,000 pounds of steel. The concrete was made of unscreened ¾-inch broken stone and Atlas Portland cement, mixed very wet. The specifications required a sectional area of 1 square inch of steel and 4 square inches of concrete for each 2,000 pounds of tensile and compressive strain, respectively. The concrete was mixed in a 6-foot Ransome mixer, which, with the hoisting apparatus, was operated by a Lidgerwood engine. The arrangement of the elevator and the 1-yard pivoted hoisting bucket used was the same as that installed for building the Ransome-concrete church in St. James Place, Brooklyn, which was described in The Engineering Record of May 5, 1900. The details of moulds and methods of building floors and walls corresponded essentially with those used for the construction of the Pacific Coast Borax Company's factory, which was described in The Engineering Record of August 20, 1898. Materials were delivered to the concrete mixer by wheelbarrows, and the concrete was distributed on the working platform in the same manner.

The contract price of the building was about $106,000. Messrs. W. B. Tubby & Brother, of New York, were the architects, and Mr. Edward Roche, of Far Rockaway, N. Y., was the contractor.

Street Cleaning by Hand in Washington.

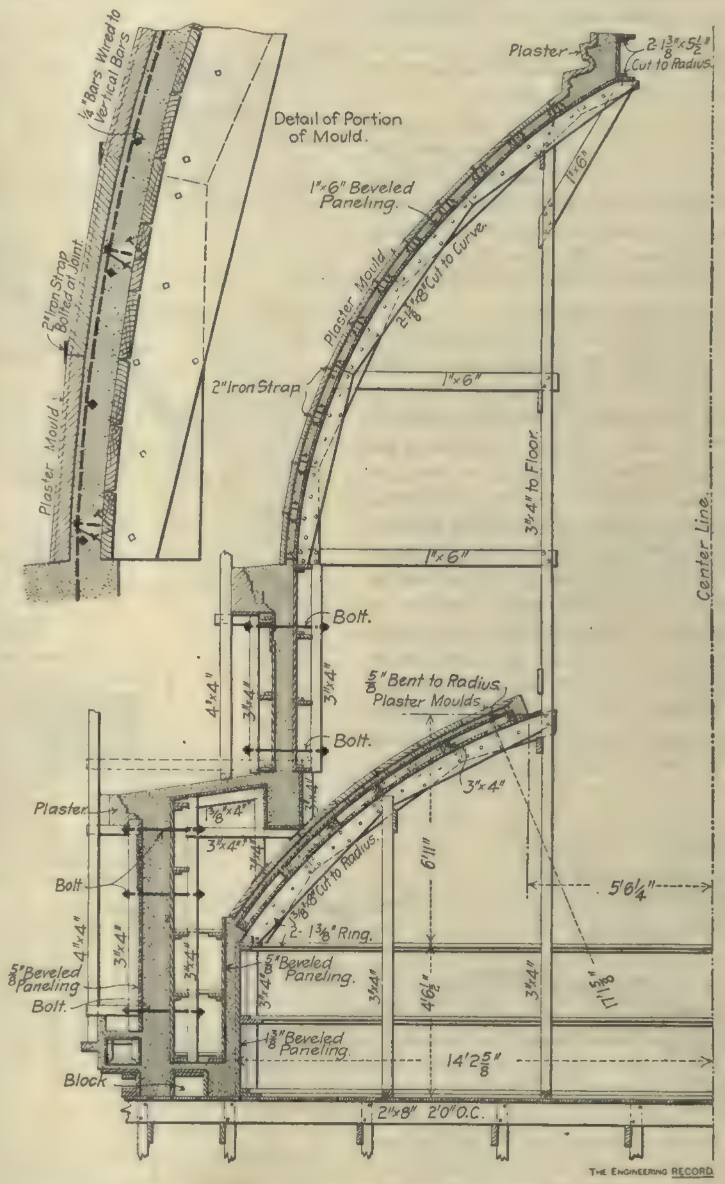
In the District appropriation act for 1900-01, there was a clause authorizing the Commissioners to contract for street cleaning and sweeping by hand and by machine, provided the contract price for machine work did not exceed 20 cents per 1,000 square yards. No bids for the hand work were received, so Mr. Warner Stutler, superintendent of streets, was directed to carry out this work by day labor, beginning July 1, 1901. An outfit of bag carriers, brooms, scrapers, shovels, sprinklers and other tools was purchased before that date and a force of 200 men engaged at $1.25 a day for the work, which covered 1,565,809 square yards of pavement to be cleaned daily. During July and August teams were hired to remove the sweepings from the streets, which service proved to be unsatisfactory and expensive, after which 18 horses and 9 wagons were purchased for use in removing the sweepings.

The daily area cleaned during the year was divided into eight divisions of about 200,000 square yards each. An inspector was assigned to each division in charge of 25 laborers, each laborer being assigned to a certain block, which he was required to keep clean during the day.

The total area cleaned during the year was 413,765,028 square yards, at a total cost, including incidental expenses, of $76,439.47, which is at a rate of 18.6 cents per 1,000 square yards.

A comparison of the cost of hand cleaning by day labor with that of the cost of hand cleaning under the last contract is given in Mr. Stutler's last annual report.

The contract rate for hand cleaning during the fiscal year ended June 30, 1900, was 21¼ cents per 1,000 square yards, whereas the cost of the same work by day labor without contract, as shown by the foregoing statement, was 18.6 cents, or 2.65 cents per 1,000 square yards less than the cost of the work under contract. In other words, to clean the total area of 413,765,028 square yards cleaned last year, it would cost, at the rate paid under the last and lowest contract, $87,925 per annum, or $11,487 more than it cost to perform the work by day labor. The reduction in the cost of the work from year to year permitted an increase in the area cleaned daily from 400,000 square yards in 1898 to 1,565,809 square yards during the past year.



Method of Constructing Steel-Concrete Domes.

At the beginning of the current year a hand "pick-up" sweeper was adopted, by the use of which the laborers can clean one-third more area than they could with the hand brooms and at the same time do the work better. The further reduction in the cost of the work on account of the use of the hand machine, which amounts to $90 per day, or $24,300 per annum, has permitted an increase in the daily area by adding thereto 500,000 square yards, thus making the daily hand-cleaning schedule for the current year 2,000,000 square yards. At the end of the current year Mr. Stutler expects to be able to report a rate of 15 cents per 1,000 square yards for hand cleaning by day labor, which rate is 17 cents less per 1,000 square yards than was paid under contract during the fiscal year 1898, the rate for that year being 32 cents per 1,000 square yards.

The hand-cleaning work is more satisfactory at the present time than ever before, for the reason that the hand machine takes up much more of the fine dust than can be taken up with the hand broom.

The Sewage Disposal Works at Madison, Wis., described in a paper by Prof. J. E. Turneaure in The Engineering Record of October 19, have between the septic tanks and filter beds a receiving chamber from which the septic sewage is distributed to the beds. This chamber has a capacity of about 500 cubic feet and not 500 gallons, as stated in the article mentioned.

The New Dry-Dock of the Wm. Skinner & Sons Shipbuilding & Dry Dock Company, of Baltimore, has been completed. As explained in The Engineering Record of March 16, 1901, it is 626 feet long over all and has a depth of water on the sills of 22½ feet at low tide. It is capable of docking a ship of 600 feet in length and 70 feet beam, with a draft of 22 feet. The basin is of timber, the entrance of granite masonry, and no expense was spared to place this dock among the best equipped of its kind in the country. It was designed and the construction superintended by Mr. James Ritchie, M. Am. Soc. C. E., of Cleveland, O., and the resident engineer was his partner, Mr. C. P. Ruple, of the same city. The work of construction was commenced in July, 1899, the contractors being the following: Dock construction, the Delaware Construction Co.; pumping plant, the Morris Machine Co.; boilers, the Heine Safety Boiler Co.; steel gate, the Spedden Shipbuilding Co.; power house, C. H. Fath & Son; steam and water piping, Wallace Stebbins & Sons.

The Efficiency of the East Providence Mechanical Filters.

In 1899 there was installed at East Providence, R. I., under the direction of Mr. Edmund B. Weston, M. Am. Soc. C. E., a mechanical filter built by the New York Filter Manufacturing Company, now the New York Continental Jewell Filtration Company. The original installation was rated at half a million gallons, and was fully described in The Engineering Record of October 21, 1899; a test of the filter was also reviewed on July 1 of that year. The capacity of the plant was recently doubled, provision for this enlargement having been made in the original plans.

The operation of the filter during the last 20 months is outlined in the accompanying table, based on the results of monthly samples analyzed under the direction of the Secretary of the Rhode Island State Board of Health. In examining these figures it is interesting to bear in mind also that during the five-month test in 1899, the average removal of bacteria with 1 grain of sulphate of alumina (containing 22 per cent. of Al_2O_3) per gallon was 99.2 per cent., and the removal of color was 83 per cent.

Mr. Weston's comments on the accompanying table are substantially as follows:

It can be seen in the tables that the bacterial results of June 5 and July 3, 1901, were unusually low, although the reduction of color was above the normal, and additional samples were collected in each of these months and bacterial results determined as shown in the table.

During the 16 months from August, 1900, to November, 1901, inclusive, while 1 grain of sulphate of alumina per gallon was used (which was about the same grade as mentioned above), the average bacterial reduction, including the results of June 5 and July 3, 1901, was 99.23 per cent., and omitting the results of June 5 and July 3, 1901, it was 99.40 per cent. During this period, with the exception of March, 1901, the average number of bacteria per cubic centimeter in the raw water was 709 and in the filtered water 10.

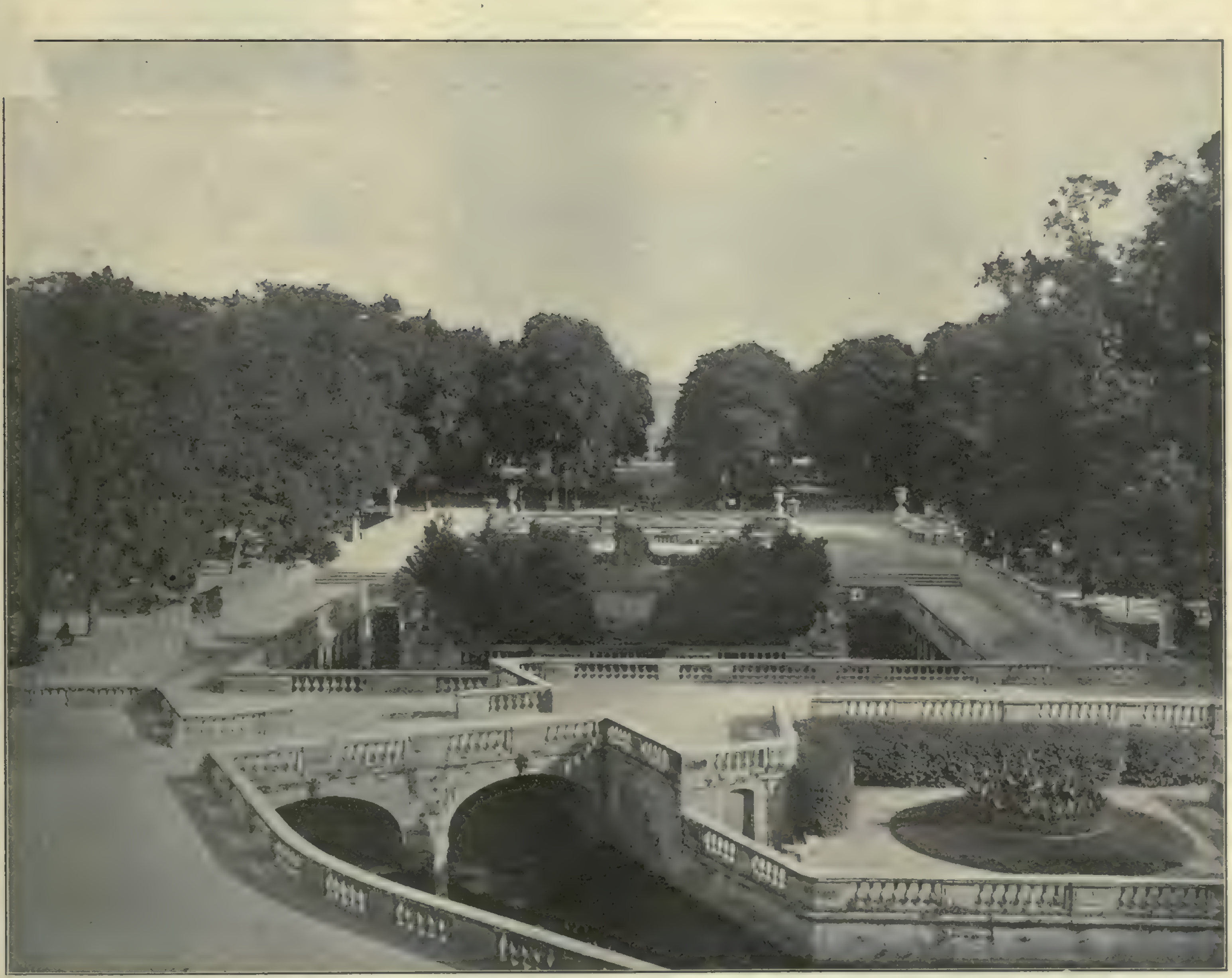
The average removal of color during the 16 months that 1 grain of sulphate of alumina per gallon was used was 90 per cent., ranging from 83 to 100 per cent.

During the four months from April to July, 1900, ¾ grain of sulphate of alumina per gallon was used, and the average bacterial reduction was 95.26 per cent. For obtaining the best results, ¾ grain of sulphate of alumina is not considered sufficient, and therefore so small an amount has not been used since the latter date.

The average removal of color for the four months that ¾ grain of sulphate of alumina per gallon was used was 83 per cent., ranging from 76 to 91 per cent.

The percentages of reduction mentioned above, while 1 grain of sulphate of alumina per gallon was used, are very satisfactory, especially the bacteriological results, as the average number of bacteria in the raw water (leaving out March, 1901), was only slightly above 700.

The bacteriological results from another point of view are of a high order, as the average number of bacteria in the filtered water, while 1 grain of sulphate of alumina per gallon was



THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLV, NIMES, VIEW IN THE FOUNTAIN GARDENS.
A pleasing architectural treatment about a canal passing through a park, formal, yet varied and refined in detail.

used, did not exceed 24, and leaving out March, 1901, the average number was only 10.

The Efficiency for Twenty Months of the East Providence Mechanical Filter.

	Bacteria per c. c.			Color of samples.		
Date.	In raw water.	In filt'd water.	Per cent. of reduction.	In raw water.	In filt'd water.	Per cent. of reduction.
1900.						
April 11.....	600	6	99.00	.50	.05	90
May 1.......	608	16	97.37	.67	.06	91
June 6......	1,129	62	94.51	.94	.23	76
July 6......	195	36	81.54	.68	.13	81
August 1...	150	4	97.33	.58	.05	91
Sept. 5......	364	4	98.90	.42	.05	88
Oct. 4.......	272	1	99.63	.33	.02	94
Nov. 7......	553	3	99.46	.42	.06	86
Dec. 5.......	1,157	15	98.70	.71	.08	89
1901:						
Jan.	3,534	25	99.29	.49	.05	90
Feb. 6......	1,178	4	99.66	.43	.05	88
March 6....	40,920	235	99.43	.53	.05	91
April 3......	673	Lost	.....	.60	.10	83
May 1.......	583	0	100.00	.61	.05	92
June 5......	414	76	81.64*	.95	.08	92
June 20.....	312	2	99.36	...	...	..
July 3.......	361	17	95.29*	.66	.05	92
July 17......	598	11	98.16	...	...	..
August 7...	146	1	99.32	.29	.00	100
Sept. 3......	192	2	98.96	.35	.01	97
Oct. 2.......	1,426	1	99.93	.36	.04	89
Nov. 4......	108	0	100.00	.41	.05	88

*As these results of June 5 and July 3, 1901, were unusually low, and as there was a question as to whether it was due to the filter or to the collection of samples and laboratory work, it was decided to collect additional samples in these months, the result of which is shown in each instance by the result immediately following.

The color is expressed in terms of the platinum-cobalt standard.

The Water Power Plant at Hannawa Falls, N. Y.

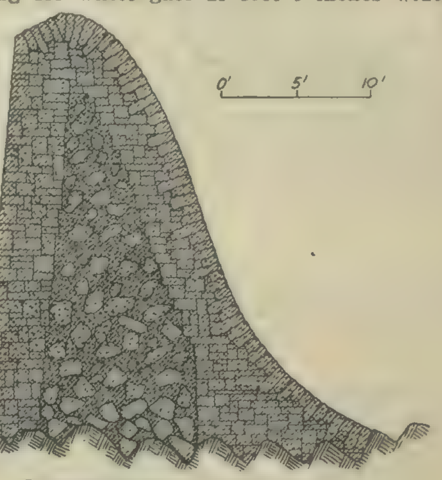
Abstract of a paper presented to the American Society of Mechanical Engineers, by Wallace C. Johnson, of Niagara Falls, N. Y.

The second largest river of New York State to draw its water from the elevated forests of the Adirondack Mountains is the Raquette River, which drains an area of upward of 1,100 square miles. This drainage area is nearly all within the great elevated plateau lying on the north slope of the Adirondacks at an elevation of from 1,200 to 1,600 feet above the sea level. In this tract are Long Lake, Raquette Lake, Tupper Lake, Little Tupper Lake, Jordan Lake and many other smaller lakes and ponds. The entire area is practically free from steep slopes and much of it is of a swampy nature. These lakes and swamps form natural reservoirs, which have a very considerable effect in equalizing the run-off. The author knows of no stream in the eastern part of the United States which has so large a low-water flow in proportion to the area of country drained as the Raquette. The flow at Colton, the point where the Raquette crosses the 800 feet elevation line, seldom falls below 1,000 cubic feet per second, though the drainage area above this is but little more than 1,100 square miles. The minimum flow of the rivers of the State, in proportion to area drained, will, he says, hardly average more than one-third this amount, and in several cases not more than one-eighth to one-tenth. The Raquette River is further remarkable in that it has a drop of about 300 feet in the first three miles of its course below Colton, and a further fall of 85 feet in the next two miles of its course.

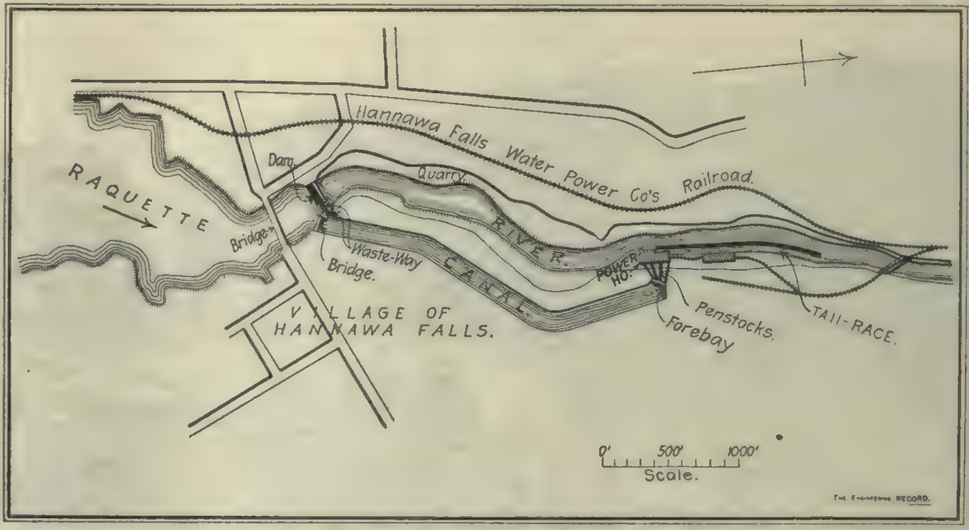
The land and water rights along this part of the river have been acquired by the Hannawa Falls Water Power Company. The lower 85-foot fall has been developed first. A dam has been built at the village of Hannawa Falls, which forms a pond 2½ miles long and covering about 200 acres. From this pond the water is conducted by a canal about 2,700 feet long to a forebay, thence by penstocks to the wheels. The tailrace extends about 2,000 feet down from the power house, being separated from the river by an embankment of earth and stone.

The location of the dam, forebay, power house and tailrace is shown in an accompanying drawing. At the point selected for the dam, the bed of the river was entirely Potsdam sandstone, the strata dipping at an angle of about 30 degrees with the horizontal down stream. The banks of the river at this point were nearly perpendicular walls of sandstone about 375 feet apart, up to a level of about 10 feet below the crest of the dam. A view of the dam and entrance to the canal is shown in an accompanying reproduction of a photograph.

On the west bank of the stream a wing wall was built on top of the ledge forming that bank of the river, and on the down-stream face the wall was carried down to the river bed. This wing wall was carried to a height of 8 feet above the crest of the dam. From the back of this retaining wall a core wall of concrete 3 feet in thickness was built from the rock up to the level of about 6 feet above the crest of the dam. This core wall was about 85 feet in length, and ran back to a point where the level of the natural ground was above the top of the wing wall. From the back of the wing wall an earth fill was made on each side of the core wall, having a top width of 8 feet and a slope on each side of 2 to 1, making the connection between the wing wall and the natural bank. Running east from this wing wall the overflow dam proper was 234½ feet in length. Then another wing wall 8 feet in thickness, and an opening for waste gate 15 feet 6 inches wide, and another wing wall against the bank on the east side similar to the one on the west side above described, both 8 feet above the crest, completed the dam.



Section through Overflow Dam.



Map of the Hannawa Falls Water Power Development.

View of the Dam and the Waste Gates.

A section of the overflow dam is shown in one of the cuts. The general level of the river bed was about 30 feet below the crest of the dam, but owing to the dip of the rock, strata being very irregular, some points in the dam are 40 feet below the crest. This irregularity, presenting as it did faces of rock nearly at right angles to the line of pressure, made the best foundation obtainable for the dam. No excavation was made, therefore, for a foundation, except to form a seat for the toe of the dam, as shown.

The materials for the construction of all the masonry work were obtained from the large quarries of the Potsdam Red Sandstone Company, which are located on the west bank of the river between the dam and the power house. This stone is obtained from the quarry with very level beds, and no cutting was done on any part of the work, except to level the crest of the dam after the stone was in place. For the down-stream face of the dam, stones from 12 to 18 inches in thickness and not less than 2 feet wide and 3 feet to 4 feet in length were used, the beds being laid normal to the surface. For the up-stream face of the dam a rubble wall about 3 feet thick was laid of smaller stone. The space between was filled with large boulders and irregular shaped quarry stones with concrete rammed in around and between. Natural cement, Union brand, was used throughout except for laying the stone on the down-stream face of the dam, where Giant Portland was used. Natural cement concrete was mixed in the proportions of 1 part cement, 2 parts sand, and 4 parts broken sandstone.

The dam was completed in the fall of 1899, and has had 4½ feet of water on its crest in two different seasons.

It was thought desirable to be able to control the level of the water in the pond, to provide for the passing of large quantities of logs by the dam, and to have a means of discharging debris floating in the stream and preventing its entering the canal; for these reasons the 15½ foot space at the end of the dam was closed by a steel waste gate. This gate consists of a steel frame closing the 15½ foot space, the sill being 30 feet below the crest of the dam. At the bottom are two openings, 6 x 8 feet, which can be closed by gates operated by hydraulic cylinders. At the top are two other openings about 6 feet square, closed by gates which are opened by being pushed down, permitting as great a depth of water as desired to flow over the top of the gate. Both of these gates, the author says, have worked very freely and accomplished the purpose for which they were designed.

The entrance to the canal is in the east bank of the pond, about 42 feet above the dam, the width of the entrance, 80 feet. For the purpose of permitting the canal to be closed, by means of stop-gates, four piers, 4 feet in thickness, were built at equal intervals in this 80-foot opening, leaving five openings, each 12 feet 7 inches in the clear, and arches were turned on these piers, forming an arch bridge across the entrance to the canal. A little below the entrance to the canal is a waste weir and gate, by means of which the water can be drawn from the canal into the river, as shown in the photograph already mentioned. This waste weir is also spanned by an arch bridge.

View of the Power House, showing the Penstocks.

Power House during Construction, showing Embankment between Tailrace and River.

The canal, from the dam to the forebay, about 2,700 feet in length, is 20 feet in depth from the top of the banks, the bottom being 14 feet below the crest of the dam. The topography of the ground through which it passes is such that it was possible to lay out the canal so that for the greater part of its length it would be partially in excavation and partially in embankment, the material taken from the excavation being nearly all used in making the embankments. The bottom width of the canal is 30 feet, the top width 110 feet, making the inside slopes two to one in all cases. The width of the top of the embankment is 8 feet, and the outside slopes 1½ to 1. The materials excavated were, for the most part, a gravelly loam, overlying hard-packed sandstone chips and sand mixed with some clay, which, though hard to excavate, proved to be excellent material for embankment. Much care has been taken in letting water into the canal and in compacting the embankments. They are now, he says, entirely free from leakage. The outside of the banks, and the inside down to the water have been given a dressing of stable manure and sown with quack grass, which is now growing luxuriantly, presenting a very pleasing appearance, as well as being of substantial benefit. The section of the canal was designed to carry 2,500 cubic feet per second of water, with a velocity of 3 feet per second, it being the intention to use that quantity of water when available.

The canal ends in a forebay, from which the penstocks lead down to the power house on the bank of the river below. At the entrance to the forebay the canal is some 4 feet in excavation; the balance is embankment. The ends of the banks are supported by retaining walls, to which the forebay walls are connected. From the retaining walls, core walls of rubble masonry from 4 to 6 feet thick are run back into the center of the embankment about 50 feet, and down to good material. To prevent water following along the face of the wall and so through the bank, three buttresses about 3 feet square are built on each side of the core wall.

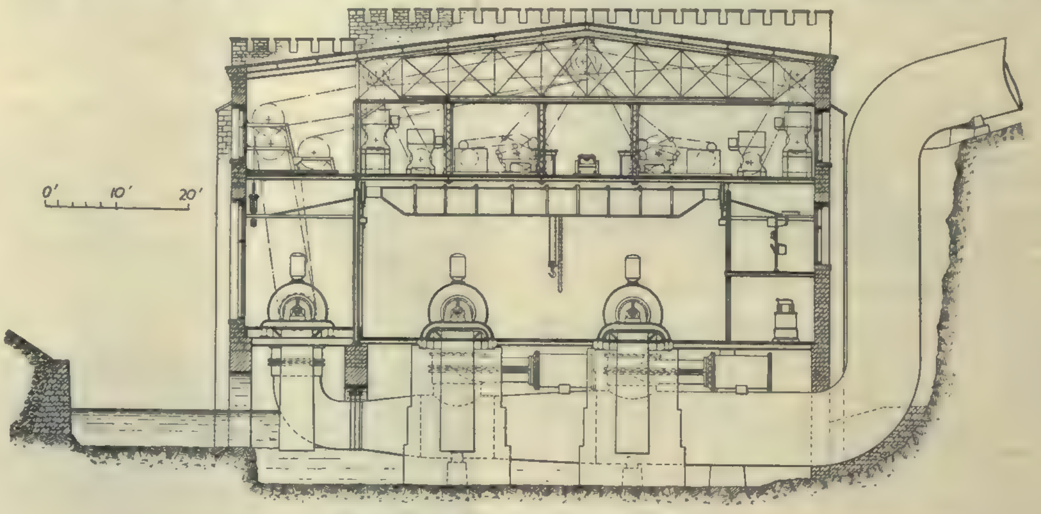
The forebay walls are built of concrete having stone embedded in it, and the outside faced with sandstone blocks 6 to 8 inches thick and 10 to 12 inches deep. In the walls are embedded the ends of seven penstock pipes, six 10 feet and one 6 feet in diameter. The 10-foot pipes are enlarged to 12 feet in the upper 4 feet of their length. Around the outside, and flush with the masonry, is a band of 6 x 6 angle iron riveted to the pipe. The penstocks are set 18 feet apart on centers; midway between each two is a buttress of stone masonry 4 feet wide and 2 feet thick. To the outer corners are fastened 6 x 6 angles, forming slides for the head gates. This arrangement leaves a space 2 x 14 feet for the free admission of air to the penstocks. The gates are of wood and are hoisted by a rack and pinion, being connected to one main shaft, which is operated by an electric motor. In front of the gates are the racks supported by a steel frame, the gates and racks being covered by a wooden building.

The natural ground upon which this forebay was built was fine sand. The walls go down to the boulder hardpan, found at depths varying from 3 to 10 feet below the bottom of the forebay. To prevent any leakage of water under the walls, the entire bottom of the forebay has been filled to a depth of about 3 feet with clay, packed by water, and on top of this is about 4 inches of concrete, in which expanded metal has been embedded. This concrete and expanded-metal lining is also carried back 50 feet into the canal on the bottom and sides of the canal, and attached to the top of the wing walls, as they follow the slope of the bank. Where the concrete and metal lining is put on the sides of the embankments, 3 x 10-inch planks were set up edgewise and embedded in the earth, the length being up and down the bank, the expanded metal being fastened to the edge of the planks before the concrete was put on. These precautions were considered necessary on account of the treacherous material on which the forebay was built, and they have proved entirely efficient.

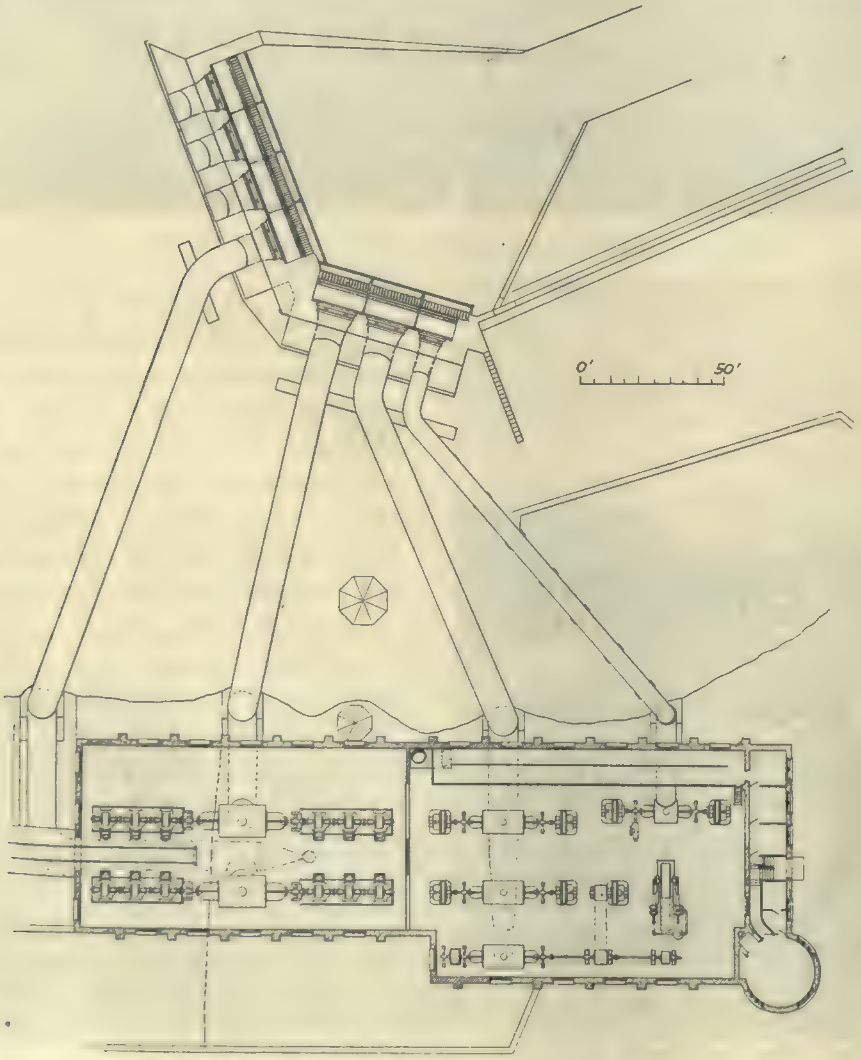
About 100 feet in front of the forebay is the high bank of the river, the water of which, at that point, is about 75 feet below the crest of the dam. Between the water of the river and the face of the high bank was sufficient room for the power house. At that point a building 250 feet in length by 60 feet in width for one-half its length, and 75 feet in width for the rest, two stories high, has been built. The floor of this power house is 72 feet below the crest of the dam. The tailraces have been excavated so that the water in them stands 12 feet below the floor, when the wheels are running, giving a working head of 84 feet on the wheels.

The building is constructed entirely of Potsdam sandstone and steel. The floors are concrete with expanded metal, and the roof is built of sandstone flags, 2 inches in thickness, laid on T-irons. The lower floor is 22 feet in clear and is served by a traveling hand-crane of 16 tons capacity. The upper floor is 10 feet in clear below the bottom chords of the trusses. A space 12 feet wide across the up-stream end of the building, including the tower at the southwest corner, has a mezzanine floor between the first and second stories, which is used for offices. The lower floor of the building, at the south end, a room 115 feet long by 75 feet wide, is the electric station. A space 12 feet in width, along the east side, the floor of which is on the same level as the office floor, is used as a switchboard gallery, the space underneath being used as a transformer room.

At the south end of the room and on the east side, is a 1,250 horse-power water wheel, fed by the 6-foot penstock mentioned above, to either end of which is direct-coupled a 350-kilowatt, three-phase, 4,400-volt generator. Underneath the north end of this room is one of the 10-foot penstocks, in which there are three openings for receiving three wheels. To each of two of these wheels will be connected two generators similar to those now connected with wheel No. 1, and the fourth will be provided with an extension shaft, to which will be belted an air compressor and other machinery.



Cross-Section of the Power House.



Plan of Forebay, Penstocks and Power House.

The penstock pipes were built of steel 5/16 inch and ⅜ inch in thickness, specified to contain not more than 0.06 of 1 per cent. of phosphorus, to have a tensile strength of from 52,000 to 62,000 pounds per square inch, 25 per cent. elongation, and 50 per cent. reduction. The plates were furnished, bent and punched by the Variety Iron Works, of Cleveland, and erected in place by day labor.

The water wheels mentioned consist of two Samson type runners on the same shaft, discharging outward. The wheel shaft stands at right angles with the penstock, which enters the wheel case on the side. The flow of water through the wheel is regulated by guides connected to a cast-iron ring and moved by an eccentric. The water is discharged through quarter-turns and draft-tubes to the tailrace. The runners are built of gun metal bronze, so-called, the movable guides of cast steel, the shaft of hammered iron, the case and draft-tubes of rolled steel, and the balance of the work of cast iron. The wheels were built by James Leffel & Company under a contract in which the general form and dimensions, the kind and quality of materials, and the speed, power and efficiency were specified. The speed is regulated by a Lombard governor geared directly to the gate rigging.

The two 350-kilowatt generators are connected to the wheel shaft by plate couplings having a movable plate between the faces. Both sides of this movable plate have a feather formed out of the same piece of metal and fitted to corresponding seats in the faces of the coupling. This enables the coupling to be driven with only two bolts, which can be quickly removed and the plate taken out in case it is desired to run either of the generators without the other. This wheel and generators run at 300 revolutions per minute. The two 350-kilowatt generators are of the revolving field type, having 24 poles and delivering three-phase current at a frequency of 60 periods per second and a pressure of 4,400 volts. Excitation is by two belted exciters, each of sufficient capacity to supply both generators.

The switchboard, of Vermont marble, consists of two generator panels with indicating instruments, one exciter panel with switches and instruments for both exciters, two 4,400-volt feeder panels, with relay, circuit breakers, oil-break switches and wattmeters, one 220-volt panel with seven distributing switches, one transformer panel, and one 20,000-volt panel with three quick-break switches having marble barriers.

The Hannawa Falls Water Power Company owns the electric lighting plant in the village of Potsdam, 4½ miles from the station. A double line has been built, each line consisting of three cables of seven strands each of No. 10 aluminum wire. This line was figured to transmit 375 kilowatts with a drop of 400 volts, delivering 4,000 volts at Potsdam. The 20,000-volt line is intended to run to the village of Colton, 10½ miles from the station, and thence to the city of Ogdensburg, 19 miles farther. The 220-volt feeder panel was intended for station lighting and local distribution.

All of the lower floor of the power-house building not occupied by the electric station above described and all of the second floor, will be occupied by a ground wood pulp mill of a capacity of 100 tons per day.

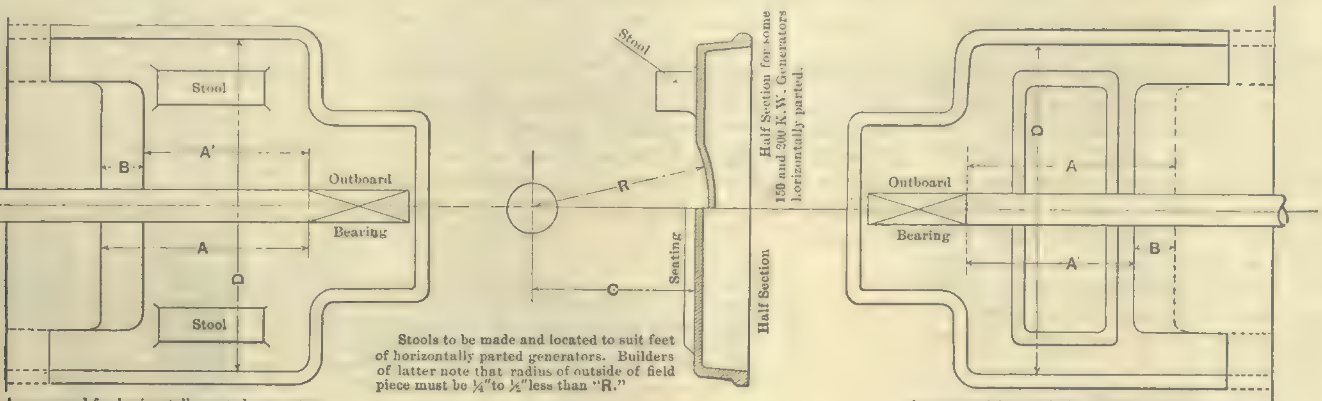
In the grinder room are placed two pairs of water wheels of 4,000 horse-power capacity each, on horizontal shafts, supplied with water from two independent 10-foot penstocks and discharging into a common tailrace. The grinders are of the four-pocket type, with stones 54 by 27 inches, twelve in number, three on each side of each wheel, direct-coupled to the same.

The entire plant has been designed by, and built under the personal supervision of the author. The details of the pulp mill have been worked out by Mr. Louis DeGeer, and the exterior of the power house is the design of Mr. V. Emile Thebaud, architect. All the excavation and masonry have been done by the faithful sons of Italy, under the direction of the author's assistant, Mr. Wilson Gilman, and the foreman, Louis La Barge. Mr. O. H. Tappan, secretary and treasurer of the company, the author says, has given the closest personal attention to the management of the work, and Mr. Wm. B. Cogswell, M. Am. Soc. C. E., director of the company, has made many valuable suggestions.

Standardization of Direct-Connected Engines and Dynamos.

The Committee on Standardization of Engines and Dynamos, of the American Society of Mechanical Engineers, consisting of Messrs. James B. Stanwood, Frank H. Ball, Wm. D. Forbes, Walter M. McFarland and Albert L. Rohrer, presented its final report at the December meeting of the society. The accompanying table and drawings embody the recommendations of the committee, with the following notes, which cover in substance what the committee had to say by way of explanation and suggestion.

The committee's investigation has covered the standardization of the following points: (1) The standard sizes of units recommended. (2) The corresponding revolutions per minute for these units. (3) The sizes of shafts for the two classes of center-crank and side-crank engines. (4) The length along the shaft required for the generator. (5) The height of axis or shaft over top of sub-base. (6) The width of top of sub-base. (7) Armature fit. (8) Overload capacity of engines and generators. (9) Brush holders. (10) Holding-down bolts, keys, and outboard bearings.



Stools to be made and located to suit feet of horizontally parted generators. Builders of latter note that radius of outside of field piece must be ¼" to ½" less than "R."

As arranged for horizontally parted generators

As arranged for vertically parted generators. Rectangular seatings to be made and located to suit bases of vertically parted generators.

STANDARD DYNAMO SUB-BASE FOR DIRECT-CONNECTED CONTINUOUS-CURRENT GENERATING SETS.

Size of Units.—The endeavor has been to reduce the number of standard units to the fewest sizes; the largest size embraced in the list is 200-kilowatt capacity. The report only covers the standardization of direct-current generators.

Revolutions.—Standard speeds have been chosen after careful deliberation and investigation of the practice of all the engine and generator builders in the country. It will be observed that the schedule provides for a permissible variation of speed of 5 per cent. above or below the mean speed.

Shaft Diameters.—In order that the reason for the diameters of shafts recommended shall be thoroughly understood, the committee explains that (especially in shafts for side-crank engines) the permissible deflection has determined the diameter. This, in some cases, is larger than would have been necessary for torsion and bending where deflection did not have to be considered. As cases sometimes arise where cross-compound engines or double engines are connected to generators coming within the recommendation, and as such units require considerably larger shafts than those given in the tables, it is stated, specifically, that the recommendations apply only to engines of usual proportions, with the generator attached at the side of, instead of between, the cranks.

Length of Generator along the Shaft.—When the committee came to investigate the question of length along the shaft (between limit lines) to be provided for the generators, it was found that the practice of manufacturers required provision for two classes, which may be called "long" and "short" generators. There is such a marked difference in the lengths for the same power that it was deemed best to make provision for these two classes, so that the engine builders can govern themselves accordingly. It will be noticed that the maximum difference in lengths between the two classes is 6 inches, which in the small sizes is reduced to 5 inches.

In the case where an engine is to be provided for a generator which falls into the "long" class, but which is only a little over the limit for the "short" class, or one which is considerably less than the maximum of the "short" class, the excess clearance is to be provided for on the side next to the engine; that is to say, the side away from the commutator. For these varying lengths of generator and shaft the engine builder has to provide different lengths of sub-base, and in order to reduce the expense of patterns here to a minimum, the idea is that these patterns be made so that the end away from the commutator can be extended the necessary amount, 5 or 6 inches, to take care of the increased length of bed. Obviously, this means simply a standard pattern with a standard adjustable end for each unit.

Height of Shaft.—As is well known, there are two classes of generators to be provided for under this head: Those which are split vertically, and those which are split horizontally. The former have a flat base which rests directly upon the flat top of the sub-base, while the latter have feet which take the weight of the generator. In order to arrange that the engine builders' patterns may be reduced to a minimum and still may be stock patterns, which will fit every style of machine, dimensions have been chosen for height of axis of shaft above top of sub-base sufficient to allow for the vertically-split machines, and also, except as stated later, to clear the periphery of the horizontally-split machines.

As will be seen, the scheme provides for a main pattern to which patterns for the stools and seatings for both horizontally and vertically-split generators can be attached before the pattern is sent to the foundry—stools for the horizontally-split machines and rectangular seatings for the vertically-split machines. In the case of the 150 and 200-kilowatt units, a recess is provided for in the top of sub-base to allow the lower part of some horizontally-split generator frames to be accommodated, and so to avoid unduly raising the center of the shaft. In the case of the vertically-split machines and those which are split horizontally and do not need this recess, the top of the sub-base will be flat and continuous.

Width of Top of Sub-Base.—This has been decided by careful examination of existing practice.

Armature Fit.—The recommendation is for what is known as a single fit. The committee obtained the opinions of manufacturers in respect to the allowance to be made for a pressed fit, and found that allowances of 0.001 inch for shafts 4 inches to 6 inches, inclusive, and 0.002 inch for shafts 6½ inches to 11 inches, inclusive, represent the best existing practice.

The armature bore is to be the exact size given in the table, and the allowance is to be made by the increase of diameter of engine shaft. The committee believes that in order to secure the best results, it will be necessary to work to a definite gauge; to this end it recommends that the generator builder furnish a gauge the exact diameter of the bore and the engine builder make the necessary allowance for the pressed fit, as recommended. This will avoid uncertainty as to the responsibility of the fit.

Overload Capacity of Engines and Generators.—As is doubtless well known, generator builders are frequently called upon to provide, during short periods, for overloads of as much as 50 per cent., and, in occasional cases, of even 100 per cent. It is evident to every engine builder that to provide an engine large enough to drive the generator under such extreme overload capacities, gives an unreasonably large engine for the rated load, and seriously interferes with the economy with which the power is produced.

The committee was led to recommend that the standard overload rating of any direct-connected unit should not, in any case, exceed 25 per cent. of the rated capacity. It will, of course, be understood, the report suggests, that under these conditions of overload the economy of the unit should not be expected to be as high as when operated at the rated load. A higher overload capacity is a special case not covered by the standard machines, and provision must accordingly be made for meeting this demand.

Brush Holders.—The committee recommends that the brush-holder rigging shall be supported upon the generator frame.

Holding-down Bolts, Keys, and Outboard Bearings.—The committee recommends that the holding-down bolts, shaft keys for securing the generator hub to the shaft, and the outboard bearings, should be furnished by the engine builders.

In the table will be found columns showing sizes of shaft keys which are recommended, also the number and size of holding-down bolts. It will be noticed that the table does not give any lengths for keys. The committee gave this matter very careful consideration, but found that such differences of opinion existed in respect to proper length, that it believed it best to leave the determination of the length of key for adjustment by engine and generator builders in each individual case. Sizes of keys have been taken so that standard rolled stock can be employed. The committee recommends that the keys be made straight and be used as feathers, that they should therefore fit accurately on the edges and top and proper allowance should be made in cutting the keyway in the armature hub, so that there will be sufficient clearance at the top of the key.

TABLE OF SIZES, SPEEDS, AND STANDARDIZED DIMENSIONS OF DIRECT-CONNECTED GENERATING SETS.

Capacity of Unit Kilowatts.	Revolutions per Minute.	Armature bore.		Diam. of engine shaft at armature fit.		Space on shaft bet. limit lines.		B, lgth. of exten. pcs. ins.	C, axis of shaft above top of base, ins.	R, ins.	D, width of top of sub-base, ins.	Key (a feather).				Holding-down bolts.	
		Cen. crank engines, ins.	Side crank engines, ins.	Cen. crank engines, ins.	Side crank engines, ins.	Long class A, ins.	Short class A', ins.					Width, ins.	Thickness, ins.	Depth in shaft at edge, ins.	Projec. above shaft at edge, ins.	Diam, ins.	Number.
25	310	4	4½	4 + 0.001	4½ + 0.001	30	25	5	23½	Flat.	48	1	¾	⅜	⅜	1	4
35	300	4	5½	4 + 0.001	5½ + 0.001	33	28	5	25	Flat.	54	1	¾	⅜	⅜	1	4
50	290	4½	6½	4½ + 0.001	6½ + 0.002	37	31	6	28	Flat.	60	1¼	¾	⅜	⅜	1	4
75	275	5½	7½	5½ + 0.001	7½ + 0.002	43	37	6	31	Flat.	66	1½	1	½	½	1¼	4
100	260	6	8½	6 + 0.001	8½ + 0.002	48	42	6	34	Flat.	72	1½	1	½	½	1¼	4
150	225	7	10	7 + 0.002	10 + 0.002	51	45	6	37¾	41¼	84	1¾	1¼	⅝	⅝	1¼	4
200	200	8	11	8 + 0.002	11 + 0.002	54	48	6	42¾	47½	96	2	1¼	⅝	⅝	1½	4

Note 1.—Five per cent. variation of speed permissible above and below speeds in table.

Note 2.—Distance from center of shaft to top of base of outboard bearing may be less than C (to suit engine builder), though not less than possible outside radius of armature.

Pressing Armature on Shaft.—Usually the contract definitely provides by whom this is to be done, but the suggestion of the committee is that if there is no such provision in the contract it should be understood that the engine and generator builders shall agree who is to do this work, so as to avoid any dispute when the separate portions of the unit are delivered on the premises.

Floor Line.—For convenience in operation and for the information of engine and generator builders, it is suggested that for units up to 75 kilowatts, inclusive, the floor line should come at the bottom of the sub-base; and for units 100 kilowatts to 200 kilowatts, inclusive, the floor line should be one inch below the rough top of the sub-base.

Protecting Commutators from Oil.—In view of the fact that in some cases the distance between bearing and commutator is very small, it is well for engine builders to bear in mind that provision should be made to prevent oil from the bearing getting on the commutator.

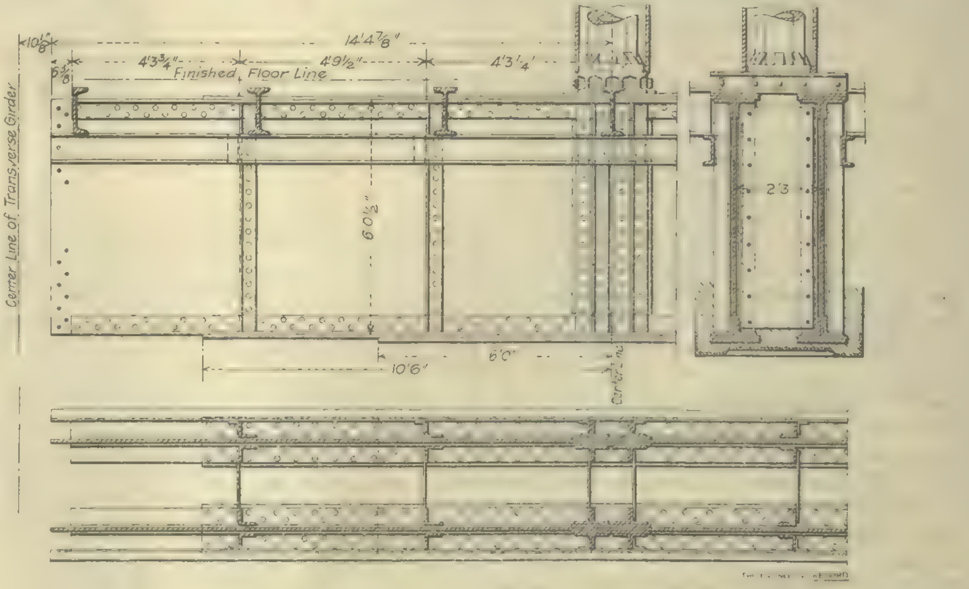
Some generator builders have asked that the end of the shaft be drilled and tapped to facilitate, if necessary, the removal or placing of the armature on the shaft at the place of erection; the committee suggests that this be done.

In some cases, generator builders require special nuts, bolts, or fixtures for attaching generators to the shaft. Under these conditions we suggest that the generator builders should furnish all attachments to their apparatus that are not already specified in the report.

In conclusion the committee expresses appreciation of the great interest in the work which has been shown by the engine and generator builders, and indebtedness to Prof. John E. Sweet, president of the Engine Builders' Association and chairman of its committee on standardization. The recommendations, it believes, will, if adopted generally by manufacturers, reduce the cost of manufacture, expedite deliveries, and remove many causes of complication and dissatisfaction.

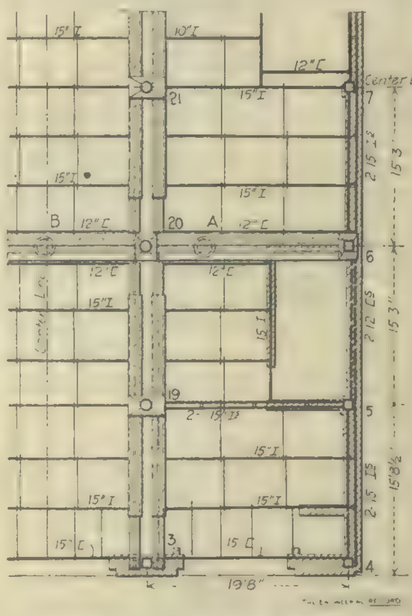
A Steel Warehouse for a Wholesale Grocery Company.

The 94 x 60-foot steel-cage fireproof warehouse building for Messrs. Park & Tilford on West 36th Street, New York, is nine stories or about 125 feet in height, and has the upper eight sections of all its interior columns carried on a very heavy system of box girders in the second floor. This arrangement was due to the requirements that there should be the least possible obstruction to wagons driven in from the street; that there should be only two longitudinal rows of interior columns in the upper stories; and to the economical arrangements of the foundations and basement columns in three longitudinal rows which are in different vertical planes from those of the upper sections of the columns. Besides the interior rows there are columns built into the side and end walls, so that altogether there are, in the basement, seven rows of transverse and five rows of longitudinal columns, equally spaced. They are about 15 feet apart, both ways, and all the five interior transverse rows have five columns each, counting the two wall columns. In the end transverse rows there are only four wall columns, two in the corners of the side walls and two intermediate ones each 9 feet 7½ inches from the center line on opposite sides, and 5 feet 4½ inches inside the adjacent lines of interior columns. These four columns are each double and support, at second-floor level, the ends of the two main longitudinal girders.



Second-Floor Longitudinal Girder

Four columns in the center of the building, symmetrical with respect to the transverse and longitudinal axes and located on the corners of a 30½ x 30-foot rectangle, support two transverse girders; these give intermediate support to the main longitudinal girders, as shown in the general plan, which is symmetrical about both longitudinal and transverse center lines. These four intersecting lines of main girders carry all the upper sections of all the interior columns, and the whole superstructure above the first tier of floorbeams is thus supported by the wall columns and the four main center columns, and the ground floor has the minimum obstruction for the wagons, which are driven in and loaded and unloaded. The main transverse girders are 60 feet long, continuous across the full width of the building, and consist each of two parallel twin plate girders bolted together to be about 2 feet 7 inches wide over all. The girders are about 6½ feet deep in the center, and each part has four 6 x 6 x ¾-inch flange angles 60 feet long and a 75 x ⅝-inch web extending from end to end of the girder in three sections.

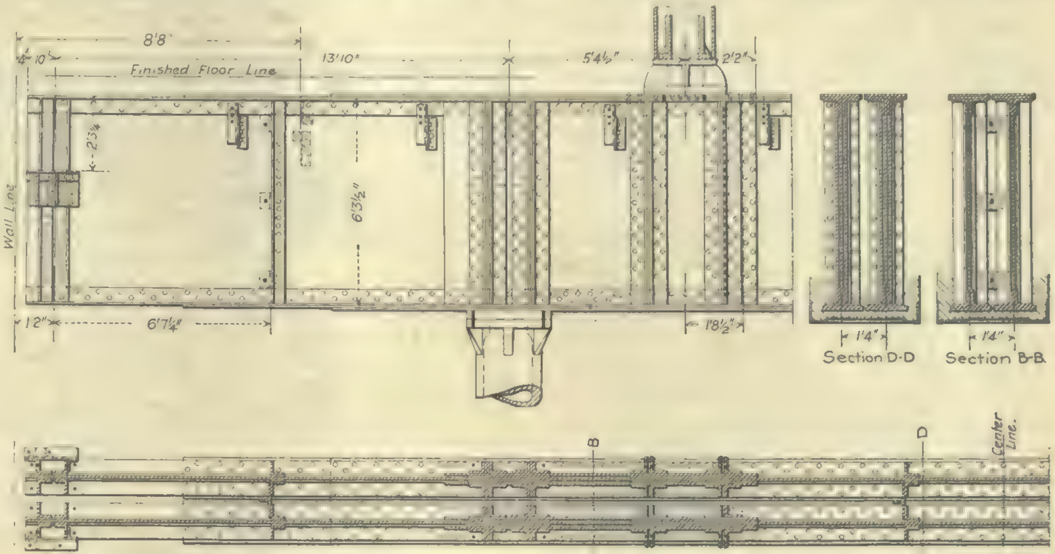


Second-Floor Beams and Girders.

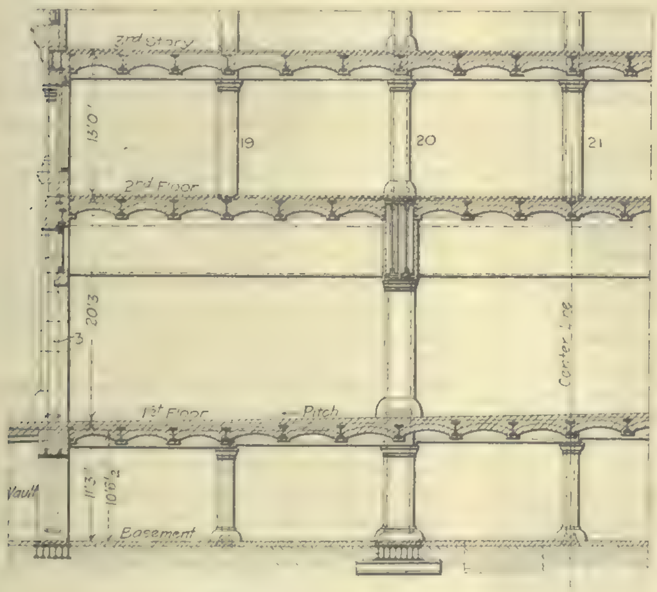
Between the columns which support the center of the girder and the columns which the girder supports each side of the center of the building, the web is reinforced by two 73 x ⅞-inch plates, riveted on outside the vertical legs of the flange angles. In the center lines of both the columns there are filler plates packed solid in the space between the continuous web and the reinforcement plates. These fillers do not extend the full length of the reinforcement plates, but leave a vacant space in the middle where there are no rivets. Each girder has eight vertical web stiffener angles in the line of each column and there are thick filler plates riveted between the outstanding flanges of the pairs of angles over the lower story columns, virtually making four columns of solid steel between the girder flanges at these places. Three short angles with their flanges turned outward, are riveted to the outstanding flanges of each of four vertical web stiffener angles on the inside of each girder. A 1½-inch hole through the flange parallel to the girder web matches a 1-inch hole in the web, and as these angles match in the two girders they take bearing on each other when the girders are set close together. Three-quarter-inch bolts put through them from out to out of the webs clamp them tightly, and secure the girders together without transmitting vertical loads from one to the other.

The longitudinal girder resembles the transverse girder, and has a 72 x 11/16-inch web and two 6 x 6 x 1-inch angles and two 15 x 1-inch cover plates in each flange. There is no web reinforcement except what is afforded by the pair of 24 x 1-inch filler and splice plates. The girder is composed of two twin plate girders, spaced 27 inches apart on centers and connected by vertical transverse diaphragms riveted to the web stiffener angles. Each end of each web is engaged between the flanges of two vertical web stiffener angles 1 inch thick on the transverse girder, and is secured to them by 27 rivets in double shear. Horizontal channels, 9 inches deep, with the webs vertical, are riveted to the outside vertical web stiffener angles to receive on their upper flanges the I-beam floor joists. Adjacent to the transverse girders the joists are replaced by 15-inch channels which receive on their lower flanges the skew backs of the floor arches. Panelled cast-iron soffits are suspended from the lower parts of both transverse and longitudinal girders to form a fireproof protection for their bottom flanges, and above them the sides of the girders are encased by wire-lath and plaster, furred out from the webs to leave a wide air space around the girder.

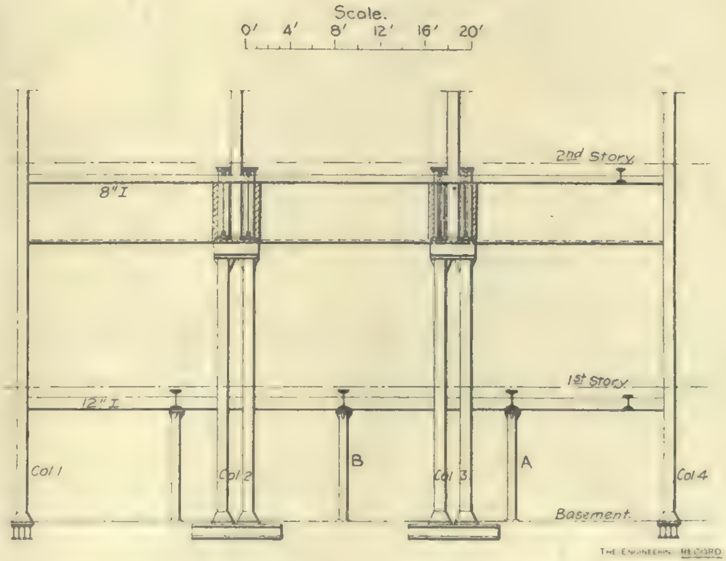
At the intersections of the girders, the second-story columns have heavy planed circular tops and square bottoms, the latter seated directly on the top chords of the transverse girders, to which they are secured with four flange bolts each. On the longitudinal girders the columns are seated on bases each made of four pairs of 8-inch channels with 6 x ⅜-inch plates riveted between their webs and bolted together with cast separators to make grillages, planed top and bottom and bolted to the girder flanges. The transverse girders are seated directly on the planed tops of the wall columns, but the ends of the longitudinal girders are seated on short girders connecting the tops of the twin first-story columns. Each girder is composed of two I-sections bolted together with separators and built up of pairs of heavy 15-inch channels, riveted back to back with 15 x ⅞-inch web reinforcement plates between. Above the second floor, the interior columns are connected by 24-inch longitudinal I-beam girders, which carry the 18-inch floor-beams about 19 feet long and 5 feet apart.



SECOND-FLOOR TRANSVERSE GIRDER.



PART LONGITUDINAL SECTION.



FRONT TRANSVERSE ELEVATION.

The columns are all of cast steel, with square cross sections in the walls and circular cross sections elsewhere, and all are seated in the basement on grillages of crossed 15-inch I-beams with concrete footings levelled up from the soft rock. For the side wall column grillages, there are four or five I-beams, from 5 feet 4 inches to 6 feet 8 inches in length. Each of the four intermediate columns supporting the transverse girders has a grillage 7½ feet square, with fourteen 55-pound I-beams in the lower course and eight 100-pound I-beams in the upper course which receives the base castings 4 feet square.

The four main columns are each 2 feet in external diameter and the metal is over 3 inches thick, giving a maximum cross section of 200 square inches, for a load of about 3,270,000 pounds. They are of ordinary design, spliced at the first story with eight bolts through circular stiffened flanges, have bracket seats and web connection lugs for the floor joists, and were cast vertically from the best car-wheel stock. They are enclosed, as are all other interior columns, by thin cast-iron cylindrical shells, outside the insulation of hollow brick, which is built close to the columns, and the girder-seat brackets are protected from fire by hollow cement capitals which enclose the tops of the columns.

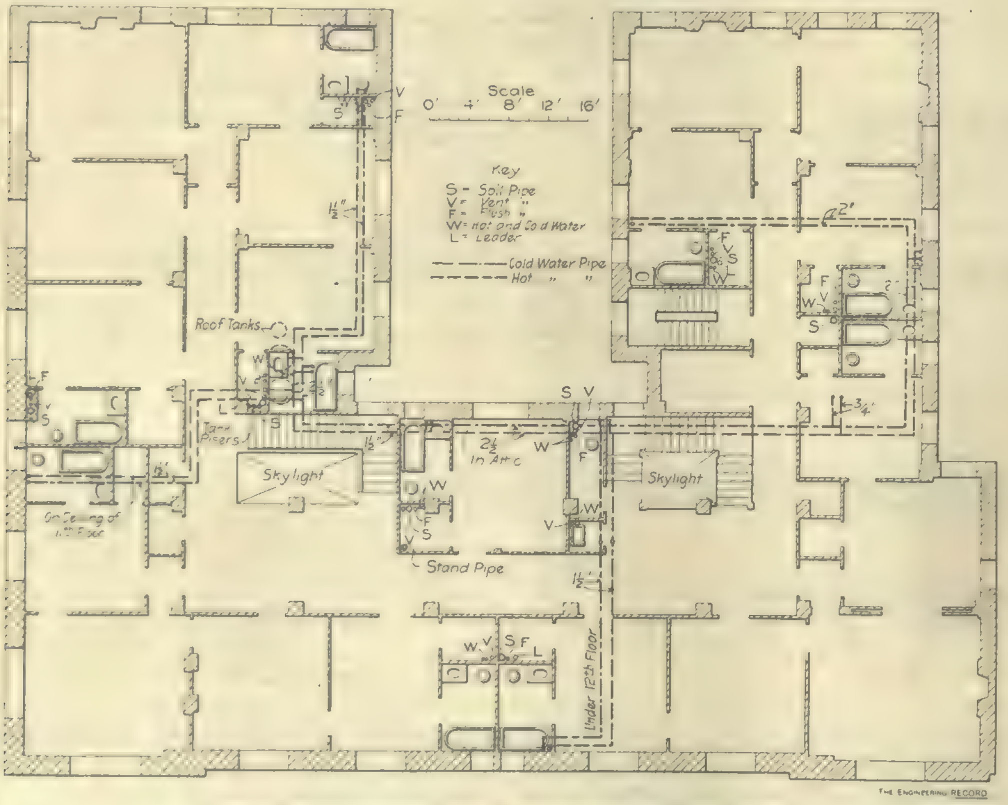
The foundation grillages are below the level of the basement floor, and the concrete surface of the latter is continued up around the column base to enclose it. In the second and third stories the bases of the columns are protected by heavy cast-iron wheel guards rising 3½ feet above the floor to receive any shocks from trucks, boxes, etc. The brick walls are 28 inches thick up to the third floor, and above that their thickness is decreased by inside offsets. The brickwork is carried by the wall columns on pairs of I-beams, which are 20 inches deep at the third floor and 15 inches deep at the fifth, sixth, seventh and eighth floors. There are no wall girders at the second and fourth floors, but there the wall columns are connected by 8-inch I-beam struts built solid into the brickwork. At each floor there is an 18-inch horizontal channel with its web in contact with the wall surface, which receives on its lower flange the skewback for the floor arch. The floors are made with end construction terra cotta segmental arches levelled up with concrete and covered with boards. They weigh 100 pounds per square foot and have a capacity of 500 pounds per square foot.

Mr. Francis Kimball was the architect for the building, and Mr. Charles C. Brown, M. Am. Soc. C. E., was the consulting structural engineer. Messrs. Mark Eidlitz & Son were the general contractors, Messrs. Post & McCord were the contractors for the structural iron and steel, and Mr. John Peirce was the contractor for the front granite.

Plumbing in the Park-Realty Building, New York.

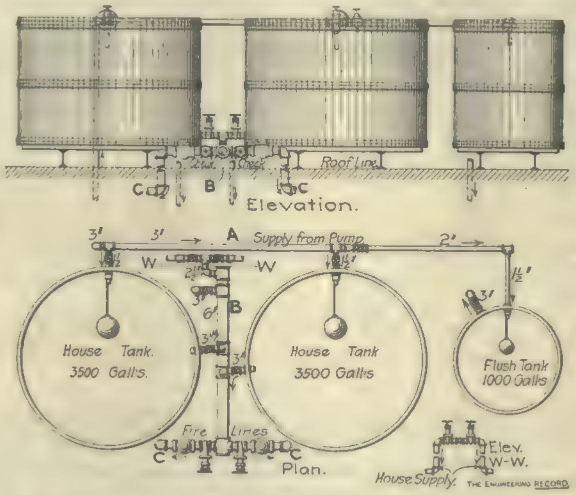
The 80 x 100-foot Park-Realty Building, at Sixty-third Street and Madison Avenue, New York, is a steel frame family hotel with twelve stories besides sub-basement, basement, mezzanine and attic. On one side of the building there is a 22 x 40-foot light court, and around each side of it on the typical floors are grouped four suites of communicating apartments, in each of which there are two or three toilet rooms, each containing a bath tub, wash basin and water-closet. Most of the toilet rooms are arranged in pairs so as to be served by single sets of risers, as indicated in the accompanying typical floor plan of the third to the seventh stories inclusive. As there are ten sets of plumbing fixtures, besides a slop sink and two fire lines on each of the regular floors, and all are supplied by apparatus installed in the basement and attic, an extensive distribution system for the water supply is required.

The metered supply from the street is delivered to a 4-inch sub-basement main, and after passing through a filter or being by-passed around it, is discharged through ball-cocks to a 2,000-gallon galvanized steel suction tank. A 12 x 6 x 12-inch brass-lined and fitted Blake or Worthington house and fire steam pump delivers water from the suction tank through a 3-inch riser to the attic tanks, and is cross-connected to the pair of 6 x 4 x 5-inch boiler feed pumps so that they may all be used for house supply or fire purposes. Between the filter and the suction tank a 1-inch distribution line is taken off the main street pressure supply and is connected to sill cocks at various places, which are the only fixtures which have not tank pressure connections.



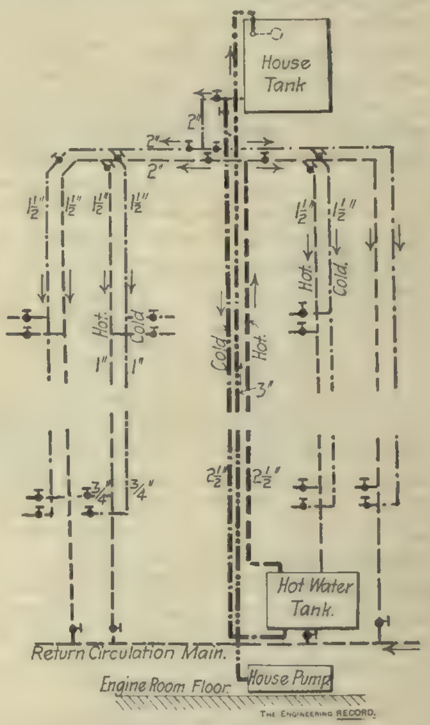
Piping Scheme in the Park-Realty Building, New York.

The pump riser passes through the attic and terminates in the roof house above with a horizontal branch from which there are connections to three ball-cocks, supplying as many cylindrical cedar-stave tanks. Two of them are duplicates, 10 feet in diameter, and are seated on platforms of 2-inch planks, supported by 8-inch steel beams 2 feet apart. These tanks have a capacity of 3,500 gallons each, and are valved at the bottom to a 6-inch horizontal header which acts as an equalizing pipe and a source of supply for all house and fire service. At one end of this pipe 2½ and 3-inch vertical lines are caried down to the sub-basement for supply to the hot-water boiler and to special fixtures, and also to the attic ceiling, where connection is made with a distribution main which supplies the risers for all regular lines to groups of fixtures in the upper stories. The other end of the equalizer terminates in a cross with two 4-inch branches, having gate valves and check valves above the standpipes which are run down in different parts of the building for fire lines. The third tank, 6 feet in diameter, with a capacity of 1,000 gallons, is used exclusively for the flushing supply. All tank pipe connections are made with lock nuts, washers and gaskets, and the tanks are covered and supplied with overflow and emptying pipes, gauges and telltales in the usual way, which are omitted for clearness in the detail drawing. There are also vent pipes from the hot-water system and from the main tank risers above their upper valves, which are carried over the tops of the tanks in the customary manner. Floats in the large tanks are connected with a Beatsall governor, which controls the house and fire pump and automatically starts and stops it when the water level in the tanks reaches fixed limits.



Storage and Pressure Tanks.

The cold-water distribution main on the attic ceiling runs around three sides of the light court, and, reducing from 2½ to 1½ inches in diameter, supplies six 1½-inch down-risers with branches to groups of fixtures on all the lower floors. As the attic does not extend over the whole area of the building branches cannot be run on its ceiling to riser lines near the outer walls in some places, therefore two such branches are carried at a lower level in lined and wasted troughs between the eleventh story ceiling and twelfth story floor, as indicated in the typical floor diagram. Each vertical riser is valved top and bottom, has an emptying valve and waste pipe at the bottom, and can be connected with street pressure if necessary. Each branch to groups of fixtures is valved and air-chambered, and any line or group can be cut out without interfering with any other part of the system. A special 2½-inch vertical pipe from the roof tanks supplies cold water to the 4-foot cylindrical galvanized steel hot-water boiler 12 feet long, which is heated by a 200-foot coil of 2-inch brass steam pipe. From this boiler a 2½-inch riser is run to the attic ceiling and is there connected to a 2½-inch distribution main, which parallels the cold-water distribution main. The hot-water risers connected to it decrease from 1½ inch at the top to ½ inch at the bottom, are valved top and bottom, and have emptying valves and waste pipes at the bottom by which any one may be separately controlled. They are connected at the bottom to a horizontal main which acts as a return circulation pipe and delivers the colder water through a Pratt & Cady swinging check-valve to the bottom of the boiler, as indicated by the conventional diagram showing typical lines and connections. It is thus seen that all distribution is on the attic ceiling, all supplies are downward under direct tank pressure, and all lines individually controlled from the tops of the risers, there being no distribution drums.



Hot-Water Supply.

The two 4-inch fire lines have 2½-inch valves and hose reels in every story, and are always under tank pressure, which may be increased to the full force of all the steam pumps without opening or closing any valves except for the boiler-feed pumps. These lines are also connected at the sidewalk with gate-valves and check-valves to outside siamese connections which permit the attachment of fire engines in the street for additional supply. All water pipes are of extra-heavy galvanized wrought iron, except where exposed in the toilet rooms, where nickel-plated brass pipe is used. In exposed situations it is covered with ½ inch of special felt and canvas, as are all the cold water pipes in the sub-basement, the hot-water boiler and some of the drain pipes. The riser lines are all accessible in pipe shafts, in the corners of closets or in ducts furred out from the main walls; generally they are run in groups of five for each set of fixtures, viz.: soil, trap-vent, hot and cold and flushing supply. The soil and waste pipes, leaders and floor drains all discharge into drains which empty into two 8-inch mains to sewers on the two adjacent streets. The blow-offs and drip basins drain to a sump, from which the contents are periodically pumped into the street sewers; all other drainage is by gravity. The soil pipes are 5 inches in diameter down to the second floor, where one of them receives a connection from the 3-inch horizontal branch from the slop sinks and is enlarged below it to 6 inches. The trap-vent pipe is connected by a long angle to the soil pipe above the highest fixture, and runs adjacent to it to the sub-basement, where it has a separate connection with the horizontal drain pipe.

Messrs. Buchman & Fox were the architects for the building. The George A. Fuller Company were the general contractors, and Mr. J. W. Cooney was the contractor for the plumbing.

Important Concrete Construction in Zero Weather.

The Eastern Elevator, Buffalo, has a large number of cylindrical steel grain bins 15½ feet in diameter and 80 feet high, which are supported on a horizontal platform or floor of Ransome steel-concrete construction. This platform is about 81 feet wide, 200 feet long, and is supported 10 feet above the surface of the ground on the tops of concrete piers 33 inches square and 12½ feet apart on centers, both transversely and longitudinally. These piers have offset concrete footings on pile foundations and carry transverse and longitudinal concrete girders 30 inches wide and 36 inches deep to the top of the floor surface, which form rectangles connecting the tops of all the piers. Each of them is reinforced by eight 1-inch square twisted steel rods in the bottom and eight ¾-inch twisted steel rods in the top, which are continuous over the tops of the piers. The girders support 4½ x 36-inch floor beams 21½ inches apart on centers, each of which has one 1¼-inch bar in the bottom and one ¾-inch bar in the top. They are parallel to both sets of girders and intersect each other at right angles, forming sets of panels 16½ inches square in the clear. These panels have floor slabs from 4 to 6 inches thick, with special reinforcements where there are openings through them, and are reinforced throughout by ½-inch bars 6 inches apart. The concrete was made of 4:7:13 Portland cement, coarse, sharp lake sand and 1-inch broken stone, and was so strong that a 6-inch cube seven days old was tested up to the capacity of the machine, 150 tons per square foot, without breaking.

The concrete was nearly all mixed in December, 1900, and January, 1901, when the outdoor temperature varied from freezing to 10 degrees below zero, and the work was carried on regardless of the cold. The materials were mixed in batches of about 12 cubic feet each in a Ransome drum mixer making about 14 revolutions per minute. The product was handled by a steam derrick, which delivered it to a platform on which eight wheelbarrows were loaded at once to distribute it to different parts of the work. The capacity of the machine was limited by the ability to remove the concrete, and as many as 514 batches were mixed in a single day. The concrete was rammed in place in the usual way when the mercury was far below zero, and it froze on top almost as soon as placed.

As fast as the floor surface was finished it was covered with panels of light wooden sheathing and the work was carried on in the usual way. There were no walls enclosing the piers, and the space under the floor was enclosed by heavy canvas curtains reaching from the floor to the ground around the outside of the piers. Inside this lower story about twenty salamanders, open coke braziers, were kept burning day and night as long as the work continued and maintained a constant temperature there of from 85 to 90 degrees. Attendants continually sprinkled water on the fires, making great quantities of steam, with which the air was kept saturated. The floor was not fully loaded for several months after completion, but has now been subjected to the proposed load of 5,000 pounds per square foot for several months without showing any signs of failure or weaknes.

From observations on this work Mr. A. Wilfrid Ransome, the inspector in charge of construction, is convinced that good Portland cement concrete, well made and properly laid, is not at all injured by severe freezing if it is properly protected and allowed to set uninterruptedly without re-freezing after it commences to thaw. The work was built by the Donnelly Contracting Company, Mr. C. R. Nehr, chief engineer.

Trade Publications.

Single-phase alternating-current motors, up to 30 horse-power in capacity, for any voltage up to 500 and any frequency, are described in a new bulletin of the Wagner Electric Mfg. Co., St. Louis. The field of usefulness of these machines and their construction are explained, and the usual tables of dimensions of standard sizes are given.

The various applications of Lundell motors are described in the latest bulletin of the Sprague Electric Co., New York. These motors range in capacity from 1/20 to 1,000 H.-P., and among the machines to which they are applied are house pumps of different types, blowers and fans for ventilating purposes, printing presses, pipe cutters, sand screens and a large number of machine tools. One interesting illustration shows a small motor with a swivel mounting on a horizontal base and fitted with a flexible driving shaft for attachment to small tools and the like.

The Evans system of heating by the mechanical circulation of hot water is described in a well-illustrated pamphlet from Evans, Almirall & Co., 44 Dey St., New York. The principles and advantages of this method of heating are discussed at length, and there are descriptions of its use in many large office buildings, schools, depots, industrial plants and central stations, from which hot water is distributed to detached buildings.

A new type of jet condenser is illustrated in a pamphlet issued by Dean Bros.' Steam Pump Works, Indianapolis, Ind. The steam cylinder is mounted on four posts above the air pump cylinder, which is double-acting and placed beside the valve chest.

Box and screw concrete mixers of various sizes and portable and stationary types, dump cars, conveyors and horse-power wheels are illustrated in a folder from the Jeffrey Mfg. Co., Columbus, O.

Steel buildings for sugar plants, constructed by Milliken Bros., 11 Broadway, New York, are illustrated in a handsome atlas published by that company in English and Spanish editions. It contains many views of the large refineries of Oahu, Waialua, Olaa, Mauri, Kauai, Molokai and Eva, on the Hawaiian Islands, Banes, Guayabal and Elizalda in Cuba, and Remolacha, Cal., which illustrate some noteworthy examples of steel buildings. There are also views of warehouses, rolling mills and other structures the company has erected.

An anti-bursting chamber for use on water pipes exposed to danger from freezing is described in a pamphlet published by the Anti-Bursting Pipe Co., Standard Bldg., Pittsburg. A number of interesting experiments made with the device are described.

Two additions have recently been made to the valuable circulars of the Westiughouse Electric & Mfg. Co. The first describes its standard alterating-current switchboards for 1,100-2,200-volt circuits. The construction of the different panels is explained, the method of making connections for different classes of service is indicated and there are voluminous descriptive price-lists. The second circular is a very complete description of O. D. transformers for lighting and power work, a line of apparatus in which several new features have recently been introduced, without, however, departing from the characteristics of the Westinghouse transformer of earlier date.

Personal Notes.

Mr. Frank H. Sloan has been elected city surveyor of Baltimore.

Mr. Leon S. Moisseiff has been promoted to the position of assistant engineer in the Department of Bridges, New York City.

The first doctor's degree in engineering granted under the new Austrian laws was given on November 14 to Mr. Hans Löschner at Gratz.

Prof. Henry M. Howe, of the School of Mines, Columbia University, has been elected an honorary member of the Russian Technical Society at St. Petersburg.

Mr. Howard J. Cole, M. Am. Soc. C. E., has opened an office in the Columbia Building, 29 Broadway, New York City.

Messrs. Rudolph Hering & Geo. W. Fuller have been engaged to review plans for water supply, water purification and sewage disposal for the city of Manzanillo, Mex.

Mr. Philip Dawson has been retained by the London, Brighton & South Coast Railway to advise on the proposed handling of its suburban traffic by electric motive power.

Mr. J. Q. Jamieson has been appointed division engineer of the Northern Pacific Railway, with headquarters at Tacoma, Wash., to succeed Mr. Charles S. Bihler, who has resigned.

Patrick Sullivan, for several years manager of the plant of the Warner-Quinlan Asphalt Company at Guariquine, died at Caracas, Venezuela, December 2. He was 45 years of age and a native of Syracuse, N. Y.

Mr. A. W. Robinson, M. Am. Soc. C. E., formerly of the Bucyrus Company, of South Milwaukee, has been appointed consulting engineer to the Canadian Government for river and harbor improvements and dredging plant.

Mr. Edwin M. Wheelwright, of Boston, has been retained by the Commissioners of the District of Columbia as adviser in regard to the competition and selection of plans for the proposed municipal hospital at Washington.

The Engine Builders' Association of the United States has elected the following officers: President, W. L. Taylor, Indianapolis; Vice-

President, C. O. Gates, Massillon, O.; Treasurer, C. H. Bonsal, Salem, O.; Secretary, D. N. McBriar, Erie, Pa.; Executive Committee, Walter C. Kerr and S. F. Bagg, of Watertown, N. Y.

At the annual meeting of the Engineers' Society of Western New York, held December 3, the following officers were elected for the ensuing year: President, Samuel J. Fields; Vice-president, Charles H. Tutton; Director, T. Guilford Smith; Secretary, George T. Roberts; Librarian, Francis J. Tresise; Treasurer, George B. Bassett.

Mr. Howard L. Ingersoll has been appointed acting division engineer of the Eastern Division of the New York Central & Hudson River Railroad, with headquarters at No. 5 Vanderbilt Avenue, New York, succeeding Mr. J. C. Nelson, resigned, and Mr. William F. Jordan has been appointed resident engineer on new construction, Eastern District, with headquarters also at New York, to succeed Mr. Ingersoll.

At the opening session of the annual meeting of the American Society of Mechanical Engineers, Mr. Edwin Reynolds was elected president, Messrs. M. E. Cooley and M. P. Higgins vice-presidents, Mr. Wm. H. Wiley treasurer, and Messrs. R. S. Moore, H. A. Gillis and Charles A. Corbett managers. At the same meeting a proposed amendment to the constitution increasing the annual dues was rejected by a vote of 647 to 191.

Mr. Perez M. Stewart has been appointed superintendent of buildings of the Borough of Manhattan of New York City, under the administration which will enter office January 1, and Mr. William Martin Aiken has been appointed consulting architect of the borough. Mr. Stewart has been engaged in business as a contractor and builder for 15 years. Mr. Aiken was not long ago supervising architect of the Treasury Department at Washington, prior to which time he was engaged in the practice of architecture at Cincinnati. His appointment is one reflecting much credit on Borough President Cantor and speaks well for the city's architectural work.

The following candidates for admission to the various grades of membership in the American Society of Civil Engineers were announced elected December 4: Members: A. V. Abbott, Chicago; J. W. Beardsley, U. S. Engineer Office, Detroit, Mich.; A. C. Dennis, Canadian Pacific Ry., Winnipeg, Man.; E. M. Douglas, U. S. Geological Survey, Washington, D. C.; G. E. Ellis, Standard Signal Co., Troy, N. Y.; E. A. Frink, Structural Iron & Steel Co., Baltimore, Md.; A. L. Johnson, St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo.; L. S. Johnson, U. S. Engineer Dept., Jamestown, R. I.; C. A. Miner, U. S. Assistant Engineer, Fort Washington, Md.; A. G. Norton, Baltimore & Ohio Southwestern Railroad, Flora, Ill.; Hugh Serjeant, resident engineer, Western Australian Government, South Perth, W. Australia; S. LaR. Tone, Southern Traction Co., Pittsburg, Pa.; L. W. Tucker, assistant engineer, Boston & Maine Railroad, Boston, Mass. Associate Members: O. F. Bellows, superintendent of construction, War Dept., Fort Morgan, Ala.; L. DeV. Conklin, assistant engineer, Elmira, N. Y.; J. R. Downman, Department of Highways, Borough of Bronx, New York City; Lee Highley, Missouri Pacific Railway, Jefferson City, Mo.; H. A. Reid, New York Rapid Transit Railroad Commission, New York City; R. H. Sears, assistant engineer, East Indian Railway, Cawnpore, India; E. A. Steece, city engineer, Burlington, Ia. Juniors: R. L. Burwell, Harwood, Md.; E. E. Howard, Alexandria, La.; H. C. Ives, Worcester Polytechnic Institute, Worcester, Mass.; G. E. J. Pistor, Newark, N. J.; Clyde Potts, Bayfield, Wis.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv and xxiii.

WATER.

Baltimore, Md.—Bids are wanted Dec. 31 for furnishing and delivering to the Water Board such supplies as may be required for the year ending Dec. 31, 1902, including lead-lined iron pipe, cast-iron pipe and fittings, brass castings, valves, clamps and water meters, cement, etc. Alfred M. Quick, Water Engr.; Thos. G. Hayes, Pres. Bd. Awards.

Washington, D. C.—Bids are wanted Dec. 14 for making detailed design for furnishing and erecting a steam generating equipment, steam piping, etc., at the Trumbull Street Piping Station. John Biddle, Commr., D. C.

San Jose, Cal.—It is stated that bids are wanted Dec. 26 for sinking an artesian well at the Agnew State Hospital, to a depth of 1,000 ft. T. S. Montgomery, Sec'y, 7 West Santa Clara St.

Newburg, N. Y.—The Moodna Light, Water & Power Co., of Newburg, has been incorporated. Capital, $20,000. Directors: H. A. Pressey and H. J. Long, Washington; W. J. McKay, Newburg.

Pleasantville, N. J.—C. T. Leland, 421 Chestnut St., Philadelphia, Vice-Pres. of the Pleasantville Water Co., writes that the contract for constructing a water-works system, estimated to cost $75,000, for Pleasantville and Absecon, will not be opened to public bidding. Howard Ahrens, of Reading, Engr. in Charge.

Devil's Lake, N. D.—Allen Tompkins is offering for sale $25,000 water-works bonds. Contracts for constructing a system estimated to cost $20,000 will be let about March 1, 1902.

Port Arthur, Ont.—See "Power Plants, Gas and Electricity."

Raleigh, N. C.—A new corporation, known as the Wake Water Co., has been formed, with capital of $101,000, and has purchased and will operate the plant and business of the Raleigh Water Co. The officers of the new company are: Julius Lewis, Pres.; A. A. Thompson, Vice-Pres.; F. H. Briggs, Treas.; E. B. Bain, Sec'y and Supt.

Cadott, Wis.—Village Clk. Ross Hardy writes that the contract for constructing water-works has been awarded to Maxey & Gray, of Oshkosh, for $11,000.

Findlay, O.—City Engr. John W. S. Riegle writes that investigations are now pending for a new water supply from wells or springs 11 miles east of city.

Kaufman, Tex.—Mayor Geo. G. Shaw writes that bids will be received in January, 1902, for the construction of water-works, estimated to cost $20,000. Wm. McIntosh, of Houston, Engr. in Charge.

Greeley, Colo.—The Gray Reservoir Co. has been incorporated by J. L. Gray, Edwin Hull and G. W. Bailey to build reservoirs in Larimer and Weld Counties. Capital, $10,000.

Webster Groves, Mo.—Geo. Burnett, of St. Louis, representing the Missouri River Light & Water Co., has made a proposition to furnish this city with a water supply from Missouri River. T. C. Young, Mayor.

San Francisco, Cal.—M. C. Taylor, of 7 Guerrero St., has filed with the Board of Public Works a proposition for supplying the city with water. He offers to supply 47,852,000 gal. daily from the North and Middle Yuba River for $20,000,000, or 71,852,000 gal. daily for $26,233,390.

Dover, N. J.—The Board of Water Commissioners, subject to the approval of the Common Council, has awarded to the Allen & Russell Granite & Construction Co., of Stanhope, a contract for the construction of two reservoirs, to be located on Cold Spring Mountain; contract price, $19,616.

Graham, Va.—Press reports state that the Council is preparing to let contracts for water-works equipment.

New Ulm, Minn.—Plans are said to be under consideration for new machinery for the water station.

Albany, Minn.—Press reports state that this village has ordered plans prepared for a system of water-works.

Wellington, Kan.—Press reports state that the Council has authorized the Mayor and Committee on Pub. Wks. to engage a water expert and electrical engineer to investigate the water-works situation at Wellington, with a view to putting in a temporary pumping station and power house.

Evansville, Ind.—Press reports state that the establishing of a filter plant and meter system is under consideration.

Ontario, Cal.—B. C. Shepherd, Sec'y San Antonio Water Co., writes that a pipe line and power plant are to be constructed at a probable cost of $100,000. Specifications not completed. W. H. Sanders, of Pomona, Cal., Engr. in Charge.

Los Angeles, Cal.—Water-works bonds to the amount of $2,000,000 have been sold by the City Council.

Glace Bay, N. S.—Town Engr. C. M. Odell writes that it is hoped to let contracts in May for the construction of a system of municipal water-works, to consist of 6 miles of 12-in. main pipe; combined gravity and pumping; usual distribution system of 10, 8 and 6-in. pipe, and 70 hydrants. Estimated cost, $130,000.

Cheney, Wash.—The city is considering the proposition to purchase the plant of the Cheney Water Co.

Utica, N. Y.—Mayor Sherman has filed a veto of the resolution of the Common Council, adopted Nov. 15, granting a franchise to the Whitestown Water-Works Co.

Lake Providence, R. I.—Bids are wanted Dec. 18 for constructing a combined water-works and electric light plant, and for the sinking of an artesian well. G. M. Franklin, Mayor; T. J. Powell, Acting Sec'y.

Lincoln, Ill.—The Lincoln, Heat, Light, Water & Power Co. is stated to have been incorporated, with a capital of $50,000. Incorporators: W. A. Thomas, J. W. Collins, and others.

Aylmer, Ont.—Bids are wanted Dec. 14 for $30,000 water-works bonds. Wm. Warnock, Town Treas.

Delano, Pa.—The Delano Water Co. is stated to have been incorporated, with a capital of $10,000, by Thos. W. Huline, of Mount Holly, N. J.; Wm. Anderson, of Overbrook, Pa., and others.

Glenellyn, Ill.—The matter of establishing water-works is said to be under consideration. O. O. Dodge, Pres. of Bd.

Ardmore, Ind. Ter.—This city has granted a 25-year franchise to J. Weldon Baker and associates, of Joplin, Mo.

Springfield, Tenn.—Bonds to the amount of $25,000 have been voted for constructing a system of water-works.

Hartford, Ky.—The Hartford Water Co. has been incorporated by J. W. Ford, H. P. Taylor and R. E. L. Simmerman, with a capital stock of $6,000, its purpose being to supply this city with water.

Charleston, W. Va.—The Charleston Water, Gas & Electric Co., of Wheeling, has been incorporated here for the purpose of owning, maintaining and operating water-works, gas works and electric light and power plants, and to furnish water, light and power to the city of Charleston and elsewhere. The principal office is to be in Wheeling. Incorporators: George E. House, John B. Garden, C. M. Oliver, John A. Howard and George Baird, all of Wheeling. Capital stock, $1,000,000.

Ft. Wayne, Ind.—Bids are wanted Dec. 12 for furnishing and erecting one horizontal compound condensing high duty pumping engine of 6,000,000 gal. daily capacity; said engine shall be capable of pumping 2,000,000 gal. of water per 24 hours with 6 revolutions, and 6,000,000 gal. in 24 hours with 18 revolutions. Wm. Kaough, Water-Works Trustee.

Bird Island, Minn.—Recorder Frank K. Murray writes that on Nov. 11 it was voted to issue bonds for a water supply.

Pueblo, Colo.—Plans have been completed for a water plant to be built by the Pueblo Water Co. on Minnequa Heights, Bessemer. Press reports state that the plant will cost $200,000 and will include a standpipe or reservoir, with a 30-in. main and boilers of 300 H.-P.

Hornellsville, N. Y.—Water bonds to the amount of $50,000 are stated to have been sold.

Richmond, Cal.—The Richmond Light & Water Co. has been formed, with a capital of $25,000, by H. Disque, T. M. Ferguson, Frank A. Edinger and others.

Fayette, Miss.—An additional issue of $14,000 bonds has been voted, with which to build municipal water-works and operate electric lights.

Rockville Center (L. I.), N. Y.—It is stated that bids are wanted by the Village Board until Dec. 10 for $10,000 bonds, to be used to purchase a new pump.

Minneapolis, Minn.—It is stated that bids are wanted Jan. 31 for furnishing boilers and traveling crane for the two 15,000,000-gal. pumping engines in the N. E. pumping station. G. W. Sublette, City Engr.

A special committee has under consideration the proposition to install a filtration plant, estimated to cost $350,000.

Virden, Ill.—The question of constructing a system of water-works is under consideration. Address Mayor Westlake.

Ogden, Utah.—The South Fork Reservoir Co. has been organized, with a capital of $50,000, its object being to build a dam in South Fork Canyon. The officers are W. H. Burrows, of Huntsville, Pres.; F. A. Miller, of Harrisville, Vice-Pres.; George W. Bramwell, of Plain City, Sec'y and Treas.

The stockholders of the Davis & Weber Counties Canal Co. have voted to increase the capital stock of the company from $250,000 to $500,000 for the purpose of making improvements. J. C. Nye, Sec'y of Co.

Birmingham, Ala.—The Jefferson County Medical Society has voted to appoint a committee (Dr. J. C. Le Grande, Chmn.) to co-operate with the Jefferson Co. Sanitary Commission in an investigation of the water supply of this city, and to make every effort to ascertain what is necessary to secure a pure water supply.

Arkadelphia, Ark.—Articles of incorporation have been filed by the Wilson Water & Electric Co., of Arkadelphia. Capital stock, $75,000. The officers are: J. W. Wilson, Pres. and Treas.; J. H. Crawford, Vice-Pres.; Josiah Hardage, Secy.

Port Huron, Mich.—Bids are wanted by the Board of Water Commissioners until Dec. 21 for furnishing and installing a horizontal compound condensing crank and flywheel high duty pumping engine, with all pipings, fittings and necessary appliances. Wm. H. Avery, Consulting Engr.

Los Angeles, Cal.—The Salinas Water, Light & Power Co., of Los Angeles, has filed articles of incorporation. Capital, $200,000. The subscribers are: John M. Gardiner, Los Angeles; R. C. P. Smith, Los Angeles, and others.

Chico, Cal.—City Clk. Richard White writes that contracts will be let after Feb. 1, 1902, for the construction of a system of water-works; bonds for same have been sold to the amount of $45,000.

Woodhull, Ill.—This village has engaged T. S. McClanahan to prepare plans for a new water-works plant, estimated to cost about $15,000.

Albany, N. Y.—Local press reports state that the Clerk of the Board of Contract and Supplies will receive bids for furnishing water meters and parts of meters.

Schenectady, N. Y.—The Board of Water Commissioners has asked for authority to lay an additional pipe line from the Rotterdam pumping station to this city, and put up an additional standpipe. Total amount asked is approximately $115,700.

Berlin, Md.—The City Council is considering the question of constructing a combined system of water-works and electric lights.

Orange, Tex.—The Orange Ice, Light & Water-Works Co. is reported to have voted to sell $50,000 bonds to be used in increasing the boiler and engine power of its plant and extending water mains. J. W. Link, Pres.; Chas. M. Rein, Secy.

Grand Rapids, Mich.—Local press reports state that the following bids were opened Nov. 26 for furnishing the city with a pure water supply: The L. K. Davis Co., of Indianapolis, Ind., bid on 7 propositions, prices ranging from $660,000 to $1,532,000; the T. A. Gillespie Co., of Brooklyn, N. Y., bid on 3 propositions, prices ranging from $1,585,000 to $2,350,000; Edwin C. Low and Chas. Cooper, of Brooklyn, N. Y., bid on 5 propositions, prices ranging from $3,845,000 to $4,995,000.

SEWERAGE AND SEWAGE DISPOSAL.

Seattle, Wash.—It is stated that bids are wanted Dec. 14 for constructing 3 miles of sewers, at an estimated cost of $36,000. R. H. Thompson, City Engr.

New Castle, Ind.—It is stated that bids are wanted Dec. 10 for constructing a sewerage system, approximately 7 miles long. W. H. Adams, Town Clk.

Pueblo, Colo.—Bids are wanted Dec. 23 for constructing combined sewers for sanitary and storm drainage in Sanitary Sewer District No. 1 and Storm Sewer District "A." Geo. F. West, Mayor.

Winchester, Ind.—City Engr. C. C. Yunker writes that the contract for constructing 3,330 ft. of 8 to 10-in. pipe sewer has been awarded to Moorman & Goodrich, of Winchester, for $3,248. The trench to average 12 ft. in depth.

Sheridan, Ind.—Town Clk. D. J. McMath writes that the contract for constructing a sewer system has been awarded to Jas. B. Johns, of Tipton, Ind., for $9,000.

Belleville, Ill.—City Engr. Louis Graner has completed plans and estimates for a brick and pipe sewer soon to be built on West Main St.; estimated cost $13,390.

Glenville, O.—The Village Council has passed an ordinance providing for the improvement of Robinson Ave. and other streets by the construction of storm-water sewers with catch-basins, etc. Ira C. Farley, Clk. to Council.

Pawtucket, R. I.—The City Council has passed resolutions calling for an expenditure of $16,300 for sewer and highway improvements.

Roswell, N. Mex.—The contract for constructing a system of sewers is stated to have been awarded to Matt & Roberts, of Independence, Mo., at a reduced bid of $30,000.

Wilkinsburg, Pa.—Bids are wanted Dec. 9 for constructing a 4-ft. circular brick sewer in the alley in Franklin Land Company's plant. Frease & Sterling, Boro. Engrs.

West New York, N. J.—Press reports state that the contract for constructing Niles Ave. sewer has been awarded to the Metropolitan Construction Co. for $7,000.

Orangeburg, S. C.—Local press reports state that it is proposed to engage an engineer to make surveys, plans and estimates for a sewerage system. L. H. Wannamaker, City Clk.

Los Angeles, Cal.—The City Council has, according to press reports, passed resolutions for 3 miles of sewer construction in the southwest portion of the city.

San Francisco, Cal.—The following estimates for bonds for various purposes have been made to the Board of Supervisors by the Board of Public Works: New schools and repairs, $1,755,000; modern sewerage system, $5,600,000; lands for park and library purposes, $1,595,000; total, $8,950,600.

East Las Vegas, N. Mex.—The Committee on Sewers has recommended the construction of a complete system of sewerage and that an engineer be engaged to prepare plans, specifications and estimates for same. Mr. Money, Mayer.

Pittsburg, Pa.—Numerous ordinances for street and sewer work have been finally passed.

Connellsville, Pa.—Sewer bonds to the amount of $35,000 have been sold.

Boston, Mass.—Bids are wanted Dec. 9 for constructing sewerage works in Walter St. and Outlet, West Roxbury District, Boston. Guy C. Emerson, Acting Supt. of Streets.

Ottawa, Ill.—The citizens are considering the proposition to establish a system of sewerage in that portion of the First Ward lying westward from Christie St. Address Alderman Prichard.

Cincinnati, O.—City Engineer Stanley has been directed to prepare a sewer plan for Elam Ave., in Camp Washington.

Toledo, O.—City Engineer Tonson has prepared plans for sewer district No. 38.

Salina, Kan.—City Clk. A. W. Godfrey writes that the sewer contract, awarded to the Salina Plumbing Co., of Salina, Kan., for $10,994, includes 830 ft. of 24-in.; 2,040 ft. 21-in. and 2,205 ft. of 18-in. sewer, with 13 manholes, 11 catch basins and 2 lamp holes; average depth of trench about 15 ft.

Nashville, Tenn.—Bids are wanted Dec. 19 for 1,936 lin. ft. circular brick trunk sewer, 11 ft. inside diameter. Geo. W. Stainback, Chmn. Bd. Pub. Wks.

Lestershire. N. Y.—The Village Board of Trustees is said to be considering the question of sewerage.

Omaha, Neb.—It is stated that bids are wanted Dec. 26 for furnishing the county with 12, 18 and 24-in. sewer pipe. D. M. Haverly, City Clk.

Vincennes, Ind.—The City Council has, according to press reports, decided to construct a complete system of sewerage. Estimated cost, $100,000.

Durham, N. C.—Contracts for a system of sewers are stated to have been awarded to A. L. Patterson & Co., of Macon, Ga., for the construction and to Montague & Co., of Chattanooga, Tenn., for furnishing the piping. Total amount of contracts, $84,220.

New Albany, Ind.—It is stated that bids are wanted Dec. 16 for constructing a 10-in. sewer in 2 alleys. Thos. M. McCulloch, City Clk.

Philadelphia, Pa.—The Councils' Finance Committee has favorably recommended an appropriation of $270,000 for the construction of a sewer for the relief of Cohocksink sewer.

Opelika, Ala.—This city is reported to have made a contract with the Sanitary Sewer Co., of Philadelphia, for a complete system of sewers, to cost about $30,000. The company to bear the cost and have a contract for 30 years.

Marion, Ind.—It is stated that bids are wanted Dec. 17 for constructing sanitary sewers. Cyrus G. Robbins, City Clk.

Pittsfield, Mass.—The contract for erecting the new pumping station and screen house at the sewage disposal fields has been awarded to J. J. Prinderville, of South Framingham, for $9,548.

Huntington, Ind.—It is stated that bids are wanted Dec. 10 for constructing a 12-in. pipe sewer, with appurtenances, in Washington St. Frank Guthrie, City Engr.

BRIDGES.

Buffalo, N. Y.—Bids are wanted Dec. 20 by the Grade Crossing Commission for constructing the superstructure for a viaduct over the railroad tracks in Louisiana St., as advertised in The Engineering Record.

Bay City, Mich.—Bids are wanted by the County Commissioners until Dec. 14 for a steel drawbridge across the west channel of Saginaw River, as advertised in The Engineering Record.

Sandusky, O.—The Lake Shore Electric Ry. Co. has made an offer to construct a bridge connecting Sandusky and Vermillion, the cost to the County not to exceed $10,000.

Cleveland, O.—The business men of the East Side are contemplating the construction of a steel viaduct to connect the East and West sides of the city, at Huron and Franklin Sts., respectively.

Louisville, O.—It is stated that the Stark Electric Ry. Co. will construct a bridge across the Pittsburg, Ft. Wayne & Chicago Ry. tracks.

Erie, Pa.—The City Engineer has been authorized to report to the Railroad Committee of the Councils an estimate of the cost of constructing a proposed bridge at East Buffalo Road, together with the damages to surrounding property, etc.

St. Joseph, Mo.—Press reports state that the officials of the Chicago, Rock Island & Pacific R. R. Co. have requested the St. Joseph & Grand Island Ry. Co. to strengthen and enlarge the bridge across Missouri River, at St. Joseph, now used jointly by said companies. If improvements are not made, it is stated that the Chicago, Rock Island & Pacific R. R. Co. will construct a steel double track bridge across Missouri River at St. Joseph, to be owned and operated by them.

Worcester, Mass.—Subscriptions are being solicited for the construction of a $150,000 steel bridge to replace present causeway at Lake Quinsigamond. Many business men are interested in this project, among them being Thos. J. Sawyer.

Niles, O.—The County Commissioners have agreed to construct 2 bridges across Mosquito Creek, at a cost of about $6,000.

Indianapolis, Ind.—It is stated that the officials of the Pittsburg, Cincinnati, Chicago & St. Louis Ry. Co. will rebuild their bridge across White River, at Indianapolis.

Leechburg, Pa.—The Apollo, Leechburg & Vandergrift St. Ry. Co. has been granted a charter to construct a bridge across Kiskiminetas River, at Leechburg.

Buffalo, N. Y.—A resolution has been passed by the Board of Aldermen to accept the bid of John Mumm to construct the superstructure and subway under the Pennsylvania R. R. tracks at Fillmore Ave., for $44,237.

Lexington, Ky.—It is stated that the Georgetown & Lexington Interurban Traction Co. will construct a bridge across the Cincinnati Southern R. R. tracks, at a probable cost of $8,000.

Huntington, W. Va.—Reports state that the Huntington Railroad Bridge Terminal Co. has been granted a charter to construct a railroad bridge across Ohio River, between Huntington, W. Va., and Rockwood, O.

Chicago, Ill.—City Engineer Ericson, in his estimates for 1902, has asked for the construction of 13 bridges of the bascule type. at a total estimated cost of $2,100,000.

Minneapolis, Minn.—Press reports state that the widening of Lake St. bridge for the Third Interurban Street Ry. is under consideration.

Santa Monica, Cal.—It is stated that steps are being taken to construct a steel bridge at Ocean Ave., to replace present structure.

Dayton, O.—See "Electric Railways."

Northfield, Mass.—A. G. Moody, representing the bridge committee of the town of Northfield and County of Franklin, has submitted to the Harbor & Land Commissioners preliminary plans for the proposed Schell Memorial Bridge, to cross Connecticut River. The bridge is to be a steel structure, of the cantilever design, on granite piers, and is to have a 352-ft. span. It is given to the town by Frank R. Schell, of New York, as a memorial to his father, and will probably cost $32,000.

Altoona, Pa.—The Citizens' Bridge Committee, appointed to secure plans and estimates of the cost of constructing a bridge or subway at 11th St., has decided against the subway plans because of the cost. The bid submitted for the subway, exclusive of sewerage and street car tracks, was $245,000. The bridge estimate was $108,000 if paved with brick and flagstone, and $83,000 if paved with wood. A motion has been passed to urge the construction of the bridge.

Lansing, Mich.—Plans and specifications submitted for the construction of a bridge at Washington St. have been approved.

Strasburg, Va.—The Board of County Supervisors has appropriated $4,000 to construct an iron bridge across Shenandoah River, at Old Town Ford, near Strasburg.

Bay City, Mich.—City Engineer Thompson has prepared plans for a drawbridge at Henry St., which will replace present structure.

Kenosha, Wis.—It is stated that bids are wanted Dec. 16 for building center pier and approaches to the proposed Middle St. bridge. Gus. Jacob, City Clk.

Saginaw, Mich.—The Common Council has ordered plans and estimate of the cost of moving present bridge from Geisser Ave. to Center St., including construction of approaches; also plans and estimate of the cost of a new bridge at 6th St.

Gonzales, Tex.—The contract for constructing a double track steel bridge across San Marcos River has been awarded to E. P. Allsbury & Son, of Houston, for $5,675.

Port Huron, Mich.—The only bid received Nov. 30 for the construction of a bridge at Military St. was from the Wabash Bridge & Iron Co., of Wabash, Ind., at $27,000 for a life bridge and $19,500 for a swing bridge.

Pendleton, Ore.—Ch. Engr. J. G. Cutter, at Walla Walla, Wash., writes that the Washington & Columbia River Ry. Co. proposes to put in 2 150-ft. spans on concrete abutments for bridge to cross the river at Pendleton. Work to be done next season.

Easton, Pa.—The viewers appointed by the Court of Northampton County have reported in favor of the construction of a new county highway bridge, to be about 600 ft. long, over Lehigh River, at Glendon.

New York, N. Y.—Bids are wanted Dec. 12 for furnishing the Department of Bridges with about 40,900 lbs. iron plates or sheets, painted; 9,050 lbs. half-oval iron, ⅜ in. by 1 in., painted; 3,550 lbs. 4-in. x 4-in. x 5/16-in. iron angles, painted; 800 iron bolts, ¾-in. x 2-in.; 2,800 iron bolts, ¾-in. x ½-in., button heads and square nuts; 9,000 stove bolts, ¼-in. x 1⅛-in., countersunk heads, and 3,600 lbs. iron bars, 4-in. x ¾-in., in 12 lengths of 30 ft. each. John L. Shea, Commr. of Bridges.

West Bay City, Mich.—It is stated that bids are wanted Dec. 13 for constructing a bridge across Kawkawlin River. H. C. Thompson, City Engr.

Cincinnati, O.—Bids are wanted Dec. 21 for repairing 3 bridges and approaches thereto, on the Snider road, Sycamore Township; also for constructing substructure and approaches to bridge on Madisonville pike, Columbia Township. Eugene L. Lewis, Co. Aud.

Norristown, Pa.—It is stated that bids will be asked in about 3 weeks by the Reading Ry. Co. for constructing a bridge across Schuylkill River, at Norristown.

Brooklyn, N. Y.—The following bids were opened Dec. 5 by John L. Shea, Commr. of Bridges, N. Y. City, for constructing a bridge over Newtown Creek, from Manhattan Ave. to Vernon Ave., Boro. of Queens: A, King Bridge Co., 120 Liberty St., N. Y. City; B, Liebmann & Gahagan, 140 Nassau St., N. Y. City; C, United Engineering & Contracting Co., 13-21 Park Row, N. Y. City; D, Bernard Rolf, 39 Cortlandt St., N. Y. City.

Items.	A	B	C	D
Removing old bridge..	$10,000	$5,000	$5,000	$35,000
Remov'g temporary br.	5,000	2,000	2,000	7,000
Removing buildings....	10,000	1,000	500	500
Dredging, 500 cu. yds..	1.50	5.00	.60	.25
Earth excav., 9,000 cu. yds.	3.00	2.00	2.00	.50
Rock excav., 200 cu. yds.	5.00	5.00	1.75	2.00
Earth fill, 23,000 cu. yds.	.25	.30	.50	1.00
Fill, rip rap, etc., 600 cu. yds.*	450	600	510	300
Piles, 40,500 ft.*..........	14,100	16,200	8,100	10,200
Timber, 615 M. ft.*......	26,496	20,300	26,570	25,075
Dry wall, 200 cu. yds..	2.00	3.00	4.00	2.00
Concrete, 3,500 cu. yds..	6.50	7.00	8.00	8.00
Conc. open caisson, 1,000 cu. yds.	7.00	8.00	10.00	13.00
Pneu. caisson work, 1,250 cu. yds..............	25.00	30.00	20.00	20.00
Mas'ry, brk., 90 cu. yds.	11.00	10.00	9.00	14.00
Mas'ry, face, 600 cu. yds.	14.00	15.00	10.00	12.00
Mas'ry piers, 1,100 cu. yds.	14.00	12.00	12.00	10.00
Coping, etc., 8,500 cu. yds.	1.50	1.00	1.60	1.60
Castings, bolts, etc.†...	2,575	1,950	1,619	1,490
Expansion bolts, 50.....	1.00	2.00	100.00	.50
Steel Temp. Br., 240,000 lbs.*	6,750	6,750	12,900	7,275
Steel approach, 3,700,000 lbs.	.041	.05	.036	.046
Steel spans, 2,100,000 lbs.	.053	.05	.04	.046
Machinery‡	16,350	40,000	13,450	18,100
Cast steel plates, 25,000 lbs.	.076	.10	.07	.06
Iron counterwt., 1,252,000 lbs.	.0185	.015	.02	.02
Electric equip.	10,000	10,000	10,000	10,000
Gates, posts, houses, etc.*	19,630	18,500	20,666	12,995
Designs, patent rights, etc., to construct and operate bridge.........	200,000	200,000	200,000	200,000
Totals of whole bid....	$631,198	$636,192	$547,047	$614,803

* Total bids, the amounts being in most cases calculated from a number of separate items in same general class.

† 5,500 lbs. gratings and spouts, and 46,000 lbs. bolts, washers, etc.

‡ 30,000 lbs. re-erected and 175,000 lbs. new.

Note.—In all there are 74 items, of which 46 are included in the foregoing table; the remaining 28 relate to sidewalk and roadway pavement and water and sewer pipes.

Cincinnati, O.—Bids are wanted Dec. 30 for constructing the superstructure; also the substructure and approach work for the St. Clair St. bridge. Geo. F. Holmes, Clk. Bd. Pub. Service.

Victoria, B. C.—Press reports state that the Puget Sound Bridge & Dredging Co., Seattle, Wash., has secured the contract for constructing the Point Ellice bridge, at $92,000.

Eufaula, Ind. Ter.—A bridge is to be constructed, according to reports, across the Canadian River, near Eufaula.

Milwaukee, Wis.—The City Council has agreed, according to local press reports, to accept the bid of A. F. Blues for the construction of the Broadway bridge, at $125,375.

Dravosburg, Pa.—The West Elizabeth & Dravosburg Bridge Co. has been incorporated to construct a bridge across Monongahela River, from Port Vue to Jefferson Township. Incorporators: J. A. and W. T. Pierce, of McKeesport; Chas. H. Kline, R. H. Jackson and E. J. Askey, of Pittsburg.

Lima, O.—Bids are wanted Dec. 14 for constructing an iron or steel bridge, 80 ft. C. to C., and a roadway 26 ft. in the clear, with a total width of 40 ft., across the Ottawa River at North St. C. E. Lynch, City Clk.

PAVING AND ROADMAKING.

Hoboken, N. J.—It is stated that bids are wanted Dec. 11 for grading, paving with Belgian block, etc., on Jackson and Grand Sts. John Haggerty, City Clk.

St. Louis, Mo.—Bids are wanted Dec. 13 for maintaining and keeping in repair for and during a term of 10 years, commencing from the date of contract, the asphalt pavement on portions of numerous streets. Hiram Phillips, Pres. Bd. Pub. Improvements.

Belleville, Ill.—City Engr. Louis Graner has completed plans and estimates for the paving of West Main St., estimated cost $51,151, and "Public Square," estimated cost $8,044.

East Chicago, Ind.—City Clk. H. E. Jones writes that the contract for street improvements has been awarded to La Bounty Morrison & Co., of Chicago, Ill., as follows: stone curb at 65 cts. per ft.; fill, 35 cts. per cu. yd.; macadam, 80 cts. per sq. yd.; estimated total, $45,000.

Cincinnati, O.—Bids are wanted Dec. 13 for grading, setting curb and macadamizing portions of Eden Ave. Geo. F. Holmes, Clk. Bd. Pub. Service.

Cincinnati, O.—Bids are wanted Dec. 21 for improving the John Muhlenkamp road, Sycamore Township, and Oak Ave., Springfield Township. Eugene L. Lewis, Co. Aud.

Wilkinsburg, Pa.—Bids are wanted Dec. 9 for grading, curbing and paving portions of several streets. Frease & Sterling, Boro. Engrs.

New York, N. Y.—Bids are wanted Dec. 12 for widening the roadway on the northerly side of 59th St., between the "Plaza" at 5th Ave. and the "Circle" at 8th Ave.; for furnishing and setting curbstones and paving with asphalt on West 86th St., Boro. of Manhattan; also for setting new curbstones, putting in water supply system, constructing asphalt walks, etc., in the public park bounded by Broadway, Bennett, Herberton and Vreeland Sts., Boro. of Richmond. Geo. C. Clausen, Commr. of Parks.

New York, N. Y.—Bids are wanted Dec. 13 for paving with asphalt block on a concrete foundation portions of Broadway and Audubon Ave., and for repaving with asphalt block, on a concrete foundation, portions of Fourth Ave. and 139th St., Boro. of Manhattan; also for paving with granite block pavement on a sand foundation East 136th St., and for regulating, grading, setting curb, etc., on portions of several streets in the Boro. of Bronx. Jas. P. Keating, Commr. of Highways.

Oskaloosa, Ia.—City Clk. C. Leighton writes that the contract for constructing 4,218 sq. yds. of brick pavement on 3 streets has been awarded to Geo. H. Carlon & Son, of Oskaloosa, at $1.39 per yd.

Pawtucket, R. I.—See "Sewerage and Sewage Disposal."

Columbus, O.—A. G. Pugh, of Columbus, has received the contracts for paving Hickory and Walls Sts., at $4,565 and $1,825, respectively.

Pittsburg, Pa.—See "Sewerage and Sewage Disposal."

Bloomfield, Conn.—Bids are wanted Dec. 16 for constructing a macadam road in the town. W. J. Gabb, 1st Selectman.

Buffalo, N. Y.—Bids are wanted Dec. 18 for paving Bond St., 28 ft. wide, and for repaving Carroll St. R. G. Parsons, Sec'y Bd. Pub. Wks.

New Orleans, La.—Local press reports state that the City Comptroller will receive bids for the repaving of several streets, where the maintenance guarantee has expired.

Pittsburg, Pa.—Bids are wanted Dec. 27 for improving Lincoln Ave. extension and Wildwood Branch Road. W. E. Thompson, Co. Compt.

National Military Home, O.—Bids will be received at the Central Branch, National Home for D. V. S., near Dayton, until Dec. 31, for furnishing material and labor to lay 2,542 sq. ft. of cement pavement and 8,470 sq. ft. cement roadways and crossings. A. J. Clark, Treas.

San Francisco, Cal.—The contract for paving Mission St. with asphalt has been awarded to the Alcatraz Asphalt Paving Co. for $29,297.

Wichita, Kan.—City Engr. H. J. Harding writes that definite plans have not yet been made, but some asphalt paving is contemplated.

Elyria, O.—City Engineer Snow has prepared specifications for the pavement of West Bridge St. next spring, with brick.

Rockford, Ill.—The Board of Local Improvements has been petitioned to macadamize about 9 miles of streets.

Joliet, Ill.—Bids are wanted Dec. 9 for paving with asphalt on Benton and Collins Sts. Laverne H. Hopper, Clk. Bd. Local Improvements.

Buffalo, N. Y.—The Good Roads Committee has reported in favor of buying a steam roller from the Buffalo Pitts Co. for $3,500.

Toronto, Ont.—Brick pavement has been recommended for Welling Ave. Estimated cost, $16,950.

Los Angeles, Cal.—The Council is reported to have passed an ordinance authorizing the improvement of several streets.

Wickford, R. I.—The taxpayers of North Kingstown have voted $32,500 for macadam roads.

Norwich, N. Y.—The Chenango County Board of Supervisors has voted to build, in accordance with the provisions of the Higbie Armstrong law, the Norwich-Plymouth road, for a distance of about 5 miles. Estimated cost, $39,900.

La Crosse, Wis.—City Engineer Powell is quoted as having stated that the Council will do considerable brick paving next year.

Lorain, O.—Local press reports state that there is talk of paving numerous streets next season.

Niagara Falls, N. Y.—City Engr. E. D. Very has estimated the cost of paving Prospect and Niagara Sts. as $13,569.

Brooklyn, N. Y.—The Council has authorized the issue of $31,000 bonds for paving a portion of Hinsdale St. with asphalt.

Grosse Pointe, Mich.—Supervisor Trombly is having plans prepared for the paving of Jefferson Ave., width of highway 100 ft., with one street car track on each side of the road; the macadamized driveway will be 22 ft. wide and about 3 miles in length.

Louisville, Ky.—The contract for paving Von Borries and Castlewood Aves. is stated to have been awarded to the Barber Asphalt Paving Co. at $1.69 and $1.70 per sq. yd. Total amount of contract, about $74,000.

Baton Rouge, La.—Two streets, about 30,000 sq. yds., will be paved with asphalt; bids will be asked within 30 days.

Omaha, Neb.—Bids are wanted Dec. 19 for $46,000 street improvement bonds. A. H. Hennings, City Treas.

Nashville Tenn.—Bids are wanted Dec. 19 for 20,000 sq. yds. granite paving and 25,600 sq. yds. vitrified brick paving. Geo. W. Stainback, Chmn. Bd. Pub. Wks.

Harrison, N. J.—Ordinances have been passed to pave Searing and Reynold Aves., from Grant Ave. to East Newark line, with brick or block, and Central Ave. with asphalt.

Chester, Pa.—Bids are wanted Dec. 16 for paving with sheet asphaltum on a portion of Walnut St. W. T. Cullis, Chmn. Street Com.

POWER PLANTS, GAS AND ELECTRICITY.

Boise, Idaho.—Bids will be received by the Boise-Payette River Electric Power Co. for the construction of its power plant on the Payette River, near Horseshoe Bend. The work consists of the construction of 3½ miles of canal, ¼ mile of flume, masonry head works, waste gates, culverts, bridges and power house of concrete masonry, etc. J. C. Stout, Gen. Mgr.

New Ulm, Minn.—Bids are wanted Jan. 2 for constructing an electric light plant. Chas. L. Pillsbury, Engr., Minneapolis.

Pittsburg, Pa.—Bids are wanted Dec. 9 for one 115 to 125-H.-P. engine and one 75-Kw. 1,200 light dynamo and switchboard. W. E. Thompson, Co. Comp.

Port Arthur, Ont.—W. McBrady, Solicitor for the Anglo-American Power Co. and E. S. Jenison, writes that said parties are interested in the proposed construction of a large power development plant which includes the furnishing of a water supply to various towns.

Denver, Colo.—State Engr. A. J. McCune writes that a company of Eastern and Colorado capitalists propose to dam Grand River at Windy Gap, in Grand County, and construct a plant to furnish power to mines and for other purposes. Estimated cost, $275,000. E. A. Lee, 400 Jacobson Bldg., Denver, Engr. in Charge.

Holley, N. Y.—The citizens are stated to have voted on Nov. 25 to issue $15,000 bonds for the construction of an electric light plant.

Lebanon, Pa.—It is stated that the Lebanon Light Co. has received a franchise to operate and maintain a gas plant.

Los Angeles, Cal.—The Fire Commission is reported to have voted to grant the Suburban Gas Co. permission to construct a gas plant near St. John and Main Sts.

New Castle, Ind.—It is stated that the New Castle Gas & Electric Light Co. will expend about $7,000 in enlarging its plant.

Brooklyn, Mich.—The boiler of the electric light plant of L. W. Greene is reported to have been wrecked by an explosion on Nov. 25.

St. Charles, Minn.—The special committee appointed by Council is stated to have reported in favor of granting a franchise for constructing an electric light plant. Sam'l M. Byrne, Recorder.

Dowagiac, Mich.—The Council is stated to have granted a franchise to Chas. T. Amsden and Earl B. Hawks for a fuel and gas lighting plant.

Lathrop, Mo.—The City Council is reported to be considering the proposition of putting in city electric lights.

Ballston Spa, N. Y.—See "Electric Railways."

Estherville, Ia.—The question of constructing an electric light plant is reported to be under consideration.

Newburg, N. Y.—See "Water."

Jersey City, N. J.—The Hudson County Gas Co. is stated to have secured the contract for furnishing gas lights for the city during the year beginning Dec. 1, at $30 per lamp per year.

Burlington, Ia.—The City Council has contracted with the People's Gas & Electric Co. for lighting by electricity; 2,000 c. p. arcs at $70 per annum; incandescent, 15 cts. per Kw. hour; power, 8 cts. per Kw. hour.

Lake Providence, La.—See "Water."

Lancaster, Pa.—Contracts for furnishing the city with light during the year beginning June 1, 1902, are stated to have been awarded by the Lamp Committee of Councils as follows: For electric lighting, to the Edison Illuminating Co. at $85 per light per yr.; for gas lighting (with Welsbach burner and new style lamp), to the Lancaster Gas, Light & Fuel Co. at $30 per light per yr.; and for gasoline lamps to the Pennsylvania Globe & Gas Light Co., of Philadelphia, which offered to furnish 150 or more Welsbach gasoline lamps, 60 c. p., at $30 per light per yr.

Havana, Cuba.—A. V. Bruce, of Havana, Cuba, is reported to be inspecting certain water powers in Georgia, U. S., to otain ideas to be used in developing Cuban water powers which he controls. It is reported that he contemplates installing a power plant in the rivers near Havana for the purpose of transmitting power for lighting and heating and propelling cars in that city.

Orange, Tex.—See "Water."

Lake Linden, Mich.—Village Clk. Jacob Steffes writes that the question of establishing a municipal electric light plant is under consideration.

Constantine, Mich.—It is stated that the Constantine Hydraulic Co. will employ an electrical and hydraulic engineer to prepare estimates of cost of a water power plant. Adolph Kern, Pres.

Corsicana, Tex.—Mayor Johnson is stated to have instructed A. F. Wood. of the City Council, to ascertain the cost of installing an electric light system to be owned and operated by the city.

Ontario, Cal.—See "Water."

Des Plaines, Ill.—The Village Trustees are stated to have authorized the Committee on Fire and Light to ascertain the cost of a municipal electric light plant.

Kaukauna, Wis.—Wm. Libert, of Kaukauna, is stated to have petitioned the Council for an electric lighting franchise.

Berlin, Md.—See "Water."

Mt. Joy, Pa.—The Mt. Joy Electric Light, Heat & Power Co., of Mt. Joy, is stated to have been incorporated with a capital of $15,000.

Pond Creek, Okla. Ter.—Jno. M. Lewis, Mgr. of the Pond Creek Electric Light & Power Co., writes that bids are now being received for the construction of an electric light plant, estimated to cost $10,000. A 20-ton ice plant is also to be built in connection with light plant.

Poughkeepsie, N. Y.—Local press reports state that the Poughkeepsie Light, Heat & Power Co. proposes enlarging its electric plant on Mill St.

Fayette, Miss.—See "Water."

Plainview, Minn.—W. J. Bonwell, of St. Paul, is reported to be preparing an estimate of cost for an electric light plant for this place.

Charleston, W. Va.—See "Water."

Aylmer, Ont.—Bids are wanted Dec. 14 for $20,000 electric light bonds. Wm. Warnock, Town Treas.

Lincoln, Ill.—See "Water."

Boyne. Mich.—The Council is stated to have granted a 20-year franchise for street and commercial electric lighting to W. H. White & Co. The service is expected to commence Jan. 1, 1902.

Arkadelphia, Ark.—See "Water."

Cleveland, O.—Bids are wanted Dec. 18 for furnishing, lighting, extinguishing and keeping in repair 978 electric lamps for one year. Chas. P. Salen, Dir. of Pub. Wks.

Los Angeles, Cal.—See "Water."

Wolfe City, Tex.—The Wolfe City Electric Light & Power Co. has been incorporated; capital, $10,000. Incorporators: W. R. Setzler and I. Jacobs.

Bryn Mawr, Pa.—See "Schools."

Muscatine, Ia.—The ordinance granting Roach & Giesler a franchise for an electric lighting and power plant is stated to have passed two readings in Council.

ELECTRIC RAILWAYS.

New Haven, Pa.—Bids will be received by the Pittsburg, McKeesport & Connellsville Ry. Co., at the office of the Gen. Mgr., M. R. McAdoo, Rm. 1001, Bank of Savings Bldg., Pittsburg, until Dec. 16 for erecting the main power station; also the main car barn and repair shop of said company, both to be erected near New Haven, as advertised in The Engineering Record.

Ballston Spa, N. Y.—The Village Trustees are stated to have granted the Ballston Terminal R. R. Co. a franchise to construct an electric railroad through Milton Ave., Front, Charlton and High Sts. The company has also made application for a franchise to erect poles and string wires in Ballston Spa for the purpose of delivering and selling current for lighting, heating and developing power for commercial and municipal purposes. J. H. Norris, Supt., Ballston Spa.

Normal, Ill.—It is stated that Jas. E. Johnson, of Bloomington, is about to petition the Town Council for a franchise for an electric railway to be constructed between Bloomington and Normal.

Mitchellville, Ia.—The City Council is stated to have passed an ordinance granting to Geo. F. McKay a right to construct, maintain and operate a street railway.

Minneapolis, Minn.—It is stated that the Twin City Rapid Transit Co. will expend about $1,500,000 on improvements to its system during the coming year. R. C. Taylor, Ch. Engr., Minneapolis.

Dayton, O.—The City Council is stated to have adopted the ordinance granting permission to the People's Ry. Co. to extend its lines in various parts of the city, with an amendment requiring the company to pay $40.000 to the Main St. bridge fund.

Lima, O.—The Western Ohio Ry. Co. of Lima is reported to have increased its capital from $1,000,000 to $3,000,000. It will build new lines from Wapakoneta to Shelby. from St. Mary's to Celina and west to the State line. F. D. Carpenter, Gen. Mgr., Lima.

Lexington, Ky.—The Fiscal Court has granted 10 specific franchises to the Blue Grass Traction Co., for the construction of electric roads between Lexington and surrounding towns of the Blue Grass region. W. L. Longbridge and M. C. Alford, both of Lexington, are among the incorporators.

Ballard, Wash.—The Council is stated to have granted three franchises for electric railways as follows: To the Seattle Electric Co., to Jasper Compton and F. E. Sander.

Little Valley, N. Y.—The Village Trustees are stated to have granted the Salamanca & Little Valley R. R. Co. a franchise to construct and operate an electric railway through the village.

Kingston, N. Y.—The Kingston Consolidated R. R. Co. is stated to have received the consent of the State Board of Commissioners to issue a mortgage for $700,000 and to increase its capital from $250,000 to $400,000. The company has merged the former Colonial Traction Co. of Kingston and will employ the increased capital in the purchase of the Kingston City Road, and for new construction.

Trenton, N. J.—The Camden & Trenton Ry. Co. has petitioned the Council for permission to extend the line. M. B. Perkins, Mgr., Beverly.

Toledo, O.—The Toledo & Northwestern Electric R. R. Co. is stated to have increased its capital from $200,000 to $350,000, and will extend its lines in Michigan.

Danville, Ky.—The Danville Electric Power & Ry. Co., is stated to have been incorporated, with a capital of $10,000, to construct and operate 8 miles of electric railway in Boyle County, between Danville, Junction City and Shelby City. Incorporators: Geo. F. Anderson, C. R. McDowell and others, all of Danville.

Hoquiam, Wash.—The Council is stated to have granted a franchise to Sam'l Benin, of Aberdeen.

Joseph, Ore.—The Joseph & Elgin Electric Ry. Co. has been incorporated, with a capital of $5,000. Incorporators: F. D. McCully, C. E. Jennings and others.

St. Louis, Mo.—An ordinance granting to the Missouri Terminal Ry. Co. the right to maintain and operate a double track passenger and freight railway in St. Louis was introduced in the City Council Nov. 26. M. M. Stephens, Pres., East St. Louis, Ill.

Phillipsburg, N. J.—The Phillipsburg & Washington St. Ry. Co. has been incorporated with a capital of $500,000 by Robt. E. Wright, of Allentown, Pa.; C. M. Bates, of Brooklyn, N. Y., and Wm. M. Davis, of Phillipsburg, to construct a trolley line from Phillipsburg to the cement industries at Alpha, Vulcanite and Washington.

Avoca, N. Y.—It is stated that the Rochester & Elmira Electric Ry. Co. propose constructing its power plant in Avoca.

Mt. Vernon, O.—The Mt. Vernon, Mt. Gilead & Western Ry. Co. is stated to have been incorporated, with a capital of $10,000.

La Salle, Ill.—The La Salle-Peru Electric Ry. is reported to have been purchased by W. V. Coons, Williamson Bldg., Cleveland, O., owner of the Streator Electric Ry. It is stated that he has secured right of way between Peru and Spring Valley and will at once extend the line to that place.

Ripon, Wis.—The Council is stated to have granted the Wisconsin Rapid Transit Co. a franchise to construct a single track railway on certain streets.

Cape May, N. J.—Lemuel E. Miller, of Cape May, and Josiah B. Seybert, of Philadelphia, Pa., are about to petition the City Council for a franchise.

Seattle, Wash.—Wm. H. Lewis has petitioned the Council for a franchise to construct an electric motor freight railway about a mile long. If franchise is secured a tunnel 2,505 ft. long, 14 ft. wide and 20 ft. high will be constructed under Beacon Hill.

Bangor, Mich.—The Council is stated to have granted a franchise to W. H. Patterson for the construction of an electric railway through the village.

Versailles, Ky.—A special committee is stated to have reported to the Woodford Fiscal Court in favor of granting a franchise to W. W. Longmoor and others, of Frankfort, for an electric railway over the McCracken's Mill turnpike, from Versailles to the Franklin County line, and over the Versailles and Lexington turnpike from Versailles to the Fayette County line.

Charlotte, Mich.—The Council is stated to have granted a franchise to the Central Michigan Traction Co., which proposes constructing a line from Grand Rapids to Jackson. W. Aldrich Tateum and C. W. Watkins, of Grand Rapids, are the chief promoters.

Huntsville, Ala.—It is stated that the Huntsville Ry., Light & Power Co. will expend about $25,000 in improvements. A. L. Sweeney, Pres., Huntsville.

Noblesville, Ind.—Geo. F. McCulloch, of Muncie, Pres. Union Traction Co., is stated to have petitioned the Council for a franchise to construct and operate an electric railway in Noblesville.

Princeton, N. J.—The Council is stated to have granted a franchise to the Trenton, Lawrenceville & Princeton Ry. Co.

St. Louis, Mo.—The Commissioners of St. Louis County at Clayton are stated to have granted a franchise on Dec. 2 to the St. Louis, Kirkwood & Manchester Ry. Co. to operate a double-track electric line between this city and Manchester.

Irvington, N. J.—Francis M. Eppley, representing the Essex Cross Ry., which proposes to construct a trolley line from Bloomfield to Elizabeth, is stated to have petitioned the Council for a franchise through Irvington.

RAILROADS

Memphis, Tenn.—The Mobile, Jackson & Kansas City R. R. Co. (F. B. Merrill, Pres., Mobile, Ala.), is stated to have purchased the Kingston & Central Mississippi R. R. and will build north from a point near Augusta, Miss., intersect the Kingston & Central Memphis at Laurel, and extend its line on to Memphis.

Charleston, W. Va.—The Virginia & Southern R. R. Co. is reported incorporated here to construct a railroad from Parkersburg, W. Va., to Newport News, Va. Principal office to be at Clarksburg, W. Va. Incorporators: Chas. W. Lynch, Geo. C. McKinley and others, all of Clarksburg.

Comer, Ga.—Surveys have been completed for the proposed railroad from Comer, a point on the Seaboard Air Line near Athens, to Lavonia, a station on the Southern Ry.

Columbus, O.—It is stated that the Big Four will expend about $100,000 for additions to its terminals in this city. G. W. Kittredge, Ch. Engr., Cincinnati.

Philadelphia, Pa.—The Board of Directors of the Pennsylvania Co., at a meeting here Nov. 27, are reported to have voted to expend about $700,000 for improvements. Thos. Rodd, Ch. Engr., Pittsburg.

Montbrook, Fla.—It is stated that the Wade & McArthur Lumber Co. will construct a railroad about 25 miles in length from this place to the Gulf.

Verdigris, Neb.—A company is stated to have been formed to construct a railroad from Verdigris to Ft. Pierre, S. D. E. A. Houston, of Niobrara, Neb., and John R. Kaucher, of Reading, Pa., are among the incorporators.

Philadelphia, Pa.—It is stated that the Pennsylvania R. R. Co. is about to petition the Council for permission to abolish the grade crossings in the Frankford section. W. H. Brown, Ch. Engr., Philadelphia.

Wilmington, Del.—The Street & Sewer Department is stated to have passed the ordinance allowing the Pennsylvania R. R. Co. to elevate its tracks through Wilmington. Expenditure will be about $6,000,000. W. H. Brown, Ch. Engr., Philadelphia, Pa.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Bloomington, Ill.—Bids are wanted Dec. 12 for erecting a central engine house, 2 fire stations and a patrol barn, estimated to cost $28,000. Elmer Folsom, City Engr.

Toronto, Ont.—Bids are wanted Dec. 18 for erecting an office building and caretaker's residence, on Wellington Ave., in connection with the Cattle Market. O. A. Howland (Mayor), Chmn. Bd. Control.

Racine, Wis.—The Congregation of St. Rose R. C. Church is reported to have under consideration the erection of a $25,000 edifice. F. J. Miller, Chmn. Bldg. Com.

Providence, R. I.—The House is stated to have passed the bill authorizing this city to borrow $20,000 to be expended for additional accommodations in the city hall.

Baltimore, Md.—Louis Levi is stated to have prepared plans for a $20,000 synagogue for the Shearith Israel Congregation, to be erected on McCulloch and Bloom Sts.

Springfield, Ill.—Mauran, Russell & Garden, Chemical Bldg., St. Louis, Mo., are stated to have been selected to prepare plans for the new Lincoln Memorial Library endowed by Andrew Carnegie, to be erected in Springfield.

Poughkeepsie, N. Y.—The Supervisors on Nov. 27 decided to erect a court house and county jail, at a cost not to exceed $150,000, also a county almshouse at a cost of $50,000.

Reidsville, Ga.—It is stated that bids are wanted Jan. 15 for erecting a court house. Bids received Nov. 11 were, according to reports, rejected. B. F. Alexander, Co. Ordinary.

Leroy, Ill.—Rob't Dallard, of Bloomington, is reported to have prepared plans for a $20,000 edifice to be erected by the Leroy M. E. Church. Rev. Thos. Clark, Pastor.

Remsen, Ia.—The St Mary's Catholic Society is stated to have decided to erect a $40,000 church. Rev. F. X. Schultz, Pastor.

Indianapolis, Ind.—It is stated that the First Christian Church will erect a $20,000 edifice. Address, Rev. J. F. Burnett.

Watertown, N. Y.—A. T. Lansing, associated with Orchard & Joralemon, of Niagara Falls, N. Y., has prepared plans for the R. P. Flower Memorial Library to be built on Washington St., at a cost of $50,000.

Hartford, Conn.—Governor McLean is stated to have appointed a commission to report upon a site and plans for a new armory for the First Regiment, C. N. G. Brig.-Gen. Geo. M. Cole, Chmn.

Deer Lodge, Mont.—It is stated that Conrad Kohrs will give this city $15,000 for a memorial library.

Harrisburg, Pa.—It is stated that plans are being prepared by A. Hutton, 400 Chestnut St., Philadelphia, for new buildings to be erected at the State Insane Hospital next spring. Two ward buildings, a kitchen and a mortuary building, to cost about $140,000, will be erected.

Carbondale, Ill.—It is stated that bids are wanted Dec. 20 for erecting a brick and stone church. Edw. S. Patten, Sec'y Bldg. Com.

Billings, Mont.—The City Council is stated to have rejected all bids recently received for the erection of a city hall. New bids will be received.

Merrill, Wis.—Van Ryn & DeGelleke, 211 Grand Ave., Milwaukee, are stated to have been selected to prepare plans for an $85,000 court house for Lincoln County.

Denver, Colo.—The city hall is reported to have been destroyed by fire on Nov. 30.

Akron, O.—Geo. W. Carmichael & Co., of Akron, are stated to have secured the contract for erecting the Summit County jail, for $47,921.

Freemont, Ill.—It is stated that a $20,000 building will be erected at the Stephenson County Farm.

Chippewa Falls, Wis.—The County Commissioners are stated to have adopted a resolution for the erection of a $25,000 court house.

Sheboygan, Wis.—Patton & Miller, 115 Monroe St., Chicago, Ill., are stated to have completed plans for a $25,000 Carnegie Library.

Philadelphia, Pa.—The contract for erecting 3 buildings for the Philadelphia Hospital is reported to have been awarded to John H. Jordan, 2118 Oxford St., for $75,950.

Elreno, Okla. Ter.—The citizens of Canadian County are stated to have voted to issue $65,000 bonds for a court house.

Parker, S. D.—The Turner County Commissioners are stated to have decided to secure plans for a $30,000 court house.

Rossland, B. C.—Bids are wanted Dec. 20 for furnishing and installing a heating apparatus in the public building, Rossland. Fred Gelinas, Secy., Dept. Pub. Wks., Ottawa, Ont.

Richmond, Va.—City Engr. W. E. Cutshaw will prepare plans for a market, brick and iron construction. Cost, about $20,000.

Rome, N. Y.—Bids are wanted Dec. 10 for furnishing and installing a feed water heater, engines and generators, switchboard, feeder cables to ward buildings and connections to switchboard, and erecting cold storage building, at the Rome State Custodial Asylum. Wm. H. Cloher, Jr., Pres. Bd. Mgrs.

Washington, D. C.—Local press reports state that competitive plans will be received by the District Commissioners until Feb. 8 for the municipal hospital to be erected on 13th St. and Arkansas Ave. The contemplated structures will cost several millions.

Baltimore, Md.—The contract for constructing a factory building at the Maryland Penitentiary is stated to have been awarded to John Stack & Sons, 250 W. Preston St., for $41,000.

Galveston, Tex.—C. W. Bulger, Levy Bldg., is stated to have completed plans for a 2-story brick edifice to be erected on 22d St. and Ave. I, for the First Baptist Church, to cost about $20,000.

McRae, Ga.—It is stated that bids are wanted Jan. 13 for erecting a 2-story brick jail and jailor's residence. Geo. M. Willcox, Commr., Bd. Roads & Revenues.

New York, N. Y.—Fire Commissioner Scannell has rejected all bids opened Dec. 4 for the new repair shops to be erected on 12th Ave. and 56th St., all being in excess of the appropriation, which is $200,000.

Atlantic City, N. J.—Appleton & Burrell, 1204 Chancellor St., Philadelphia, Pa., are stated to have received the contract to erect a Seaside Home for Children at Atlantic City, which will cost about $180,000. Architects, Frank Miles Day & Bro., Penn Mutual Bldg.

BUSINESS BUILDINGS.

Danville, Ill.—It is stated that the Danville Buggy Co. will erect a 3-story brick block on Washington Ave. and Van Buren St.

Yankton, S. D.—The Union Building is reported to have been destroyed by fire on Nov. 28.

Alton, Ill.—It is stated that the Chicago & Alton R. R. Co. will erect a union depot here, to cost about $25,000. H. F. Baldwin, Ch. Engr., Chicago.

Watertown, N. Y.—D. D. Kieff, Flower Bldg., has prepared plans for a $20,000 brick business block to be built on Arcade St. Owner, Peter Bergerin.

Lewiston, Idaho.—A company has been formed with $40,000 capital, to build a hotel. M. Scully, Pres.; Ernest McCullough, Sec'y and Architect.

New Haven, Pa.—See "Electric Railways."

Kalamazoo, Mich.—A. W. Buckley, 345 Wabash Ave., Chicago, Ill., is stated to have prepared plans for a 3-story building, 60 x 200 ft., to be erected here for the Michigan Buggy Co., to cost $30,000.

Youngstown, O.—A press report states that the Penhale-Devitt syndicate, of New York and Chicago, has purchased a site adjoining the Tod House, for the erection of a 10-story fireproof office building. Plans have been prepared and contracts for the construction will be let at once. The block complete will cost about $1,000,000.

Evansville, Ind.—The contract for constructing a passenger station for the L. & N. R. R. has been let to Christ, Kanzler & Son for $70,000, including heating and plumbing.

Des Moines, Ia.—Hallett & Rawson, 615 Walnut St., have prepared plans for remodeling the department store of the Seeley-Howe-Levan Co. Owner, Mr. Rothwell, of Boston. Cost, $20,000.

C. E. Eastman, Observatory Bldg., has prepared plans for a 3-story warehouse to be built on Court Ave. for the Bell Improvement Co. Cost, $12,000.

The Des Moines Construction Co. is about to erect a $20,000 Coliseum building. Architect, C. E. Eastman.

Richmond, Va.—W. H. Zimmerman has adopted the plans of J. K. Peebles, of Norfolk, for a 7-story fireproof hotel, 128 x 136 ft., to be erected by him in Richmond. Cost, about $400,000. Drawings will be ready for bids on or before Feb. 1, 1902.

The following bids were opened Nov. 28 by the Architect, A. H. Elwood, Adams and Main Sts., for rebuilding certain portions of Jefferson Hotel: Fuller & Co., New York and Baltimore, $73.551; N. A. Chesterman, Richmond, $86,704; John Drever, Richmond, $75,704.

Delta, O.—It is stated that a brick and stone depot will be erected at this place by the Lake Shore R. R. Co.

Philadelphia, Pa.—Roydhouse, Ayrey & Co., 24 S. 7th St., are stated to have secured the contract for erecting a depot on 52d St. for the Pennsylvania R. R. Co.

Omaha, Neb.—It is stated that the Paxton Hotel will be enlarged and improved at a cost of $55,000.

New York, N. Y.—The 7-story cigar box and veneer factory of Wm. Uptegrove & Bro., at 457 E. 10th St., was burned Nov. 28.

St. Paul, Minn.—A permit has been issued for the improvements to be made to the Hamm Brewery on Minnehaha St. and Payne Ave., to cost $300,000. Builders: F. J. Romer & Sons, 200 Ramsey St.

Cincinnati, O.—D. H. Burnham, Rookery Bldg., Chicago, Ill., is stated to have prepared plans for a 14-story building to be erected by the Cincinnati Traction Co., on 5th and Walnut Sts.

Charlotte, N. C.—Hook & Sawyer, Hunt Bldg., are stated to be preparing plans for an opera house which the Piedmont Realty Co. will erect on South Tryon St., to cost about $32,000.

Boston, Mass.—Plans have been filed for the following buildings: A 5-story warehouse, to be erected on Medway and Binford Sts., South Boston, for the Boston Wharf Co., estimated cost $100,000. M. D. Safford, Archt., 274 R St.; and for a 6-story building for light manufacturing, at 247 Atlantic Ave., near India St., for the Portland Trust Co. Architect, Chas. E. Park, 110 Tremont St.; cost, $87,000; builder, John S. Randall, 120 Tremont St.

Ludington, Mich.—W. G. Cooper & Son, of Saginaw, E. S., Mich., are preparing plans for a $25,000 brick hotel for J. O. Stearns, Ludington.

Fairmont, W. Va.—It is stated that the Fairmont Coal Co. is preparing to erect an 8-story office building. Estimated cost, $100,000.

Brooklyn, N. Y.—The plant of the National Enameling & Stamping Co. on N. 1st St. and Bedford Ave., Williamsburg, was burned on Nov. 28.

Dallas, Tex.—It is stated that the Dallas Lodge of Elks will erect a 3-story building on Main St., to cost about $15,000.

Omaha, Neb.—Local press reports state that T. R. Kimball, McCague Bldg., is preparing plans for a freight house and steel train sheds for the Burlington R. R. at Omaha. Cost, about $75,000.

Duluth, Minn.—Cass Gilbert, 524 Endicott Bldg., St. Paul, is at work on plans for remodeling the building occupied by Paulo & White; cost of work, between $50,000 and $60,000.

Baltimore, Md.—Mr. King, Pres. Security Storage & Trust Co., is reported interested in the construction of a 2-story market house, 150 x 150 ft., with a cold storage plant, to be erected in the vicinity of North Ave. and St. Paul St., at a probable cost of $100,000.

It is stated that Rob't Garrett & Sons, bankers, will erect an 8-story office building on 9 and 11 South St.

The plans of J. H. Parker, 1 Somerset St., Boston, Mass., and Douglas H. Thomas, Jr., Atlantic Trust Bldg., Baltimore, are stated to have been accepted for a white marble building to be erected on Baltimore and Charles Sts. for the International Trust Co.

Harrisburg, Pa.—W. H. Spooner will erect a 4-story office building, 52 x 159 ft., at 11 and 13 Market Sq.

Knoxville, Tenn.—L. C. Waters is preparing plans for a 6-story brick and stone business block, to be erected on Gay St. and Jackson Ave. for Geo. W. Peckel, to cost $80,000.

Los Angeles, Cal.—John C. Austin, of Los Angeles, is reported to be preparing plans for a 5-story hotel to be erected on 4th and Olive Sts. Thos. Pascoe, Mgr.

South Bend, Ind.—The Indiana Lumber Co., of South Bend, has received the contract for erecting the central fire station, for $14,639, and Voelkers & Wahlen, of South Bend, secured the contract for heating same, at $1,470.

St. Paul, Minn.—The lowest bid received by the Capitol Commissioners Dec. 3 for fireproofing the Capitol was submitted by the Northwestern Brick & Fireproof Co., at $205,498. All bids were rejected.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

56th St & 10th Ave, br and stone club; c, $30,000; o, Mission of the Immaculate Virgin; a, Schickel & Ditmars.

120 W 57th St, br and stone hotel; c, $350,000; o, Central Realty Co; a, Harry B Milliken.

5th Ave & B'way, br and stone store, lofts and flat; c, $100,000; o, Rev Eugene A Hoffman; a, John B Snook & Sons.

544 and 546 W 27th St, br factory; c, $35,000; o, John Williams; a, C. H. Caldwell.

73 and 75 E 89th St, br stable; c, $25,000; o, Edmond J Curry; a, Chas Stegmayer.

109th St and Amsterdam Ave, br stable; c, $30,000; o, Esther A Wheaton; a, H'y A Koelble.

495 and 497 B'way, raise bldg 2 stories; c, $100,000; o, A D Juilliard et al; a, Alfred Zucker; br, Thos J Reilly.

DWELLINGS.

Atlantic City, N. J.—Stiles & McClay, of Atlantic City, are stated to have secured the contract for erecting an apartment house here for Capt. John L. Young, to cost about $300,000.

St. Paul, Minn.—Reed & Stem, Endicott Bldg., are reported to be preparing plans for a $20,000 cut stone residence for B. H. Evans, to be erected on Summit Ave. near Kent St.

Chicago, Ill.—H. H. Waterman, 218 La Salle St., is stated to have prepared plans for a 3-story apartment house, 50 x 60 ft., to be erected at 5647-5649 Prairie Ave. for Thos. Reid, at a cost of $25,000.

A. G. Lund, 602 W. 63d St., has prepared plans for 2 flats, one to be erected for Colby Bros. on W. 59th and May Sts., to cost $25,000, the other to be erected at 3140 Prairie Ave., to cost $20,000.

SCHOOLS.

Pictou, Colo.—Bids are wanted Dec. 16 for erecting a school in School Dist. No. 30. G. M. Tombling, Secy. School Dist.

Newbury, Wis.—Bids will be received by the Building Committee until Dec. 21 for erecting a school in Joint School Dist. No. 3, in the towns of Trenton, Saukville and Farmington.

Austin, Tex.—Bids will be received by the Board of Trustees of the Deaf & Dumb Asylum, Austin, until Dec. 10, for erecting a school at said institution. Appropriation, $40,000. H. P. Hillard, Pres.; Olle J. Lorehm, Archt., Binz Bldg., Houston.

West Liberty Borough, Fetterman P. O., Pa. —Bids will be received at the office of J. A. Long, Archt., 1427 Park Bldg., Pittsburg, until Dec. 10, for erecting a 4-room brick school in West Liberty Borough. S. R. Lee, Sec'y.

Westerly, R. I.—The contract for erecting the high school is stated to have been awarded to G. M. Pratt, of Weymouth, Mass., for $43,000. Ross & Seabury, of Boston, secured the contract for the ventilating and plumbing at $5,380.

Newton, Mass.—Pub. Bldg. Commr. Geo. H. Elder writes that the contract for installing a ventilating and heating plant in school on Ash St. has been awarded to Bradlee & Chatman, of Boston, for $5,822.

New York, N. Y.—Bids are wanted Dec. 16 for installing electric light wiring, fixtures and electric bell system of addition to, and alterations in, school No. 22, Boro. of Manhattan; also for a ventilating and heating apparatus in the same; also for installing a ventilating and heating apparatus, electric bell system and gas fixtures of addition to and alterations in school No. 164, Boro. of Bronx. Rich'd H. Adams, Chmn. Bldg. Com., Bd. Educ.

New York, N. Y.—Bids are wanted Dec. 23 for erecting school No. 188. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ.

San Francisco, Cal.—See "Sewerage & Sewage Disposal."

Hamilton, O.—It is stated that bids are wanted by the Board of Education until Jan. 1 for erecting a school, to cost about $35,000.

Wilmington, Del.—Geo. I. Lovatt, 424 Walnut St., Philadelphia, Pa., is stated to be preparing preliminary plans for a 3-story brick convent, 45 x 100 ft., for St. Paul's Parish. Rev. J. J. Monaghan, Rector.

Ann Arbor, Mich.—The Regents are stated to have decided to begin in the early spring the construction of a $100,000 engineering department building.

Lafayette, Ind.—Purdue University is stated to have received $60,000 from Mrs. Eliza Fowler, for the erection and equipment of an assembly hall.

Kingston, N. Y.—Bids are wanted Dec. 19 for $30,000 school bonds, to be used to erect a school in School Dist. No. 11. Chas. M. Ryon, Sec'y Bd. Educ.

Schenectady, N. Y.—All bids received Nov. 18 for erecting a high school are stated to have been rejected, and new bids will be received by the Board of Education Dec. 9.

Bryn Mawr, Pa.—John D. Rockefeller has offered Bryn Mawr College a gift of $230,000 for the erection on the campus of a new dormitory and a central heating and electric light plant, conditional upon the Trustees of the college being able to secure by commencement day, in June, 1902, pledges for the additional sum of $250,000 needed for a library building.

Stanford University, Cal.—It is stated that the contract for erecting the Mechanical Engineering Building at the Stanford University will be let Feb. 1. Chas. E. Hodges, Resident Archt.

Boise, Idaho.—The plans of Wm. Schrage, Shiedley Bldg., Kansas City, Mo., are stated to have been accepted for a 3-story high school, 88 x 118 ft., to be erected on Washington and 11th Sts.

STREET CLEANING AND GARBAGE DISPOSAL.

Newport News, Va.—It is stated that bids are wanted Dec. 16 for constructing a garbage crematory. W. L. Wohl, City Clk.

Peoria, Ill.—A committee has been appointed to look into the matter of securing a garbage crematory.

Boston, Mass.—Plans have been filed with the Superintendent of Streets, by Engr. Charles Edgerton, of Philadelphia, representing the New England Sanitary Product Co., for a garbage disposing plant to be ercted on Spectacle Island, Boston Harbor, in place of the plant on Moon Island, which is to be discontinued. The building will be 160 x 94 ft., with a central section 3 stories high. It will have 40 digesters and 6 large boilers. The contract has been awarded to Jones & Meehan, 1 Beacon St. The work of dredging and construction of the wharf will be started at once. The city of Boston has made a 10-year contract with this company for disposing of its garbage.

Atlanta, Ga.—The city garbage crematory is reported to have been burned. Loss, $15,000.

New York, N. Y.—Contracts for removing snow and ice from the streets have been let as follows: To John F. Maillie, at 36¾ cts. per sq. yd. for the Boro. of Manhattan and 49 cts. per sq. yd. for the Boro. of Brooklyn; to John D. Crimmins, at 34¼ cts. per sq. yd. for the Boro. of Bronx.

Buffalo, N. Y.—Bids are wanted Dec. 17 for the collection and removal of dirt, ashes, garbage and general refuse, from the public and private buildings and places in the city, from Jan. 19, 1902, to June 19, 1903, as follows: For doing the work for a stipulated price per net ton of 2,000 lbs. for garbage (which includes offal, carrion and general kitchen refuse), and per cu. yd. for ashes and other material, in districts Nos. 2, 3, 4, 5, 6 and 7, taken separately or as a whole; also for doing the work in said districts separately for a gross sum per month or as a whole. R. G. Parsons, Secy. Bd. Pub. Wks.

GOVERNMENT WORK.

Ft. Morgan, Ala.—Bids are wanted Dec. 25 for constructing a brick storehouse at Ft. Morgan. Capt. Spencer Cosby, Corps Engrs., U. S. A., Mobile, Ala.

Portland, Ore.—Bids are wanted Dec. 23 for erecting Desdemona Sands Light Station, Ore. Capt. W. C. Langfitt, Engr. 13th Lighthouse Dist., U. S. A.

Mobile, Ala.—Bids are wanted Dec. 28 for furnishing material and making repairs to the South Pass Light Station, La. Bids will also be received Dec. 30 for furnishing material and erecting a depot at Choctaw Point, Ala. Lieut.-Col. A. N. Damrell, Corps Engrs., U. S. A.

New York, N. Y.—The Secretary of the Treasury has accepted the bid of John Peirce, of New York, for the construction up to and including the first story of the New York Custom House at $495,645, the building to be constructed of Fox Island granite. He has conditionally accepted the bid of Mr. Peirce for the construction of the whole building, provided Congress makes a further appropriation sufficient to cover the increased cost.

San Francisco, Cal.—The following bids were opened Nov. 30 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for constructing 2 brick and steel buildings at the Navy Yard, Mare Island, Cal.: *a*, machine shop and foundry complete; *b*, machine shop; *c*, foundry: Thomas Buller, San Francisco, *a* $130,350, *b* $63,797, *c* $63,533; A. M. McElroy, San Francisco, *b* $63,789, *c* $67,429; W. N. Conneaten, San Francisco, *a* $127,964, *b* $62,585, *c* $65,379; Henry Tibbitts, San Francisco, *a* $129,883, *b* $64,190, *c* $67,882; Cotton Bros. & Co., Oakland, Cal., *a* $132,000, *b* $65,500, *c* $67,000; Devar & Quinn, San Francisco, *a* $131,500; *b* $64,500, *c* $67,000; Penn Bridge Co., Beaver Falls, Pa., *a* $141,347, *b* $68,890, *c* $72,454.

New York, N. Y.—The following bids were opened Nov. 30 at the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of a 2-story brick and steel building at the New York Navy Yard. The bids are respectively for the building complete and for the building omtting two elevators: Cramp & Co., Bridgeton, N. J., $83,600, $79,680; Williams & Gerstle, New York City, $88,999, $84,799; Merrick Fireproofing Co., Jersey City, N. J., $84,000, $80,000; R. H. Hood Co., New York City, $84,400 (complete); N. Y. Bridge & Iron Co., New York City, $81,000, $76,000; C. H. Peckworth, New York City, $82,600, $78,600; Herman Probst, New York City, $85,665, $81,645; G. L. Walker, New York City, $92,250, $89,895; J. P. Carlin & Co., Brooklyn, N. Y., $82,793, $79,793; O'Brien & Hoolihan, Syracuse, N. Y., $81,300, $76,200.

Fort Monroe, Va.—The contract for erecting barracks at Fort Monroe has been awarded to Frank Pidgeon, of New York, for $58,956. The contract for the guard house at the same place has been awarded to J. H. Bronson, for $21,125.

Annapolis, Md.—The following bids are stated to have been opened Nov. 27 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for the construction of cadets' quarters, terrace and colonnades at the United States Naval Academy, Annapolis: John Peirce, New York, $2,764,500; the George A. Fuller Co., Philadelphia, $2,739,732; Doyle & Doak, Philadelphia, $2,629,000, and E. M. Noel and D. W. Thomas, of Baltimore, Md., $2,448,000.

Ft. Sam Houston, Tex.—The bid of Wm. G. Schuwirth, of San Antonio, Tex., $14,435 in amount, has been accepted for plumbing in barracks, officers' quarters, etc.

Charleston, S. C.—The report of the board ordered to lay out a general scheme for developing the naval station at Charleston has been submitted to and approved by Mordecai T. Endicott, Ch. of the Bureau of Yards & Docks, Navy Dept., Washington, D. C. The report recommends that Cooper River be dredged to a depth of 32 ft. below mean low water; and sites for the following improvements have been located on "Chicora Park" and "Lawton tracts"; a re-entrant basin for vessels undergoing repairs, with 2 dry docks in prolongation of this basin, workshops, store-houses, offices, officers' quarters, coaling station, hospital, marine barracks, etc. A crematory is isolated in a distant part of the station. It is recommended that an independent fire service be provided, pumps being located in the power house, and utilizing river water; also that piers and sea wall, about the basin and dry dock, be paved with Belgian block and the streets about the station be paved to a width of 30 ft. with macadam, sidewalks to be of concrete. It is also recommended that the electric power and lighting plant be installed in the building for steam generators, engines and dynamos of the pumping plant.

MISCELLANEOUS.

New Orleans, La.—The Board of Port Commissioners has awarded the contract for constructing a steel shed (900 ft.) over Henderson St. wharf, to the American Bridge Co., of New York, at its bid of $1,741 per 100 lin. ft.

Montreal, Que.—Local press reports state that the Harbor Commissioners contemplate building Windmill Point wharf, concrete construction, estimated cost $520,000. It is stated that bids for the year's supplies, including sand, cement, etc., will be received by said Commissioners until Dec. 17.

St. Cloud, Minn.—It is stated that bids are wanted Dec. 13 for constructing about 17 miles of ditches. J. D. Morgan, Engr., 812 7th Ave. So., St. Cloud.

Seattle, Wash.—Local press reports state that the Pacific Packing & Navigation Co. has planned to expend about $200,000 in the construction of a dock and the enlargement of its wharf facilities.

San Francisco, Cal.—The Supervisors' Street Committee has recommended that work in connection with Telegraph Hill be done in accordance with a report made by the City Engineer, which contemplates the changing of the grades, the establishment of a new street and the construction of a tunnel about 950 ft. long. Cost, approximately $430,000.

Stillwater, N. Y.—The State Canal Board has approved plans for the construction of a dam across Beaver River at Stillwater. Appropriation, $82,500.

Utica, N. Y.—Bids are wanted Dec. 20 for furnishing all material and rock required to change, straighten and turn the Mohawk River at Utica, as advertised in The Engineering Record.

Washington, D. C.—Bids are wanted Dec. 19 for furnishing 9,000 bbls. of Portland cement to the District of Columbia, as advertised in The Engineering Record.

Bloomfield, Mo.—It is stated that bids are wanted Jan. 7 for constructing about 857,095 cu. yds. of drainage ditches in 2 districts. J. N. Punch, Co. Clk.

Cleveland, O.—Bids are wanted Dec. 12 for constructing a retaining wall at the north end of Hamlet St. Chas. P. Salen, Dir. Pub. Wks.

San Francisco, Cal.—See "Sewerage & Sewage Disposal."

Providence, R. I.—An appropriation of $15,000 for the improvement of the new harbor at Block Island has passed both branches of the General Assembly.

NEW INDUSTRIAL PLANTS.

The Michigan Buggy Co., Kalamazoo, Mich., will erect a 3-story, 60 x 200-ft. brick wood-working plant, with power house, dry kilns, etc., and is in the market for two 80-H.-P. boilers, a 100 to 125-H.-P. Corliss engine, 30,000-ft. dry kiln, hot-blast heating system, wood-working machinery, and an 8 x 12-ft. elevator.

Lord & Watson, Chase City, Va., are erecting a 50,000-ft. lumber mill.

The Hyattsville, Md., Mfg. Co. is in the market for a 2 or 3-H.-P. gasoline engine and other machinery for a broom factory.

The Port Huron, Mich., Brewing Co. is erecting a new plant, to have an annual capacity of 15,000 bbls., ice plant, elevators, etc. The contract for the brewery complete has been let to the Huetteman & Cramer Co., of Detroit.

The Detroit River Sugar Co., Detroit, Mich., will erect a 5-story, 241 x 120-ft. brick and steel construction sugar house; also additional buildings of approximately the same size, at Ecorse, Mich. The boiler capacity will be 1,800 H.-P.

Kenney & Co., Scottdale, Pa., have incorporated with a capital of $125,000 to erect machine shops, contracts for which have not been let.

The Cannon Metal Wheel Works, Ltd., Pontiac, Mich., contemplate erecting a 2-story, 80 x 200-ft. factory.

The Clipper Lawn Mower Co., Norristown, Pa., is erecting a 3-story, 150 x 40-ft. building and will want a 55-H.-P. boiler and a 25 to 35-H.-P. engine.

For ice plant at Pond Creek, Okla. Ter., see Power Plants, Gas and Electricity.

The Nungesser Electric Battery Co., Cleveland, O., is erecting a 2-story, 130 x 140-ft. factory, and will install a 100-H.-P. steam plant.

The Florida East Coast Commercial Co., Oak Hill, Fla., will erect a refinery having a daily capacity of 25 tons, and a hardwood sawmill.

The Thos. Forman Co., Ltd., Detroit, Mich., makers of hardwood floors, will erect a 100 x 225-ft. main building, 50 x 65-ft. power building, 100 x 200-ft. storage warehouse and four dry kilns having a capacity of 350,000 ft.

The Planters' Oil Works, Clarksdale, Miss., has been organized, with a capital of $75,000, to erect a 4-press oil mill, having a daily capacity of about 75 tons, and will be ready to take up the matter of machinery Jan. 1. C. L. Wortham, Gen. Mgr.

The Missouri National Brewing Co., Joplin, Mo., has been organized, with a capital of $300,000, and will erect a brewery with a daily capacity of 200 bbls. and an ice plant with an annual capacity of about 15,000 tons.

BUSINESS NOTES.

The Rochester Bridge & Construction Co., Rochester, N. Y., has been incorporated, with a capital of $40,000. The directors are: J. M. Shultz, of Syracuse, and F. R. Stockley and F. C. Lee, of Rochester.

The Standard Construction Co. of Indiana, with principal office at Lafayette, has been incorporated, with a capital of $100,000, to construct bridges and buildings. The directors are Allen R. Jewett, Addison Bybee, Nicholas W. Box, Hiram Kerlin, Arthur A. McKain, Charles A. Meeker and Jacob F. Marks.

The Empire Asphalt Co. has been incorporated, with a capital of $500,000, by Edward J. McIlvain, Pittsburg; Samuel B. Goucher, Toronto; Frederick R. Pratt and Edgar R. Hollenback, New York; William M. Deutsch, Elizabeth, and Horace C. Price.

The business of the Best Steam Engine & Boiler Works and the Eureka Bark Mill Co., Lancaster, Pa., will be carried on by James B. Best, executor for the estate of the late John Best.

The Ball Engine Co., Erie, Pa., reports receiving the following orders: A 175-H.-P. engine to the Modoc Coal & Mining Co., Jacksonville, O.; a 300-H.-P. tandem compound direct-connected engine for the American Ordnance Co., Bridgeport, Conn., and an engine for the Evansville, Wis., Water, Light & Power Co.

The Crocker-Wheeler Co., Ampere, N. J., is so pushed that it has for some months been working a regular night shift. Among shipments made during the last month are two 520-K. W. generators for the American Smelting & Refining Co., Perth Amboy, N. J.; three 400-K. W. and one 100-K. W. for the Alsen Cement plant, West Camp, N. Y.; a 400-K. W. generator for the Christensen Engineering Co., Milwaukee, Wis.; a 300-K. W. generator for the Balbach Smelting & Refining Co., Newark, N. J.; three 200-K. W. generators for the Stetson & Co.'s new power plant, Philadelphia; a 375-K. W. generator for the Anglo-American Provision Co., Chicago; a 400-K. W. and a 75-K. W. generator for the Lake Shore & Michigan Southern R. R.; a 200-K. W. generator for the Vandergrift Construction Co. for railroad work; a 200-K. W. generator for the Crucible Steel Co., Blair, Pa.; a 150-K. W. generator for Latrobe Steel Co.; a 200-K.W. for the Otis Elevator Co., and a 100-K. W. generator for the United States Tube Co. The company has also completed the shipment of the 45-K. W. direct-connected generator and fifty or sixty motors for the Government Printing Office at Manila, P. I. Among the orders recently received are noted the following: Two 300-K. W. generators for the Singer Manufacturing Co., South Bend, Ind.; two 200-K. W. belted generators for Sayre & Fisher, Sayreville, N. J.; a 60 and a 30-K. W. generator for the Orange Brewing Co., with motors ranging from 35 to 2 H. P. in capacity; four 140-K. W. generators for the Fort Hill Chemical Co., Rumford Falls, Me.; two 75-K. W. generators for Henry Lang & Co., Newark, N. J.; a 90-K. W. generator for the United States Electric Lighting Co., Washington, D. C. Shipment of 13 motor-dynamos for the Western Union plant, Milwaukee, and the electrical equipment of the Skinner & Sethman Publishing Company's plant, Denver, Colo., consisting of a 40-K. W. generator and 28 motors, will also be made this month.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Dec. 9.	Pipe, Atlantic City, N. J Adv., Eng. Record, Nov. 23, 30.	Nov. 23
Dec. 10.	Riverdale, Ill Adv., Eng. Record, Nov. 30, Dec. 7.	Nov. 30
Dec. 10.	Wilmington, O	Nov. 9
Dec. 11.	Topeka, Kan	Nov 23
Dec. 12.	Hattiesburg, Miss	Nov. 23
Dec. 12.	New York, N. Y	Nov. 30
Dec. 12.	Ft. Wayne, Ind	Dec. 7
Dec. 14.	Washington, D C	Dec. 7
Dec 16.	Crow Agency, Mont	Nov. 30
Dec. 16.	Trinidad, Colo	Nov. 23
Dec. 17.	New York, N. Y	Oct. 19
Dec. 18.	Philadelphia, Pa	Nov. 16
Dec. 18.	Lake Providence La	Dec. 7
Dec. 21.	Port Huron, Mich.	Dec. 7
Dec 21.	Tunnel, etc, Cincinnati, O Adv., Eng. Record, Nov. 23 to Dec. 7	Nov. 23
Dec. 26.	San Jose, Cal	Dec. 7
Dec. 31.	Baltimore, Md	Dec. 7
Dec. —	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. 31.	Minneapolis, Minn	Dec. 7
Jan. —	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 9.	Wilkinsburg, Pa	Dec. 7
Dec. 9.	Boston, Mass	Dec. 7
Dec. 10.	Huntington, Ind	Dec. 7
Dec. 10	New Castel, Ind	Dec. 7
Dec. 10.	Portsmouth, O	Nov. 30
Dec. 11.	New York, N. Y	Nov. 30
Dec 11.	Seattle, Wash	Dec. 7
Dec. 16.	New Albany, Ind	Dec. 7
Dec. 17.	Marion, Ind	Dec. 7
Dec. 19.	Nashville, Tenn	Dec. 7
Dec. 23.	Pueblo, Colo	Dec. 7
Dec. 26.	Omaha, Neb	Dec. 7
	BRIDGES.	
Dec. 10.	New Brunswick, N J Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 12.	Saginaw, Mich	Nov. 9
Dec. 12.	New York, N. Y	Dec. 7
Dec. 13.	West Bay City, Mich	Dec. 7
Dec. 13.	Covington Ind	Nov. 23
Dec. 14.	Vincennes, Ind	Nov. 23
Dec. 14.	Melan arch bridge, Des Moines, Ia Adv., Eng Record, Nov 9, 16.	Nov. 9
Dec. 14.	Steel bridge, Des Moines, Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 14	Bay City, Mich Adv., Eng. Record, Dec 7.	Dec. 7
Dec. 14.	Lima, O	Dec. 7
Dec. 16.	Kenosha, Wis	Dec. 7
Dec. 16.	Boise, Idaho	Nov. 16
Dec. 17.	Topeka, Kan	Nov. 30
Dec. 20.	Memphis, Tenn	Nov. 30
Dec. 20.	Viaduct, Buffalo N. Y Adv., Eng. Record, Dec. 7.	Dec. 7
Dec. 21.	Cincinnati, O	Dec. 7
Dec. 27.	Harrisburg, Pa	Nov. 30
Dec. 30.	Cincinnati, O	Dec. 7
Jan. 8.	Victoria, B. C Adv., Eng. Record, Nov. 16 to Dec. 7.	Nov. 16
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Dec. 9.	Joliet, Ill	Dec. 7
Dec. 9.	Wilkinsburg, Pa	Dec. 7
Dec. 11.	Hoboken, N. J	Dec. 7
Dec. 12.	New York, N. Y	Dec. 7
Dec. 13.	New York, N. Y	Dec. 7
Dec. 13.	Cincinnati O	Dec. 7
Dec. 13.	St Louis, Mo	Dec. 7
Dec. 14.	Cincinnati, O	Nov. 23
Dec. 14.	Newport News, Va	Nov. 23
Dec. 16.	Bloomington, Conn	Dec. 7
Dec. 16.	Chester, Pa	Dec. 7
Dec. 18.	Buffalo N. Y	Dec. 7
Dec. 19.	Nashville, Tenn	Dec. 7
Dec. 21.	Cincinnati, O	Dec. 7
Dec. 27.	Pittsburg, Pa	Dec. 7
Dec. 31.	National Military Home, O	Dec. 7
	POWER, GAS AND ELECTRICITY.	
Dec. 9.	Pittsburg, Pa	Dec. 7
Dec. 10.	Wilmington, O	Nov. 9
Dec. 11.	New York N. Y	Nov. 30
Dec. 18.	Lake Providence, La	Dec. 7
Dec. 18.	Cleveland, O	Dec. 7
Dec. 19.	New York, N. Y	Nov. 30
Dec. 19.	Brooklyn, N. Y	Nov. 30
Dec. 23.	Franchise, San Leandro, Cal	Nov. 23
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
Jan. 2.	New Ulm, Minn	Dec. 7
Jan. 22.	New Orleans, La Adv., Eng. Record, Nov. 30, Dec. 7.	Nov. 30
——	Boise, Idaho	Dec. 7
——	Pond Creek, Okla. Ter	Dec. 7
	GOVERNMENT WORK.	
Dec. 9.	Ft. Washington, Md	Nov. 30
Dec. 11.	Milwaukee, Wis Adv., Eng. Record, Nov. 2, 9.	Nov. 2
Dec. 12.	Mobile, Ala	Nov. 16
Dec. 15.	Crow Agency, Mont	Nov. 30
Dec. 16.	Light House, Baltimore, Md Adv., Eng. Record Nov. 23.	Nov. 23
Dec. 16.	Metal Work for Lighthouse, Baltimore, Md. Adv., Eng. Record, Nov. 23.	Nov. 23
Dec. 16.	Cincinnati, O Adv., Eng. Record, Nov. 23 to Dec. 7.	Nov. 23
Dec. 17.	Creston, Ia Adv, Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 17.	White Earth, Minn	Nov. 30
Dec. 21.	Washington, D. C	Nov 9
Dec. 21.	Baltimore, Md Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 23.	Portland, Ore	Dec. 7
Dec. 26.	Ft. Morgan, Ala	Dec. 7
Dec. 27.	Hardwood floors, Washington, D. C Adv., Eng. Record, Nov 30, Dec. 7.	Nov. 30
Dec. 27.	Elevator enclosures, Washington, D. C. Adv., Eng Record, Nov. 30, Dec. 7.	Nov. 30
Dec. 28.	San Juan, Porto Rico	Nov. 30
Dec. 28.	Bremerton, Wash	Nov. 30
Dec. 28.	Repairing light station, Mobile, Ala	Dec. 7
Dec. 30.	Depot, Mobile, Ala	Dec. 7
Jan. 4.	Bremerton, Wash	Nov. 30
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23 to 30.	Nov. 23
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 8.	Baltimore, Md Adv., Eng. Record, Nov. 30, Dec. 7.	Nov 30
Jan. 14.	Portland, Ore.	Nov. 23
	BUILDINGS.	
Dec. 9.	Building material, New York N. Y.	Nov. 30
Dec. 9.	Armory improvements, Troy, N. Y.	Nov. 30
Dec. 9.	Observation Pavilion, Brooklyn, N. Y.	Nov. 30
Dec. 9.	School, New York, N. Y	Nov. 30
Dec. 9.	School, Brooklyn, N. Y	Nov. 30
Dec. 9.	School, Schenectady, N. Y.	Dec. 7
Dec. 10.	Htg. public bldg., Rome, N. Y	Dec. 7
Dec. 10.	Pub. bldg, Austin, Tex	Dec. 7
Dec. 10.	School, W. Liberty Boro, Fetterman P. O., Pa	Dec 7
Dec. 10.	Courthouse, Jasper, Ark	Nov. 30
Dec. 11.	Business Building, Mason City, Ia	Nov. 23
Dec. 11.	City Hall, Bridgeport, Conn	Nov. 23
Dec. 11.	Hospital, Polk, Pa	Nov. 23
Dec. 12.	School, Pittsburg, Kan	Nov. 23
Dec. 12.	Engine house, Bloomington, Ill	Dec 7
Dec. 16.	School, San Marcos, Tex	Nov. 23
Dec. 16.	Jail, Boise, Idaho	Nov. 23
Dec. 16.	School, Columbus, O	Nov. 23
Dec. 16.	Car barn, New Haven, Pa Adv., Eng. Record, Dec. 7.	Dec. 7
Dec. 16.	Htg., etc., in schools, New York, N. Y	Dec. 7
Dec. 16.	School, Picteu, Colo	Dec. 7
Dec. 17.	Library, Mankato, Minn	Nov. 23
Dec. 18.	Pub. bldg., Toronto, Ont	Dec. 7
Dec. 19.	Town Hall, Warren, O	Nov. 30
Dec. 19.	Public building, Springfield, Ill	Nov. 30
Dec. 20.	Court house, Des Moines, Ia Adv., Eng. Record, Nov. 16, 30	Nov. 16
Dec. 20.	Htg. public bldg, Rossland, B. C.	Dec. 7
Dec. 20.	Church Carbondale, Ill	Dec 7
Dec. 21.	School Newbury, Wis	Dec. 7
Dec. 23.	School, New York, N Y	Dec. 7
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
Jan. 15.	Church, Pensacola Fla	Nov. 30
Jan. 1.	School, Hamilton, O	Dec. 7
Jan. 13.	Jail, McRae, Ga	Dec. 7
Jan 15.	Court house, Reidsville, Ga	Dec. 7
Feb. 1.	Library, Muncie, Ind	Nov. 23
Feb. 1.	University bldg., Stanford University, Cal	Dec. 7
Feb. 8.	Hospital plans, Washington, D C	Dec. 7
——	Hotel Richmond, Va	Dec. 7
	MISCELLANEOUS.	
Dec. 9.	Garbage building, Newport News, Va	Nov. 23
Dec. 9.	Electric railway, Van Wert, O	Nov. 23
Dec. 11.	Garbage disposal, Cincinnati, O	Nov 23
Dec. 12.	Garbage crematory, Dallas, Tex.	Nov. 23
Dec. 12.	Retaining wall, Cleveland, O	Dec. 7
Dec. 13.	Ditches, St. Cloud, Minn	Dec. 7
Dec. 14.	Trusses, etc for dredge, Portland Ore	Nov. 30
Dec. 16.	Garb. crematory, Newport News, Va	Dec. 7
Dec. 16.	El. ry. power house, New Haven, Pa Adv, Eng. Record, Dec. 7.	Dec. 7
Dec. 17.	Garb. disposal, Buffalo, N. Y	Dec. 7
Dec. 17.	Cement, etc., Montreal, Que	Dec. 7
Dec. 19.	Port. cement, Washington, D. C. Adv., Eng. Record, Dec 7.	Dec. 7
Dec. 20.	Mohawk R straightening, Utica, N. Y. Adv., Eng. Record, Dec. 7.	Dec. 7
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Jan. 6.	Library, Niagara Falls, N. Y.	Nov. 23
Jan. 7.	Drainage ditches, Bloomfield Mo	Dec. 7
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 2

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

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The Report of the Isthmian Canal Commission.—I.

The Isthmian Canal Commission has completed its examinations and the final report has been made public, although the magnitude of its volume has prevented it from yet appearing in print as a whole. It will be remembered that a preliminary report was made by the commission about a year ago, and that certain main features of the final conclusions were then set forth, subject to such minor modifications as a more complete set of data and further extensions of surveys might make necessary. That report was printed in The Engineering Record a year ago, together with a discussion of its leading features.

The work of the commission constitutes a series of explorations, examinations and surveys, more extended and of greater magnitude than has ever before been completed in connection with a great engineering work in a comparatively unknown country. Indeed, it is evident from the scope of the work laid out and executed by the commission that practically a final survey for the Isthmian Canal on the Nicaragua Route has been made, and data have been secured on both topographic and sub-surface conditions sufficiently comprehensive and exact to reach not only accurate estimates of costs, but also to base on them contract plans and specifications. The main Nicaragua line and some alternatives have been accurately surveyed on the ground, and all structures, including the locks and the great dam at Conchuda, have been located. An extensive set of borings have been completed along the center line of the entire route, with well-considered groups of both jet and diamond drill borings into bed rock at the sites of locks, dams and waste-ways. Diamond drill borings have also been made sufficient in number to develop subaqueous rock surfaces along the prism of the canal, so as to find a location involving the least amount of rock excavation, particularly in the upper reaches of the San Juan River toward Lake Nicaragua. Although these data are both comprehensive and complete enough to justify a location of the canal line from the Caribbean Sea to the Pacific Ocean in Nicaragua, it does not appear that the commission's location is to be considered absolutely final in all its details. The general location of the line will not be changed even by the developments of actual construction, but it is quite possible that at a few points of heavy or difficult construction, minor improvements of alignment may be found.

It is to be remembered that a tropical country like Nicaragua, especially that portion of it between Greytown and Lake Nicaragua, which is subject to continual and heavy rainfall throughout the entire year, does not offer the same facilities for topographic observations as a region with a temperate climate, where both forest growths and smaller vegetation are less dense. In the country between Lake Nicaragua and the Caribbean Sea the forest is so dense that it is impossible, over the greater portion of the route, to take a sight of even 50 feet without cutting away the vegetation. Under such circumstances preliminary operations like reconnaissances are only made in the most laborious manner and at an exceedingly slow rate, and it is impossible to determine where valleys or low saddles may be found away from the course of the river without exploring practically every square rod of ground.

The operations of the commission have settled conclusively and finally all the main features at least of the Isthmian Canal problem. It is absolutely certain that there are no other routes from the Atrato River in the one direction to Lake Nicaragua in the other, so practicable and feasible as those at Panama and across Nicaragua. The commission's explorations and surveys on the Isthmus of Darien show that the shortest line across the isthmus is on the San Blas Route, between sixty and seventy miles east of the Panama, but that a ship tunnel about 4¼ miles long would be required on it. The tunnel feature of this line may be considered as settling its practicability and feasibility. The Caledonia Route is somewhat more practicable, but cannot be seriously considered in comparison with the two routes which have occupied so much popular attention during the past twenty-five years.

So much being settled, the work of the commission narrowed down to a selection between Panama and Nicaragua. The former route has been completely located and surveyed for a considerable number of years, and both the old and new Panama companies have done much work on it; the principal features of this route, therefore, were fairly well known before the commission was appointed. The exhaustive work of examination and survey done by the commission on the Nicaragua route, to which allusion has already been made, puts it in an equally well-known condition with the Panama line. In spite of the voluminous literature which has already been brought forth in connection with the Nicaragua Route, comparatively little was certainly known about it of a technical character prior to the work of the Nicaragua Commission, which completed its report at about the time the Isthmian Canal Commission was created. The work of the latter has supplemented the former with a far greater mass of information, better adapted to engineering estimates and intelligent discussion.

The first prominent feature of the report of the commission is the demonstrable conclusion that both the Panama and the Nicaragua routes are entirely practicable and feasible. The clearing of that broad and crucial question is not the least among the results accomplished by the commission's work. In the times of the old Panama Canal Company, when the Isthmian atmosphere was beclouded with a continuous series of wild claims and egregiously distorted statements, it was a question whether the construction of the Panama canal on any plan was a feasible enterprise. While few American engineers have had any doubts about the feasibility of the Nicaragua route, serious claims as to its infeasibility have emanated from sources too well informed and too responsible to be ignored. It is a substantial point gained, therefore, to be assured beyond a doubt that both routes are entirely practicable and feasible.

Another main feature of the report, indeed it may be considered the most important single feature of all, is the amount of the estimated costs of the canal as designed for the two routes. It will be remembered that the estimated cost of the Nicaragua canal in the commission's preliminary report was $200,540,000. Contrary to usual experience in such matters, the commission's complete estimate, as made in the final report, brings the estimate down to $189,864,062, a decrease of not far from $11,000,000 from the sum named in the preliminary report. This decrease is understood to be due to certain improvements in the alignment, reducing the amount of work to be done, and a more nearly accurate classification of materials revealed by the borings along the line. The total estimated cost of completing the canal on the Panama route is now found to be $144,233,358, a sum but slightly changed from the preliminary estimate. In order to determine the total cost of constructing the canal on the Panama route, however, it is necessary to add to the preceding sum the price at which the rights and property of the New Panama Canal Company can be acquired. The commission estimates this cost at $40,000,000, but the New Panama Canal Company estimates the value of the same rights and property at $109,000,000, which the commission considers unreasonable. It is not to be doubted, however, that the French company would be willing to part with its property at a considerably lower figure than that which it first named. Indeed, it would not be surprising if an offer of hard cash no greater than the commission's estimate would ultimately be found quite satisfactory. The decision, therefore, as to the relative costs of the canal on the two routes depends largely upon what sort of a bargain, if any, can be made with the new French company. It is reasonable to imagine that some later developments in this respect may be reached before the present Congress adjourns.

Again, as the commission points out, both the governments of Nicaragua and Costa Rica must grant concessions and treaty rights before a canal can be constructed on the Nicaragua route, just as the government of Colombia must grant concessions and accord treaty rights to the United States Government before the Panama canal can be built. Inasmuch as all of these governments are in a state of chronic bankruptcy, or very near it, they will desire to improve such a good business opportunity, and charge the United States Government for these concessions all that the bargain will stand. The commission indicates that this feature of the cost is one that is to be carefully considered, and it is not difficult to imagine that although the definite recommendation of the report is in favor of the Nicaragua route, the ultimate cost of the requisite concessions and treaty conditions may be an element in the final selection of a route for construction.

These are among the more prominent business and political features of the report, and they indicate that the wide scope of operations outlined in the law which created the commission has been thoroughly occupied and worked.

They embody the considerations which will probably have almost, or quite, controlling weight in the Congressional treatment of the question. The features which will excite the most interest in the minds of engineers, however, are those of a more nearly engineering character, and they will receive detailed comment in the next issue of The Engineering Record.

The Pennsylvania Railroad Terminal in New York.

The most interesting engineering report of the week was unquestionably the announcement that the Pennsylvania Railroad Company had abandoned its project to cross the North River by a $100,000,000 bridge and would seek to enter New York by a tunnel route, which Messrs. Jacobs & Davies have been studying for some time. It has been known that the bridge project was hanging fire, because the various railways with terminals on the Jersey shore of the North River were averse to paying large sums to the Pennsylvania Railroad toward building such a structure without having any voice in the management of the enterprise, which that company refused to grant. It was also known that the company had been acquiring property along the water-front of New York Bay and near 34th Street, which showed a purpose to greatly enlarge its terminals in some way. In addition to all this, a Pennsylvania company, the Long Island Railroad, had announced that it would soon begin work on a tunnel connection between its terminal at Long Island City and the heart of Manhattan Island.

The last fact is of much interest in connection with the official statements made on Wednesday by Mr. Cassatt. The Long Island Railroad is a small suburban affair with no through business, depending for its very existence on the high rates made possible by the absence of all competition. But the late Austin Corbin, who made it what it is, saw in it the last link of a trunk line. He dreamed of through trains from the West to Montauk Point, and of lines of ocean greyhounds and freighters making that place their American port, rather than New York Bay. Whether that scheme is an influence in the Pennsylvania's purchase of this suburban system, now as isolated as a patient in a pest house, remains to be seen. The Pennsylvania officials do not tell their plans to every caller, but they have filed in the County Clerk's office in New York plans showing that the Long Island system has been acquired to enable through trains to be run from Western and Southern points into New England. For this purpose use may be made of the proposed bridge, illustrated in The Engineering Record of May 12, 1900, from Astoria on Long Island to Port Morris, where there are already large terminals belonging to the New Haven system.

The official announcement of this great engineering undertaking, given out by President Cassatt, reads as follows:

"The Pennsylvania Railroad Company is now prepared to carry out its policy, long since adopted, of extending its railroad into New York City, therein establishing a suitable passenger terminus for the accommodation of the public.

"To accomplish this on a comprehensive plan the Long Island Extension Railroad Company will withdraw its application for powers to construct its terminal railroad, and in lieu of such independent construction it is now proposed to build, under the charter of the Pennsylvania New York Extension Railroad Company, just organized, and a New Jersey railroad company, about to be organized, a through underground connection between the Long Island Railroad and the Pennsylvania lines in New Jersey, and to construct a proper and commodious joint underground terminal station in New York City for the Pennsylvania and Long Island Roads.

"After years of exhaustive study the conclusion has been reached that a tunnel line, operated by electricity, is in every way the most practical, economical, and the best, both for the interests of the railroad company and of the city. The line as adopted, will traverse the City of New York from the Hudson River to the East River, and be underground throughout, and at such depth as not to interfere with the future construction of subways by the city on all its avenues, similar to the one now building along Fourth Avenue.

"As the railroad will be wholly underground and operated electrically, in the same manner as the recently constructed Orleans Railway Extension in Paris, it will not be objectionable in any way. There will not be any smoke, dirt or noise, and as all the surface property may be built upon after being utilized underneath for railroad purposes, the neighborhood of the station will be improved instead of marred, as is often the case when railroad lines are constructed on the surface or elevated.

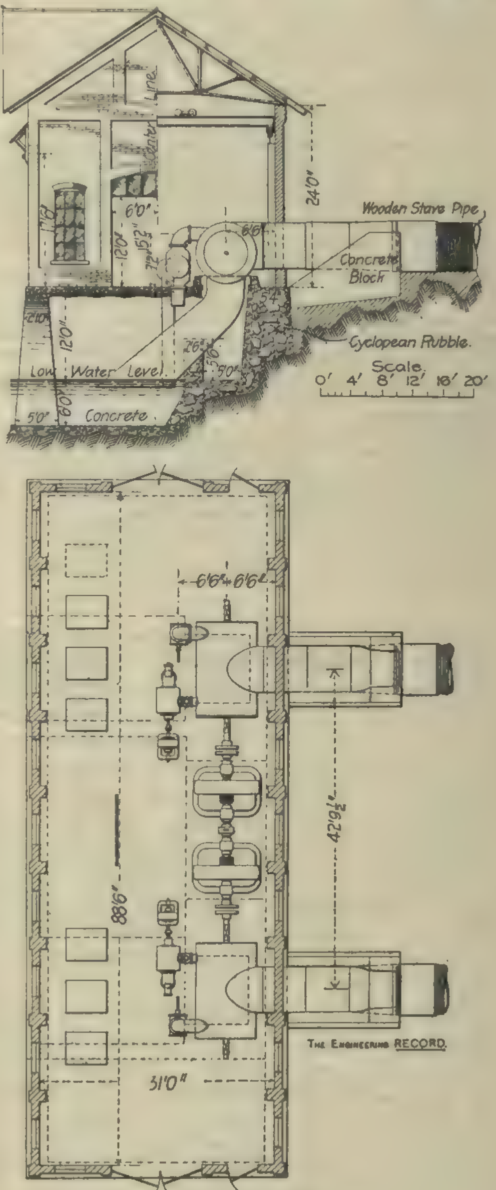
"The company has acquired the bulk of its property for its principal station and means to go forward in the acquisition of such additional properties as will be required, either by purchase or condemnation, in the belief that the city authorities will meet the application in a spirit of fairness and expedite as much as possible this much-needed improvement and great public convenience. Immediately upon the necessary authority being granted the work of construction will proceed and the whole line be completed and put in operation as soon as possible."

The plans show tunnels under 31st and 32d Streets and part of 33d Street, connecting with two subaqueous tunnels of a new type, patented by Mr. Jacobs, under the North River and prolonged to a surface connection at Newark, N. J., and four under the East River with approaches rising to a main surface station near East New York on Long Island. The chief engineering interest lies in the enormous passenger station in New York, 800 feet long and 500 feet wide, between Seventh and Ninth Avenues. This terminal will be one of the most unique railway stations in the world, as it will have to accomodate underground the passenger and baggage movement of a focal point of this great railway system as well as considerable through traffic to and from New England and the local Long Island commutation traffic, doubtless becoming much larger in volume when these improvements raise life on the Island from semi-imprisonment to rational existence.

The Growth of the Correspondence School system is well shown in some figures given out at the tenth anniversary of the International Correspondence Schools of Scranton a short time ago. This institution was started in 1891 as the Correspondence School of Mines. The first student was a coal miner, Thomas Coates, who has now worked his way up from the lowest position in a colliery to that of mine superintendent. At the outset less than ten people were required to conduct the school's affairs, while to-day there are needed about 2,500 employees at Scranton, in the sixteen district offices and on the six cars which are traveling over the railways of the country all the time for the benefit of the railway employees who are taking the school's courses. The number of students now enrolled is about 341,500. The headquarters of the enterprise ten years ago were easily housed in a couple of rooms in a Scranton office building, while to-day they have accommodations in 18 buildings.

The Truckee River Electric Power Plant.

No small amount of interest has been elicited in the plant of the Truckee River General Electric Company, formed to furnish to the silver mines along the famous Comstock lode electric current generated by water power obtained from the Truckee River at Floriston, Cal., over thirty miles distant. The Comstock lode is situated on the east flank of the Sierras at Virginia City, and, up to the time of the installation of the Truckee River plant, power for mining, milling and pumping was obtained chiefly through the use of steam generated with wood costing from $8.50 to $15 per cord as fuel. A small quantity of water was also brought to Virginia City through a flume 40 miles in length, which was paid for at the rate of $240 per miner's inch per year. The cost of power at Virginia City was so great that most of the milling was done on the Carson River, 15 miles distant, where water could be obtained at reasonable cost, the ore being shipped by rail to that point.



The Generating Station.

A dam of timber cribwork filled with rock and sheathed with 4-inch plank has been built, having a length of 142 feet and a height of 7 feet, the cribs at each end being built about 10 feet higher as a protection to the abutments in time of high water. As the stream is fed by the snows of the Sierras the rise and fall is marked, amounting to about 8 feet. Five headgates, separated by walls of 12 x 12-inch timbers built up into cribs above and at the sides, and built into the head of a canal on the north bank of the river above the dam, control the water. The gates proper are constructed of wood sliding in angle guides, and are operated by means of screw stems and hand wheels. The canal, which forms a settling pond as well, is about 600 feet long and from 20 to 100 feet wide. From the canal the water enters a flume through a finger bar screen 28 feet wide. The fingerbars, scour gate and spillway are maintained in place by cribwork similar to that in the dam. The flume is 8,600 feet long, 6 feet 8 inches high and 10 feet wide, converging from the width at the screen to this size within 40 feet from the screens. The flume is constructed of native pine, and its capacity is 300 cubic feet per second with a depth of 6 feet in the flume. Spillgates are fitted at intervals by means of which the flumes may be emptied quickly in case of accident. For 200 feet back of the penstock, a spill flume 5 feet 8 inches wide is built alongside the main flume to take the spill water when the penstock gates are closed. The penstock, measuring 36 x 20 feet, is built of heavy pine braced with ¾-inch iron rods. It is divided by a bulkhead, and from one of the compartments two pipe lines are run. The flow of water to each pipe is controlled by three wooden gates in the bulkhead, operated by hand wheels from a platform above. Water flows to the wheels through these pipes, which are 6 feet in diameter and 160 feet in length, built up of redwood staves bound with ⅝-inch round steel bands. Where joints come in abutting staves, a metallic tongue of ⅛-inch sheet iron is fitted into the ends of both. A few feet from the power station the wooden piping terminates in steel pipes, which are continued to the station and riveted to the wheel casings.

The power house, located near the river bank, is 88 feet long and 31 feet wide. The foundations and tailraces are of concrete, and the roof is built of corrugated iron supported on steel trusses and wooden purlins. An overhead traveling crane, supported on I-beams, running the length of the building, spans the interior. The roofs of the tailraces, which are 18 feet in depth, are formed by springing concrete arches between steel I-beams, and the floors are concrete protected by heavy planking. In the station are two pairs of 27-inch horizontal McCormick turbines, each pair developing 1,400 horse-power, running at 400 revolutions per minute under a working head of 84¼ feet. The wheel casings are of heavy plate steel, and the buckets of the runners are of cast steel, with heavy bands around them. Heavy cast-iron brackets are bolted to the wheel case, the bases of which are planed off to fit similar brackets on the I-beams which support the wheel cases. Each pair of turbines discharges into a cast-iron draught box in the center of the casing, to which is riveted a single draft tube. These tubes are 20 feet long, and increase from 54 inches to about 72 inches in diameter at their outlets. Lombard governors are used for operating the gates, and there are Ludlow balanced valves operated by wire ropes passing on sheaves mounted on the shafts of the two gates and on countershafts. The levers operating the Ludlow valves are placed between sheaves, and the wire ropes are fastened to them in such a manner that the revolution of the gate shafts on opening or closing the gates closes or opens the valves in the opposite direction, thus maintaining an approximately constant velocity of flow in the pipe lines, whatever variation of load may be taking place. The water thus diverted would otherwise be wasted over the spillways or dams, and by this means a much closer regulation is maintained, as the inertia of the volume of water in the pipes does not have to be considered. The valves discharge into the tailraces and are connected to the wheel casings by short lengths of steel pipe.

One 750-kilowatt Westinghouse three-phase, 500-volt generator is direct-connected to each pair of wheels by means of flexible couplings. The generators may also be connected together by means of a rigid coupling, so that both machines may be driven from one pair of wheels. The flexible couplings were designed by the Westinghouse company. Two 22½-kilowatt multipolar exciters are driven by separate turbines operated at 975 revolutions per minute. Either exciter will excite the fields of both machines, thus insuring a reserve machine. The exciter turbines are connected by a short length of pipe to the casings of the large wheels and discharge into their respective tailraces.

The 500-volt output of the machines goes to a switchboard of three panels, one being used for the exciters, the other two for the generators, by means of which either generator may be connected to a set of three oil insulated 22,000-volt transformers. From the high-tension side of the transformers leads run to high potential switches. All high potential wires are run on glass insulators, and the switches are arranged so that either or both sets of transformers may be used on either of the two three-phase trans-switches and lightning arresters the two three-multiple. After leaving the high-tension switches and lightning arresters the two three-phase circuits go through an aperture in the power house wall to the pole line.

The Power Station of the Truckee River General Electric Company.

Redwood poles 11 inches square and 30 feet long, tapering to 7 inches square at the top, are used. Lock insulators, carried on eucalyptus pins, are carried by cross-arms. The three wires receive one complete turn of transposition in a length of 150 poles. In this way the current is carried on poles 139 feet apart for a distance considerably over 30 miles, the size of wires being calculated to limit the transmission loss in voltage to 10 per cent.

At Virginia City, a sub-station is erected for supplying the Consolidated California & Virginia mine. By means of transformers three-phase current is transmitted to the mines at 2,200 volts. The sub-station is similar in design to the main station, but is smaller. Here are also installed recording watt-meters. A loss of 4 per cent. between the sub-station and the mines is allowed. The mines are being operated by electric hoists driven by 200-horse-power induction motors geared to the hoists. Motors are connected to the air compressors by means of belts, while current for the underground stations is taken down the shaft to the 1,800-foot level by means of a lead-covered cable.

An interesting feature connected with the plant is the contract for the sale of power. The clause relating to the measurement of power delivered provides that current and power shall be measured by recording instruments at the sub-station, and that the number of horse-power furnished shall be determined by the maximum demand reading of such recording instruments. In determining what is the maximum demand during any month the highest readings of the instruments for any period of time exceeding five minutes are taken, except where any motor direct-connected to a hoist is used, in which case the maximum demand shall be determined by the highest reading of the meters for any time exceeding two minutes.

The Engineering Offices of San Francisco had in charge the engineering work connected with the design and installation of the plant, and the Pacific Construction Company, of the same city, were the contractors for the construction of the dam, flume, pipe lines and building.

The Interprovincial Bridge at Ottawa.—II.

The construction of the bridge was delayed so much by the steel famine of 1899, that materials ordered from the mills were not received at the bridge shops in time for the erection to be commenced in August, 1900, as planned, and when finally begun in the following December it had to be carried on through a severe winter, which involved much additional delay and expense. The river is subject to 20-foot floods, and has a high-water current of about 4 miles an hour. It has a low-water depth of nearly 80 feet under the south anchor arm, and from 25 to 65 feet between piers 1 and 4, where the rock bottom is covered with a mass of sawdust and mill refuse 50 feet deep, which is very tough and hard to penetrate and has many long and heavy logs and slabs embedded in it.

These conditions made it difficult to drive pile bents there, and four steel-frame scows were built to support the falsework under the anchor arms and the 247-foot span. Each scow was 100 feet long, 26 feet wide and 8 feet deep over all and weighed 150,000 pounds, and unloaded, had a draft of 13⅜ inches. Each side of the scow was stiffened just inside the sheathing by a riveted steel truss 6¼ feet deep and 98 feet long. The trusses had T-shaped top and bottom chords composed of pairs of angles, back to back, and X-brace web members composed of single angles. The chord angles were light at the ends of the truss and very large and heavy in the center, where they were reinforced by deep vertical web plates which served as connections for the web members. The trusses were shipped from the bridge shop in three sections each, and the scows were built at the site by the erection gang. In each scow the lower chords of the trusses were connected together by fifteen transverse 15-inch I-beams riveted to the connection plates for the web members at panel points. The top chords were connected together by transverse timbers bolted across the horizontal flanges and there was no deck planking, except for small platforms needed to support pumps, etc.

Four scows were arranged at equal distances apart and connected together by a pair of Howe trusses 20 feet deep, about 230 feet long and 25 feet apart on centers. These trusses were connected in turn by transverse top and bottom struts and X-bracing at panel points, and were bolted to the top chords of the scow trusses and knee-braced to them by timbers. The Howe trusses supported, at alternate panel points, framed pony bents with longitudinal knee-braces, which carried wooden stringers on which the permanent trusses were assembled. Each scow was calculated to carry a maximum net load of 750,750 pounds, and, when placed under the anchor arm, water ballast was admitted until they attained a draft of 6 feet, corresponding to the weight of the span to be supported. As the erection progressed and steel weight was placed on them careful observations were made and the water was daily pumped out to keep the elevation of the falsework constant within an inch or two.

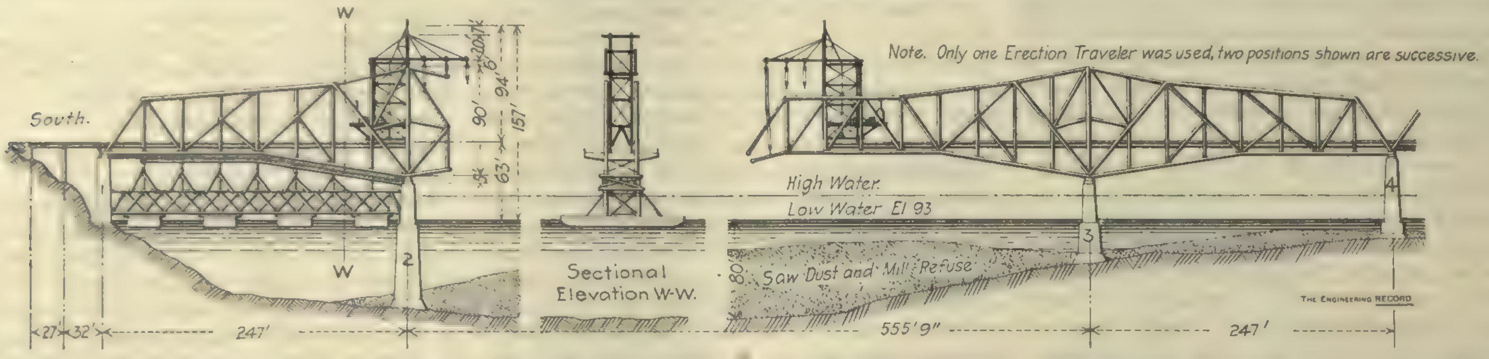
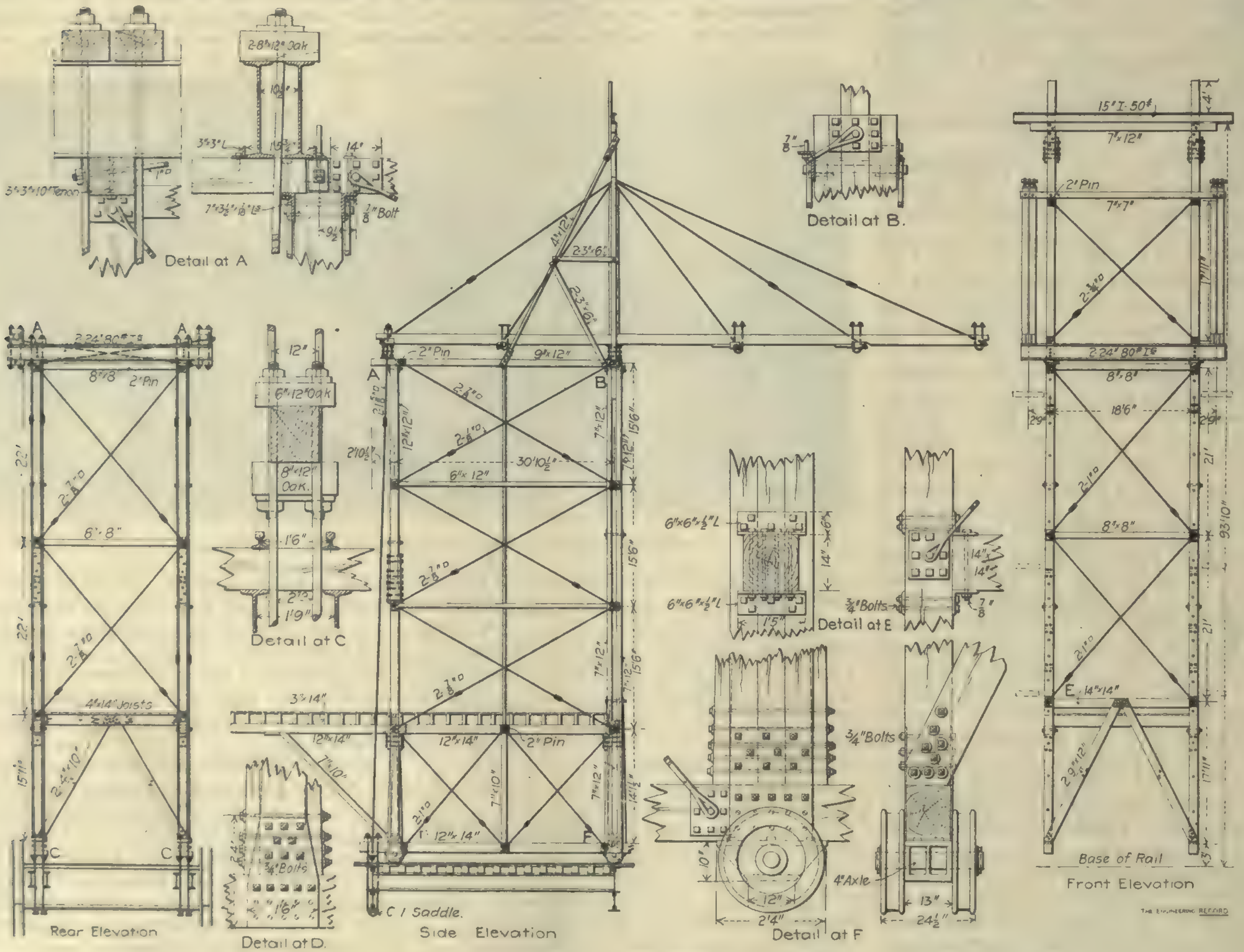


DIAGRAM OF GENERAL METHODS OF ERECTION OF INTERPROVINCIAL CANTILEVER BRIDGE.



DETAILS OF THE CANTILEVER TRAVELER.

The fixed 247-foot span was first erected on the floating falsework by the traveler, which was afterward used for the cantilever and anchor arm trusses. Before its completion the weather became so cold that the river was closed with ice, and when this was cut away and an attempt was made on February 1 to move the scows around to the position required for the erection of the opposite anchor arm, very great difficulty was occasioned by the frazil or sludge ice, which filled the river with a spongy mass above the top of the sawdust deposit and often rose 2 feet above the surface of the water. It was stiff and adhered so tenaciously to the bottoms of the scows that it was necessary to sweep them with ropes passed underneath and dragged from end to end. As soon as the ropes had passed, however, the frazil ice appeared to stick again as tightly as ever, and caused a resistance so great that two hoisting engines operating ordinary four-part tackles were unable to move the scows in an otherwise clear open channel cut through the ice. They were finally started by more tackles operated by eight teams of horses and sometimes reinforced by additional tackles operated by men. It was estimated that a pull of 150 tons was required to move the scows a little at a time, and only about 4 feet a day was accomplished, with many breakages. Under these conditions it took four weeks to move the scows about 1,100 feet, which could have been accomplished in 4 hours in the fall or in 4 days through solid surface ice if there had been no frazil ice to contend with.

By the time the scows were moved it was too late to erect the first anchor arm before there was danger of the ice breaking up and wrecking the falsework, so operations were suspended until the spring of 1901, when the two anchor arms were successively erected on the scows by the cantilever traveler moving on the horizontal roadway platform instead of directly on the top of the falsework, which was inclined to correspond with the bottom chords of the trusses. The anchor arms were self-supporting and were strengthened against erection strains by the addition of temporary wooden braces to the centers of the main inclined end posts and by reinforcing the bottom connections of the suspended posts to support the traveler.

The traveler consisted essentially of a pair of triangular trusses about 28 feet deep and 76 feet long, set on top of a rectangular tower 18½ x 28 feet on centers and 63 feet high. A pair of transverse I-beams were set over each bent of the tower and the trusses were seated on their overhanging ends and anchored to the bottom sills of the tower by pairs of adjustable rods at the rear ends. Each of the two front posts of the tower was made with three pieces, the center one being continued 30 feet above the top of the tower to carry one end of a transverse lifting beam. The overhanging trusses were connected together by X-bracing in the plane of the horizontal bottom chords, and at panel points supported transverse beams, from which the hoisting tackles were suspended. All the compression members of the tower and trusses were made of wood, and the tension members were square steel rods with screw ends and loop eyes engaging connection pins which passed through the compression members and their pairs of bolted steel connection plates.

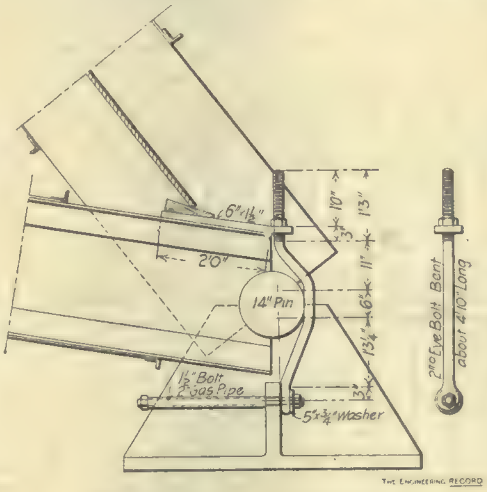
The tower was mounted on four 2-foot double-flange wheels and had, 19 feet above the rail, a working platform with a floor bracketed 20 feet beyond the posts in the rear to give a long lever arm for the engines, boilers, etc., which were set there to act as efficiently as possible as counterweights. The transverse sway bracing was, in the lower panel, replaced by knee-braces, which left a clear A-shaped open space in the center, giving clearance for the delivery through the traveler of the bridge members on trucks on a center material track from which they could be handled by the overhang tackles. In operation, to secure reaction for loads on the overhang, the traveler was anchored by U-bolts, which engaged semicircular saddle castings under the floor-beams of the assembled structure, and had nut bearings on the ends of the sills.

During erection bent rods were bolted as keepers over the lower chord pins in the feet of the main vertical posts, to prevent any danger of their kicking out of the half hole in the shoe under the unbalanced stress from the diagonal posts before the end post of the cantilever arm was connected. During erection all splices in the bottom chords of the anchor arms and in the top chords of the suspended span, and all diaphragms in the posts, were kept completely bolted or riveted.

Pin U_{14} fits tight in a round hole in the top chord of the suspended truss and passes through a slotted hole in the horizontal strut U_{13} U_{14}. During erection it was engaged by the loops of two 2¼ x 2¼-inch U-bars about 6 feet long, which had, at the opposite end, 3¼-inch screw ends and nut bearings on a cast-iron block, with a vertical bearing on a set of slotted steel shim-plates packed against the ends of longitudinal diaphragms in the strut. The end lower-chord pins of the suspended span were similarly arranged with expansion bearings in the struts, but were provided with rollers and wedges to keep them at any required position in the slots. When these joints were assembled the wedges and U-bolts were set so as to make the center trusses a little too high and a little too long, and when the final connection in the center was made that joint was easily brought to exact bearing by slacking off on the U-bolts and on the wedges, two men with a long wrench being able to turn each nut.

The plate-girder viaduct was erected by an overhead traveler which had a long timber platform mounted on two wheels at each end and running on the permanent standard gauge track. Over the forward wheels there was a two-post vertical bent with a long boom pivoted to the foot of each post and the topping lift tackles attached to the cap across the top of the bent. Two inclined posts in the transverse plane of the bent were seated on its bottom sill, and their divergent tops were tied together; each supported a hoisting tackle which hung clear of the traveler and viaduct. The hoisting engine and boiler were set at the end of the platform over the rear wheels and served as a counterweight for the boom loads.

In erecting the anchor arms, the tower traveler acted also as a viaduct traveler, assembling the roadway platform in advance from its forward overhang, and then moving along it to assemble the next panel, and so on. It assembled all bottom chord and lower web members, and completed all bottom chord main connections, and, after returning idle to the anchor pier, moved back to the main pier, completing the trusses behind it as it advanced and then built them out in front, one panel at a time, to the center of the suspended connecting span, which was erected as a cantilever. When the traveler reached the middle of the channel it was taken down, carried across the river, reassembled on the Hull shore, and similarly erected the anchor and cantilever arms there. The scows were anchored in the middle of the river, between main piers, and the lower chords of the suspended span were blocked up from its falsework to afford a partial support and facilitate making the final connections.



Erecting Clamp on Main Shoe.

The bridge was built for the Ottawa & Gatineau Railway Company, Mr. Guy C. Dunn acting chief engineer. The plans were approved by Mr. Collingwood Schreiber, deputy minister of railways and canals for the Dominion Government, and were also examined and reported on by Mr. Robert C. Douglas, bridge engineer for the Department of Railways and Canals. The superstructure was built and erected by the Dominion Bridge Company, Montreal, Mr. Phelps Johnson, manager, and Mr. C. H. Duggan, chief engineer. Mr. H. D. Bush was the engineer in charge of erection, and Mr. Fred P. Shearwood was in charge of the drawings and computations.

The Austin Dam is to be rebuilt if the members of the Water and Light Commission of the Texas city can influence the voters to approve the step. At a recent meeting they passed a resolution to "select from among the citizens of Austin seven men in favor of rebuilding the dam, to confer and consult with the Commission and aid it in devising ways and means for reconstructing the dam and power house." A considerable part of the dam is still standing in an apparently uninjured condition, and it is proposed to utilize it in the repairs.

Sewage Disposal at Wauwatosa, Wis.

Wauwatosa is a residential suburb of Milwaukee, having a population of about 3,000. Some time ago Messrs. Alvord & Shields, sanitary engineers of Chicago, were retained to design a system of sewage disposal for the city, and the plant which has been built and is now being operated by them is one of the most interesting in the country. As originally designed, it was to include a septic tank, then single-contact bed treatment, and finally sand filtration. Owing to lack of funds the contact beds were omitted and the area of the sand filters increased to one-quarter acre. The works have a nominal capacity at present of 60,000 gallons per day, so the filters are worked at the rate of 240,000 gallons per acre per day. The sewerage system comprises about 4.6 miles of sanitary sewers, with a hundred house connections. The water supply of the town comes from a large artesian well, which sends to waste about 200,000 gallons of water not required by the consumers. The sewer system is conveniently located to the overflow from the well, so that any amount of the waste water desired can be taken into the system. During September and October the full quantity has been flowing through the plant, producing an average daily quantity of 245,000 gallons. For the following information concerning the works The Engineering Record is indebted to the engineers and the "Municipality," a publication issued by the officials of a number of Wisconsin cities.

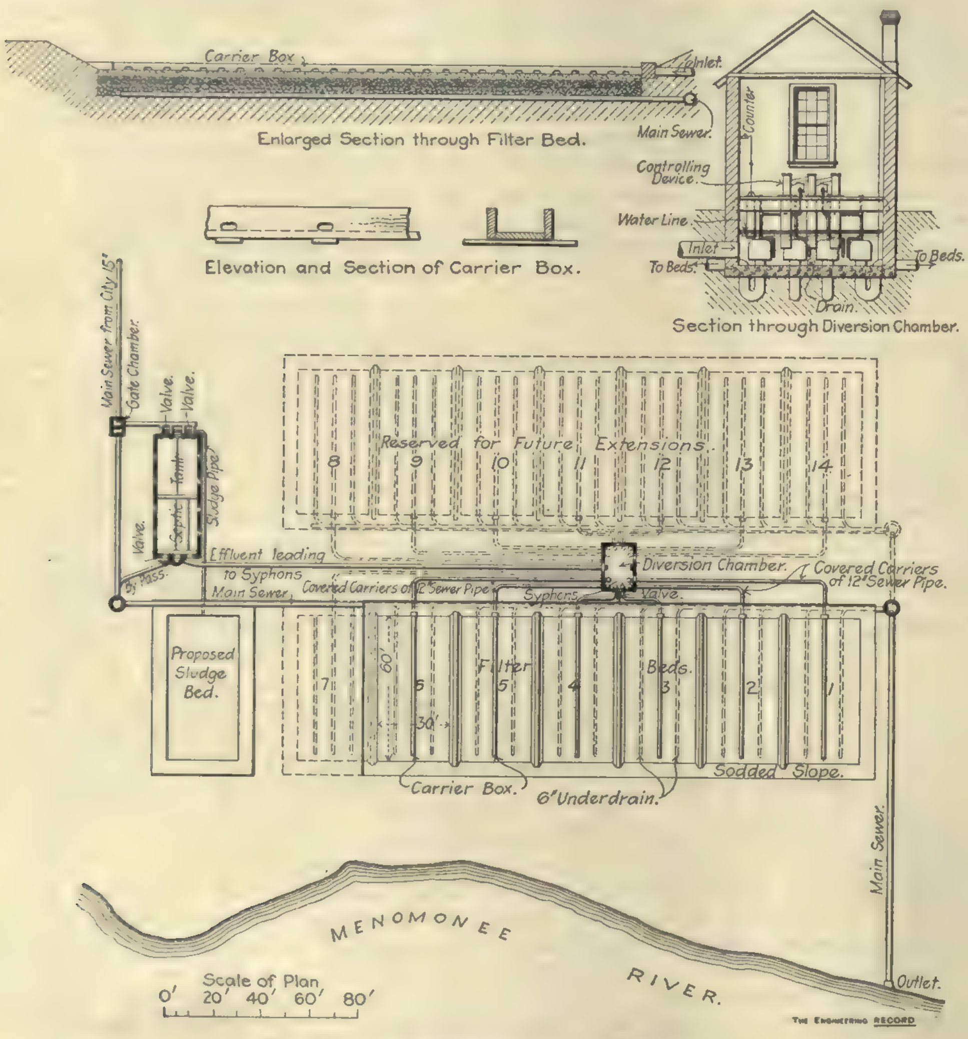
The most available location for the plant was at such an elevation as to make it difficult to get the sewage through the plant by gravity, consequently the main sewer approaches the septic tank at a flat grade, and before reaching it passes for some 500 feet through an inverted syphon beneath railway tracks and some low land, and terminates in the valve chamber near the tank. From this chamber the main outlet is carried from the level of the syphon through the filter beds and into the Menominee River, as indicated on the general plan. By closing a sluice valve in this valve chamber the sewage rises in the syphon and passes into the septic tank through four 12-inch inlets, the bottoms of which are placed 8 inches below the water line of the tank, each inlet being provided with a hand gate which can be opened and closed at will.

The tank itself is constructed of concrete, is 20 feet wide by 50 feet long and 10 feet deep. The bottom and sides are rendered water tight with Portland cement, and a neat brick building is constructed over the tank. The basin contains 8 feet of sewage, and since the sewerage system is new, and it will be several years before any considerable quantity of sewage will be produced, the tank is divided into five compartments by wooden partitions, so arranged that the size may be adjusted to the quantity of sewage, or the time in passing through the tank be extended from 6 to 24 hours. The capacity at the flow line is 44,650 gallons, and the partitions can be arranged to give fourteen different combinations, with a rest period varying from 35 per cent. up to the full capacity of the tank. The design is based on the same general principles as the Holland septic tank, described in The Engineering Record of March 16.

As arranged on October 12, with a water content of 33,400 gallons and a flow of 170 gallons per minute over the outlet weir, a color mixture admitted to the sewage in the valve chamber appeared at the weir crest in just one hour, yet in this quick passage the sewage, which is quite cloudy and contains considerable suspended matter, comes over the weir clear and bright, with only an occasional appearance of suspended matter in it. There was no scum formed over the surface on that date, and the passage of the colored fluid through the tank could be readily traced.

The effluent leaves the basin by passing over wide weirs at the surface of the tank, and after passing through a trough leaves the tank and enters a small chamber on the outside, from which it may be discharged directly into the main outlet, or by closing a valve in this connection it is made to pass through an underground conduit into the controlling chamber.

The controlling chamber is a brick building 12 x 14 feet, with door, three windows and an iron roof. Its interior is neatly finished with pine ceiling and floor, and beneath the floor is a masonry tank or cistern in which are placed six 10-inch automatic flushing syphons of the Miller pattern. These syphons are arranged so that each discharges onto a separate filter bed through a 12-inch sewer pipe laid through the embankment around the filter beds as indicated on the drawings. This tank is used as a distributing tank and is placed at a lower elevation, so that the effluent from the septic tank flows into it and fills it to a predetermined height, when the syphons discharge the contents of the tank onto the filter bed. The outlets from the syphons onto the beds are surrounded with a concrete block to hold them in position.



The Wauwatosa Sewage Disposal System.

The controlling device consists of a 3-inch metal ball and six galvanized iron floats which, working through wooden boxes upon the floor above, rise and fall with each filling and emptying of the tanks. These boxes are connected with each other by short inclined troughs through which the ball, when lifted by one of the floats to an outlet in the box, rolls into the next box, and in its passage opens a valve on the end of an air pipe connected with the dome of one of the syphons. This valve, when opened, releases the air and starts the syphon to discharge. When the tank is empty the syphon receives air and the discharge is stopped, when the tank again fills, raising the ball and sending it on to open the next syphon. The operation is simple and positive, and the contents of each discharge being known, a revolution counter is arranged so that each filling of the tank is automatically recorded, making it possible to determine the quantity of sewage passing through the tank, as well as that delivered to each filter bed. The apparatus was installed a week or so before water could be turned into the plant, and the only care it had since was to prime the syphons, adjust one of the troughs, and loosen the air valves. The 10-inch syphons discharge the contents of the dosing tank in an average of 7 1/3 minutes, or at the rate of 750 gallons per minute. They will discharge of themselves with 30 inches of water above the bottom of the bells, but are now operated at 22½ inches. The bottoms of the bells are but 0.9 foot above the top of the sand beds.

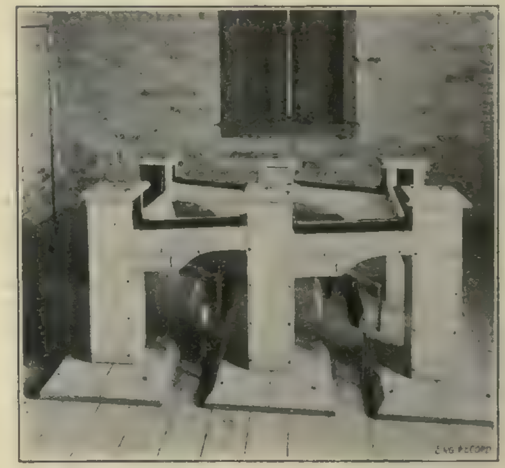
The six filter beds are each 30 feet wide by 60 feet long, with 3 feet of filtering material. They are underdrained by three parallel rows of 6-inch tile drains, connecting with the main sewer; over and around these pipes are placed from 8 to 10 inches of coarse gravel, and on top of this a second layer of fine gravel and coarse sand, then finished with 12 inches of clean, sharp sand. The water is distributed over the bed by means of a single wooden box sluice extending through the center of the bed, with openings on each side through which the water discharges. The beds are surrounded with an embankment carried above the high water level of the river. The inner slope of this embankment will be sodded.

The cost of the plant was as follows: 2.4 acres of land, $5,000; septic tank and valve chamber, $2,435.84; controlling chamber and device, $1,325.69; filter beds and pipe connections, $1,610.41; total, $10,371.94.

The New Stack of the Prudential Building, Newark, N. J.

A rather novel feature in office building construction is furnished at the new building of the Prudential Life Insurance Company at Newark, N. J., where architectural conditions connected with the arrangement of the plan and exterior appearance of the building required that the chimney should be built as an independent shaft carried up to a height of 230 feet 9 inches above its foundations.

The bed of concrete constituting the foundation is 3 feet thick by 25 feet square, and rests upon a compact soil of fine gravel about 16 feet below the surface grade, 2 feet 6 inches above the permanent water-level. This concrete is made in the proportion of one part Atlas Portland cement to three parts of sand and five parts of 2-inch broken stone, carefully rammed to place in layers not more than 6 inches thick, and leveled on top to receive the footing courses of the brick masonry. Through the center of the concrete bed a 4-inch terra-cotta pipe was imbedded in a vertical position to serve as a conduit for the copper lightning conductor.



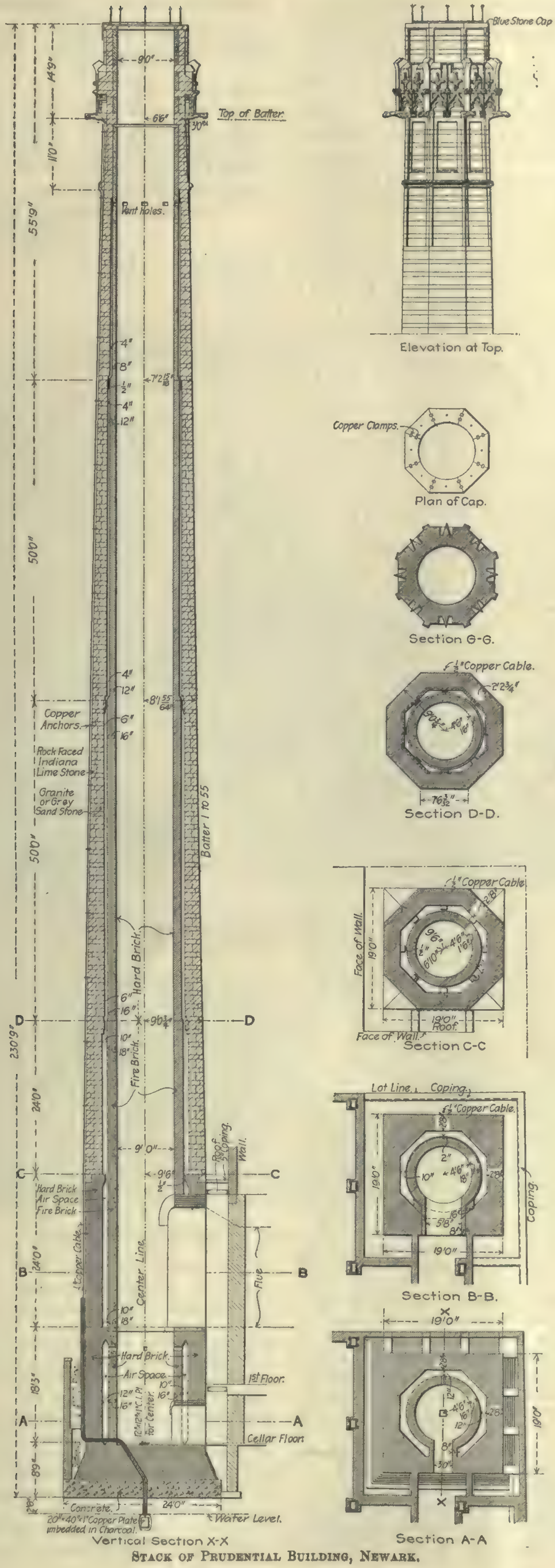
Controlling Device at Wauwatosa.

The brick base of the shaft is 19 feet square by 48 feet high, with arched openings for flue and clean-out. The core wall is cylindrical, with an inside diameter of 9 feet for the full height of the chimney, and is built of fire brick, 18 inches thick and 48 feet high from sill of flue, and of hard red brick from this level to the top of the shaft, all laid with close joints in a grouting of fire clay.

The stone shaft rising from the brick base changes to an octagonal shell having a batter of 1 to 55, with a diameter of 19 feet at the base and 13 feet at the top. It is built of dimension stones cut to specified sizes, the facing being of Indiana limestone, well bonded with a backing of cut granite. Eight corbels from the stone shell, at intervals of 50 feet, brace the brick core wall with just sufficient clearance to allow expansion and contraction. Vent holes near the top of the stack permit the free circulation of air between the core wall and exterior shell.

At the top the shaft is enriched with a capital of cut stone. This is carefully bonded and tied together vertically and horizontally with brass pipe dowels and dovetailed copper clamps in each course, and surmounted with a cap course of bluestone.

It will also be noticed that the flue lining stops several inches below the bottom of the capital, space being allowed for contraction and expansion, and from this point the lining is built up on the projecting stone of the capital, in this way counterbalancing the overhanging weight of the latter. As a protection from lightning a cable of copper wire, half an inch in diameter, extends from the eight points at the top



Vertical Section X-X. Elevation at Top. Plan of Cap. Section G-G. Section D-D. Section C-C. Section B-B. Section A-A.

STACK OF PRUDENTIAL BUILDING, NEWARK.

to a 20 x 40 x ¼-inch plate imbedded in charcoal beneath the foundation, below water-level, and is secured to the shaft by copper anchors set at 10-foot intervals.

The chimney is designed to carry off the gases of combustion from a battery of boilers which will ultimately aggregate 2,500 horse-power. The required area of the chimney has been determined by the conditions controlling its height together with those specifying the full capacity of the boiler plant it is intended to serve. As a matter of fact, it is quite probable that the full power of all the boilers will never be in action at the same time, as it is intended that a reserve of one pair of boilers shall always be maintained in case of accidents and to provide for repairs. But the design for the chimney area has been based upon the assumption that in case of emergency it should be equal in capacity to the full duty of the entire battery.

Estimating an assumed evaporation of 7 pounds of water per pound of coal, and 5 pounds of coal per horse-power per hour, the formula adopted for determining the area in square feet becomes $A = 0.3$ H.-P. $\div \sqrt{h}$. In this case H.-P. = 2,500, and the effective height from the flue entrance to the top of the shaft is 183 feet. Therefore $A = 0.3 \times 2{,}500 \div \sqrt{188} = 54.71$. This gives the effective area in square feet equal to a diameter of 8 feet 4 inches inside. Allowing for a cushion of air 4 inches thick over the whole interior surface to provide against the retardation of the velocity of the current by the friction of the walls, it is apparent that the actual diameter required is 8 feet 4 inches + 8 inches = 9 feet, and this dimension is maintained throughout from base to cap.

Mr. Geo. B. Post was the architect for the building, other features of which were illustrated in The Engineering Record of July 6. Mr. Amory Coffin handled the engineering features of the building.

Working Loads for Manila Rope.

A paper presented to the American Society of Mechanical Engineers by C. W. Hunt.

The technical reference books in use by engineers do not contain definite information in relation to the proper working loads for manila rope, when used in tackle blocks or for cargo hoisting. The hoisting of heavy weights is an important branch of erecting work, and I desire to record in the proceedings of the society a statement of the result of an extended experience, together with some examples of the life of rope in actual service, which will be a guide to engineers in judging what service can reasonably be expected in similar cases.

The ultimate strength given in Table II is materially affected by the age and condition of a rope in active service, and also it is said to be the fact that rope is weaker when it is wet. Trautwine states that a few months of exposed work weakens rope 20 to 50 per cent. The ultimate strength of a new rope given in column *B* is the result of tests made by the company with which I am connected of full-sized specimens of manila rope, purchased in the open market, and made by three independent rope walks. The results were given in a paper printed in volume xii, page 230, of the Transactions of this society. Prof. B. Kirsch, of the Imperial Royal Technological Industrial Museum, in Vienna, has since broken over 200 specimens of rope, mostly 35 millimeters (1⅜ inches) and 55 millimeters (2⅛ inches) diameter, and his results agree within five per cent. with these figures. Professor Kirsch demonstrated that within the limits of commercial sizes of hoisting rope, the full strength could be obtained for larger as well as for smaller sizes. When the strength falls off, the rope is imperfectly laid, or made on a machine too weak for the work. The ultimate strength of rope is, in this class of work, useful for one purpose only; that is, to estimate the factor of safety with any given stress. The strength given is for ordinary commercial rope, which may be greatly exceeded in strength by rope made of selected materials. The table can be depended upon as a reliable and safe guide in estimating the factor of safety for any case in hand.

The proper diameter of pulley-block sheaves for different classes of work, given in columns *F*, *G* and *H* (Table II) is a compromise of the various factors affecting the case. An increase in the diameter of sheave will materially increase the life of a rope. The advantage, however, is gained by increased difficulty of installation, a clumsiness in handling, and an increase in first cost. It can safely be assumed that the best size is one that balances the advantages and the drawbacks as they are found in practical use, and makes a fair balance between the conflicting elements of the problem. It would be rash for anyone to attempt to make a decision from theoretical considerations; but an average of the practice of a large number of users working under all the various circumstances of financial stress or superabundance, of urgency or leisure, of mathematical analysis, or rule of thumb decisions, furnishes an acceptable basis for a decision as to the limits of good engineering practice. That average the table aims to give.

An abundance of data is available from which to draw a reasonable conclusion in the premises. A few typical illustrations will make clear the method of procedure, and also be of service in showing what changes in sizes or proportions an engineer, in any given case, could make to reach a higher efficiency of mechanism, or a greater commercial economy. In driving 28,908 piles on the Chicago, Milwaukee & St. Paul Railway, the engineering department kept an accurate account of the number of piles driven by each one of the 79 lines of various sizes of manila rope used. From this record the average number of piles driven by each size of rope was computed, and also the cost of rope per pile driven was ascertained. This account showed that for hammers weighing from 1,800 pounds to 2,600 pounds, 1½-inch diameter rope was the best, and for hammers from 2,600 to 3,200 pounds, rope 1¾ inches in diameter should be used. Similar records covering many years have been kept by various coal dealers, of the diameter and cost of their rope per ton of coal hoisted from vessels, using sheaves of from 12 to 16 inches in diameter. These records show conclusively that, in hoisting a bucket that produces 900 pounds stress upon the rope, a 1¼-inch diameter rope is too small and a 1¾-inch rope is too large for economy. The size in general use for this work is 1½ inches. The Pennsylvania Railroad Company uses 1½-inch rope, running over 14-inch diameter sheaves, for hoisting freight on all their lighters in New York harbor, and handle on a single part of the rope loads up to 3,000 pounds as a maximum. Greater weights are handled on a six-part tackle.

Robert Grimshaw, in 1893, in collaboration with Lieut. J. A. Bell, of the Equipment Bureau, U. S. N., made a series of tests at the Brooklyn Navy Yard on sheaves of various diameters and with various loads. "The rope was ordinary manila, 3 strand, 3¾ inches in circumference, such as is used in the United States Navy. It was dry, and tested on a 'cat and fish' tackle constituting a six-fold purchase; sheaves 8 inches in diameter, the three upper ones having roller bearings and the three lower ones plain solid bushings. The lower block and hook weighed 75 pounds."

It is interesting to compare the life of a rope when used with the stresses and sheaves given in columns *C* and *F* (Table II) and one used with those of columns *D* and *G*. To illustrate this, take two cases using exactly the same size and quality of rope; one to be worn out in hoisting coal from vessels, with stresses and sheaves as per columns *D* and *G*, and the other to be used on a rope drive with the stresses and sheaves as per columns *C* and *F*; all the wear on the ropes comes from its internal friction in bending over sheaves, and its external chafing in running on and off them. A record of the number of bends made by each of the ropes will be a convenient means of comparison. A rope 1½ inches in diameter usually hoists from a vessel from 7,000 to 10,000 tons of coal on a well-arranged hoist. The rope will have a working stress of from 850 to 900 pounds running over three sheaves, one 12 inches and two 16 inches in diameter; in hoisting 10,000 tons it makes 20,000 trips, bending in that time from a straight line to the curve of the sheave, or vice versa, 120,000 times. The rope, when this service is completed, is worn out and must be replaced by a new one.

To illustrate the endurance of the rope used in the transmission of power, take a tin-plate mill transmitting 1,000 horse-power to the rolls by means of 1½-inch diameter manila ropes. In one particular case the sheaves are 5 feet and 17 feet in diameter and 36 feet apart, center to center. The rope is 86 feet long, runs 5,000 feet per minute, making 13,900 bends per hour, or more bends in 9 hours' service than the other rope made in its entire life. As is well known, the life of a transmission rope is measured by years, not hours. This enormous difference in the life of ropes of the same size and quality is wholly gained by reducing the stresses on the rope and increasing the diameter of the sheaves.

The weakening effect given in the table of various knots, hitches, and bends used in rope tackle is based upon experiments made in the laboratory of the Massachusetts Institute of Technology. Forty-five pieces of 2½-inch circumference, three-strand manila rope, cut from one coil, were broken in sets of from three to seven ropes, each rope of a set having the same fastening, and an average of each set computed. Each different set tested some one of the fastenings in common use. The results were not erratic, but consistent, and from them a safe conclusion can be drawn. In examining the various knots broken, it is evident that those fastenings in which the standing part makes a short bend over another part of the rope are the weakest. Those like a round turn and a half-hitch, or a timber hitch, have a less abrupt bend in the standing part, and are materially stronger. With care, an eye in the end of a rope having the ends of the strands tapered down, can be spliced over an iron thimble so that it will have substantially the full strength of the rope, but as it is usually made it is not so strong, for which due allowance is made in the table. The same remarks apply to a splice in a rope. In the table some knots are included that were not tested, but whose approximate strength is evident from their formation. The table is only a guide to be used in estimating the factor of safety. The loss of efficiency by the use of these knots was conclusively settled by the experiments above mentioned, and the numerical value fixed within such narrow limits that the results cannot safely be ignored in executive work.

TABLE I.—GRIMSHAW-BELL SHEAVE TESTS.

Load raised by tackle.	Theoretical weight required to lift.	Actual weight required to lift.	Excess weight over theoretical.	
600 lbs.	100 lbs.	158 lbs.	58 lbs.	58 per cent.
800 lbs.	133.3 lbs.	198 lbs.	64.3 lbs.	48 per cent.
1,000 lbs.	166.7 lbs.	243 lbs.	76 lbs.	45.8 per cent.
1,200 lbs.	200 lbs.	288 lbs.	88 lbs.	44 per cent.

TABLE II.—WORKING LOADS FOR MANILA ROPE.

Diam. of rope, ins.	Ultimate strength, lbs.	Working load in pounds.			Min. diam. sheaves, ins.		
		Ra'd.	Med.	Slow.	Ra'd.	Med.	Slow.
A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*
1	7,100	200	400	1,000	40	12	8
1⅛	9,000	250	500	1,250	45	13	9
1¼	11,000	300	600	1,500	50	14	10
1⅜	13,400	380	750	1,900	55	15	11
1½	15,800	450	900	2,200	60	16	12
1⅝	18,800	530	1,100	2,600	65	17	13
1¾	21,800	620	1,250	3,000	70	18	14

TABLE III.—RELATIVE EFFICIENCIES OF KNOTS.

Efficiencies in a percentage of the full strength of the rope, and the factor of safety when used with stresses of Column E, Table II.

	Knot Efficiency.	Factor of Safety.
Eye splice over iron thimble	90	6.3
Short splice in the rope......	80	5.6
Timber hitch, Round turn and Half-hitch...............	65	4.5
Bowline slip knot, Clove hitch	60	4.2
Square knot, Weavers' knot, Sheet bend......................	50	3.5
Flemish loop, Overhand knot	45	3.1
Rope dry, average of 4 tests from same coil as knots..	100	7.

It will be understood that a table of working loads must be a general one, covering ordinary cases arising in practice. Local conditions may be such as to make it advisable to vary from the stresses given in the tables. In cases of great importance an engineer should carefully investigate the subject in detail, and then decide upon the exact stresses that he will put on his tackle, but ordinary cases are fully covered by the data given in the tables herewith.

In this table the work required of the rope is, for convenience, divided into three classes—rapid, medium and slow, these terms being used in the following sense: "Slow"—Derrick, crane, and quarry work; speed from 50 to 100 feet per minute. "Medium"—Wharf and cargo, hoisting 150 to 300 feet per minute. "Rapid"—400 to 800 feet per minute.

The diameter of the rope in column *A* is obtained by dividing the girth by 3.1416. This method gives for a three-strand rope nine-tenths, and for a four-strand ninety-three hundredths of the diameter of a circumscribed circle. The girth method corresponds closely to the circular diameter of the rope when under stress, and is the most convenient to use.

A Pump Head for deep wells has recently been brought out by S. W. Luitwieler, of Los Angeles, Cal., which is designed to give a constant upward motion to the water. There are two plungers, one driven by a hollow shaft through which the solid shaft of the other works. Motion is imparted to these shafts or rods by two cams set 180 degrees apart. Each cam has two surfaces against which press upper and lower roller bearings on the shaft it drives, so that the downward as well as the upward strokes are positively controlled. The lifting track of the cam covers 55 per cent. of its angular periphery, so that when the lift of one plunger is completed it descends more rapidly than it rose and begins its upward stroke before that of the other plunger is finished.

Asphalt Paving Repairs are now the subject of concern in St. Louis, where the municipal assembly has passed a bill which restricts the repairs for ten years to Trinidad Lake, Bermudez or Buena Vista brands of asphalt, all controlled by one corporation. A local corporation, the Trinidad Asphalt Company, is making a strong fight to have the bill vetoed by the mayor, unless the words "or any other asphalt equal in quality or superior thereto" are inserted after the names of the brands. This company advocates the retention of the city's present asphalt plant for repairs, and presents figures from the street commissioner's office showing that the annual cost of such repairing in the last six years has averaged $8,840, the total extent being 1,264,765 square yards. The proposed contract is at the rate of $18,000 a year.

The Present State of Cement Testing in Germany.—I.

Extracts from a paper by Max Gary before the Budapest Congress of the International Association for Testing Materials.

In 1877 the German manufacturers of Portland cement formed a union and in the following year, on November 12, this union published certain "Standards for the Uniform Supply and Testing of Portland Cement," which had been approved of by the highest officials in the Prussian Department of Public Works. These were published with a view to excluding rival products of inferior quality from the German market.

On July 28, 1887, the Prussian Ministers for Commerce and Industry and for Public Works issued an ordinance to the officials in their departments enjoining the observance of the "Revised Testing Standards," and in the course of the same year these received recognition in the other States of the German Confederation. In reality the "Standards for the Uniform Supplying and Testing of Portland Cement" of the year 1887 form still the basis for testing Portland cement in the German Empire. The discussion of the methods at present employed for testing Portland cement will involve, therefore, a consideration of these standards, and attention will be directed in due course to the experiences of recent years and to such changes as have already been accepted or are in contemplation.

The standards are prefaced by the following definition of Portland cement: "Portland cement is a product obtained by first burning an intimate mixture of substances containing lime and clay as essential ingredients until a shrunken mass is formed, and then finely pulverizing the resultant mass." This definition was made in consequence of the practice, begun in the year 1882, of mixing slag from smelting furnaces, in a finely ground condition, with Portland cement, a practice which the Association of German Cement Manufacturers justly feared would lead to the decline of the German Portland cement industry. The association opposed the practice of mixing from the outset by means of the following resolution, passed on July 6, 1882: "'The General Assembly of the Association of German Cement Manufacturers declares that the sale of cement to which foreign bodies of inferior value have been added after the burning as Portland cement is to be considered a deceiving of the purchaser, unless at the sale and on delivery of such mixed goods, plain notice is given to the purchaser that such additions are in the cement. Additions to the extent of 2 per cent. of the weight, made only for the purpose of imparting particular qualities to the cement are, however, not to be regarded as adulterations."

After the issuing of the Revised Standard the association changed its name to that of "Association of German Portland Cement Manufacturers," and imposed upon its members the following regulation: "Members of the association are allowed to bring into commerce under the denomination of 'Portland cement' only such a

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLVI, BUDAPEST, A HUNGARIAN BRIDGE APPROACH.
Terrace opposite the suspension bridge shown in a previous issue.

product as is obtained by burning an intimate mixture of substances containing lime and clay as essential ingredients until a shrunken mass is formed and then finely pulverizing the resultant mass. They are under the obligation not to recognize as Portland cement products formed in any other way than the above, or products to which foreign bodies have been added, either during or after the process of burning, and they bind themselves to regard the sale of such products under the denomination of 'Portland cement' as a deceiving of the purchaser. Small additions to the extent of 2 per cent., required for regulating the time of setting of the Portland cement are, however, not included in this obligation. If a member of the association infringes the above obligations, he shall be excluded from the association and the fact of his exclusion made known publicly."

Purity of Portland cement.—Deleterious admixtures present in consequence of defective preparation of the raw materials are principally in the form of lime, magnesia and gypsum. In good Portland cement the proportion of lime should be from 58 to 67 per cent. Cements containing a greater proportion of lime show an inclination to expand. Also cements burnt to a shrunken mass which contains more than 3 per cent. of magnesia are, according to the results of German experiments, especially those of Dyckerhoff, to be regarded as dangerous, as they are liable, often first after the lapse of a considerable time, to begin to expand. Finally, cements which contain more than 2 per cent. of gypsum are, in Germany, not admissible, because these also are usually not stable in volume. The quantity of these three bodies present in the Portland cement can only be accurately estimated by means of chemical analysis, although the proposed processes to be employed for determining the constancy of volume, as discussed later, give an idea concerning the lack of this quality.

As additions to Portland cement there are employed coloring matters, clay, sand, ashes, ground limestone, ground slate, hydraulic lime, trass and silicates of lime, such as, for example, slag from smelting furnaces. These materials, with the exception of slag, can be qualitatively detected without difficulty by determining the specific weight, the rate of loss of heat and the action under the influence of diluted acids, or by other methods. Additions of hydraulic lime are detected from the alkaline nature of the water solution and the absorption of carbonic acid.

According to Fresenius, a water solution containing 5 grammes of good pure Portland cement ought to be alkaline to such a degree that it can be neutralized by the action of from 4 to 6.25 c.c. of 0.1 normal hydrochloric acid, and 3 grammes of the cement should not absorb more than 1.8 milligrammes of carbonic acid.

A reliable method of detecting admixtures of slag has hitherto been wanting. Most slags are similar in color to Portland cement, and their chemical composition is not sufficiently different from that of cement to permit of showing the admixtures in a reliable manner by means of the analysis of the mixed product.

The older process for proving the presence of slag in Portland cement, proposed by Fresenius, consists in determining the specific weight, the loss of heat, the neutralization of normal hydrochloric acid, and the reducing effect on a chameleon solution ($KMnO_4$ in one liter of water). For pure Portland cement Fresenius established the following limits: (a) A specific gravity of at least 3.125 and in any case not less than 3.1. (b) A degree of alkaline strength such that a water solution containing 0.5 gramme of cement neutralizes 4 to 6.25 c.c. of 0.1 normal acid. (c) An absorption of 18.8 to 21.67 c.c. of normal acid by 1 gramme of cement powder under direct treatment and in any case not materially less than this. (d) An action in chameleon solution so that 1 gramme of cement reduces 0.79 to 2.8 milligrammes of permanganate of potassium, and in any case very little more than this.

The specific gravity is to be determined according to the methods of Dr. Schumann or of Dr. Erdmenger. Both methods consist in determining the space occupied by a given weight of cement by bringing the cement into a vessel filled with oil of turpentine, and, after removing all air bubbles, observing what displacement of liquid takes place. To avoid mistakes in measuring, it is necessary that the cement and the filled apparatus shall have been left standing together for a greater length of time in the experimenting room, so that they shall have the same temperature during the experiment.

The results of treating with water are in so far characteristic, that the different materials under similar treatment give off to the water different qualities of constituents possessing alkaline properties. Fresenius has therefore proposed to pass a gramme of the suspected cement through the sieve of 5,000 meshes, to shake it with 100 c.c. of distilled water at the temperature of the room for ten minutes and then, after filtering through a dry filter, to titrate 50 c.c. of the filtrate obtained with 0.1 normal hydrochloric acid.

Fresenius investigated the action of dilute acid by shaking for 10 minutes 1 gramme of the powder, passed through the sieve of 5,000 meshes, with a mixture of 30 c.c. normal hydrochloric acid and 70 c.c. water. This is then allowed to stand or is filtered through a dry filter, and to the clear solution thus obtained is added 50 c.c. of normal sodium hydrate, and thence calculated how many cubic centimeters of normal hydrochloric acid are neutralized by one gramme of the powder.

The test with the chameleon $KMnO_4$ solution was prescribed by Fresenius as follows: One gramme of finely powdered cement was treated with a mixture consisting of one part of diluted sulphuric acid (specific gravity, 1.12) and two parts of water, and to this fluid drops of the chameleon solution were added until it became colored permanently red. Thus it was ascertained that one gramme of Portland cement rendered colorless 0.79 to 2.8 milligrammes of potassium permanganate.

By means of the same chameleon solution Fresenius found that under a similar treatment 44.34 to 74.67 milligrammes of potassium permanganate were required for different kinds of slag powders. The difference arises from the circumstance that in Portland cement the iron is present almost exclusively in the form of ferric oxide, whereas in the slags it is present only as ferrous oxide, and in addition sulphides are sometimes found in slags in considerable quantities.

It has, however, quite recently become known, that cements which have been burnt in a rotary kiln or in the reducing flame, likewise may require the use of a considerable quantity of potassium permanganate although they do not contain slags.

The chameleon test has therefore alone no decisive value for proving the presence of high-furnace slags and can only be used as a preliminary test.

The chameleon $KMnO_4$ solution test is now conducted as follows. One gramme of the cement passed through the sieve of 5,000 meshes is placed in an Erlenmeyer piston and worked up into a paste with 30 c.c. of water. Then 20 c.c. of the chameleon solution are added, together with 150 c.c. of a mixture consisting of one part of sulphuric acid (specific gravity 1.12) and two parts of water. If within a short time there is a discoloration, 20 c.c. more of the chameleon solution are added and this process repeated until the color is a permanent red. This is allowed to stand for 5 minutes, being stirred at intervals and then titrated with a solution of Moors salts (66 grammes to the liter) until the color entirely disappears, and afterwards $KMnO_4$ chameleon solution is again added until a permanent red color is attained.

The method employed for testing slag at the time this report was printed is as follows:

(A) Preliminary Test.—The cement to be tested is treated with potassium permanganate, according to the method of Fresenius. If less than 3 mg. are required for 1 gramme of cement, the cement cannot be suspected of containing slag; if more than 3 mg. of potassium permanganate must be used for 1 gramme of cement, then the cement can be: (1) Cement from a rotary kiln (cement burnt in the reducing flame). (2) Cement mixed with blast-furnace slag, (a) made out of raw materials with pieces of slag added, and, (b) with slag added after the process of burning. (3) Cement to which slag has been added to form an intimate mixture before burning.

The cement requiring more than 3 mg $KMnO_4$ must be subjected to the separate test as follows:

(B) Separate Test.—By means of sieves of 2,500, 5,000 and 10,000 meshes the cement is separated into two heaps, a and b, of different degrees of fineness and carefully dried at a temperature of about 100 degrees Centigrade. Afterwards 5 grammes from each heap are, in accordance with the method of Haradas, passed by means of a dry funnel into a mixture of methyl-iodide and purified turpentine oil, which, at a temperature of 15 degrees Centigrade, should possess a specific gravity of 3.01. The methyl-iodide, dried if necessary by means of calcium chloride, is, before being used, filtered through Portland cement which has been calcinated and again cooled in a desiccator. The specific gravity of the fluid is then determined by means of Hauenschild's aerometer.

The separation of the parts of a and b which are lighter or heavier than 3.01 is carried out by an evacuating process. The state of the air pressure is without importance. In employing an air valve with water jets it is advantageous to fix up a Wolf's bottle between the funnel and the suction valve.

1. The light parts which swim in the fluid can be

Coal of average specific gravity.......	1.39
Gypsum of average specific gravity....	2.33
Coal slack of average specific gravity..	2.73
Furnace slag of average specific gravity	2.94

With suitable fluids these different constituents can be separated.

In the case of cements as given under A 1 and A 3, little light material separates, and what separates consists for the most part of coal and coal slack. In cements mixed with slag (A2a) and (A2b) the slag separates out clearly.

2. The heavy parts which sink in the fluid of specific gravity 3.01 can be cement of specific gravity 3.035, or iron from the furnace slag and different iron compounds.

With methyl-iodide or other suitable fluid these parts can be differentiated.

(C) Analysis.—The chemical analysis of the individual constituents discloses the nature of the substances being dealt with.

Slag is always richer in silicic acid, and always poorer in lime, than Portland cement.

Cement Testing in Accordance with the Standard.

I. Weight.—The Prussian standards have fixed no definite limits for the weight of the cement required to occupy the unit of space. The regulation is limited rather to fixing the gross and net weight of the casks of cement usually found in commerce. The total weight of such a cask of cement should be 180 kg. gross and 170 kg. net, and for half a cask 90 kg. gross and 83 kg. net; 180 kg. gross correspond to 400 pounds. The size of the casks is not prescribed. But although no minimum space is fixed for a given weight of cement to occupy, it has become usual to determine this space, both for the cement in loose condition and also when it has been well shaken together.

Meanwhile a uniform method for determining this unfortunately does not exist. Not even the form of the liter measure is uniform; the old Prussian measure for fluids as well as the liter measure for grain is employed, or a cylinder the contents of which is one liter and the diameter of which is equal to the height, or a cubic decimeter measure.

For the determination of the weight of the cement, when shaken together, the form of vessel employed is of small importance, but, on the contrary, in determining the weight of the cement occupying a unit of space when the cement is in a loose condition, the form of the vessel is of great importance, and it would be very desirable to come to an agreement as to the apparatus which ought to be employed for the purpose of filling a liter measure with loose cement. In some places at present a plane inclined at a certain angle is used, and on this plane the powder is sprinkled, to be thence allowed to fall into the vessel. In other places the cement is riddled into the vessel, and in Charlottenburg a special apparatus, constructed by Böhme, with a movable bottom, is in use. It has been attempted to accomplish this riddling into the vessel mechanically, but this, however, is not to be recommended, as, through the unavoidable shaking to which the vessel is subjected by the motion of the sieve, a shaking together of the powder ensues.

In order to obtain uniformity in this part of the test, I recommend the introduction of a simple apparatus which was first used in France, and which consists of a funnel with a sieve fixed in the lower orifice. Illustrations and descriptions of this apparatus are given in the Resolutions of the French Committee, as well as in the proposal of the Sub-Committee B. of the International Association for Testing Materials, adopted at Dresden on September 27, 1899. In order, however, to agree with the German regulations with regard to gauging, I do not advise the introduction of the liter vessel proposed for use in France, of which the height and diameter are equal, but the employment of a cylindrical liter vessel for dry substances as prescribed in Art. 17 of the gauging regulations, according to which the proportion of the diameter to the height shall be as 3 is to 2, that is to say, a liter measure whose diameter is 124.1 mm. The diameter can vary between the limits 128 mm. to 120 mm.

II. Time of setting.—The Prussian standards with regard to the time of setting run as follows: "According to the purpose for which it is required, Portland cement can be demanded of such a nature that it sets slowly or rapidly. Those cements are to be described as setting slowly which set first in two hours or after a longer period."

"Explanations.—In order to ascertain the time which the cement takes in setting, pure slow setting cement is stirred 3 minutes and quick-setting cement 1 minute, in water until it forms a stiff paste. This is put all together directly on a glass plate to form a cake about 1.5 cm. thick in the middle, but becoming thinner toward the edges. The degree of fluidity required for producing this cake shall be such that the paste, placed on the glass plate by means of a spatula, first begins to run toward the edges after the glass plate has been several times shaken, for which purpose in most cases 27 to 30 per cent. of water suffices. As soon as the cake is hardened to such a degree that it resists a light pressure with the finger nail, the cement must be regarded as set. For determining more accurately the time of setting and for fixing the moment when setting begins, which is of great importance in quick-setting cements (as the cement must be worked up before setting commences) a normal needle is employed which weighs 300 gr. and has a cross-section normal to the axis of 1 sq. mm. Then a metal ring 4 cm. in height and with an interior diameter of 8 cm. is placed on a glass plate and filled with the cement paste of the above-mentioned fluidity and afterward placed under the needle. The moment in which the normal needle can no longer completely penetrate the cake of cement is to be taken as the beginning of setting. The time which elapses until the normal needle leaves behind on the hardened cake no visible impression is the time of setting. As the setting of cement is influenced by the temperature of the air and water employed in its application, in so far that high temperature accelerates and low temperature retards the setting, it is recommended that the experiments be made under an average temperature of water and air of 15 to 18 degrees Centigrade in order to obtain consistent results. During the process of setting, slow-setting cements should not show any material degree of heating, whereas quick-setting cements may disclose a notable increase of temperature."

The method here described for determining the time of setting is in general use in Germany, and, so far as I know, with slight deviations also in other countries. It possesses, however, such great defects that the discovery of a more reliable method is extremely desirable.

The determination of the amount of water required for preparing the stiff paste is unreliable, because it depends on the opinion of the person experimenting. The quantity of water required varies considerably, according to the vigor with which the paste is stirred, and the quantity of water added is of decisive influence on the time which the paste requires in setting. But even if, after some practice, the same person can fix the amount of the water to be used with moderate certainty, the deciding of the moment when the normal needle leaves no longer a visible impression on the hardened cake remains very uncertain, because the upper surface of the cement cake is usually covered with a fine coating of mud, on which the needle leaves traces a considerable time after the setting is accomplished. Also, when the cake is removed from the glass plate and the under surface put to a test, there remains frequently a ring-shaped impression even when the cement is already perfectly set.

The attempts hitherto made in other countries than Germany for improving the methods of testing the time of setting cannot be regarded as successful.

The mechanical needle apparatus, constructed by Tetmajer, has the disadvantage of jerking and shaking the cake at every fall of the needle. The apparatus constructed by Goodman in England, in which a small wheel is dipped in the cement paste and moved at a controllable velocity through a bath full of cement paste, during which a pencil placed in the axis of the wheel marks the setting curve, gives in parallel experiments values which disagree to a considerable extent and which cannot be brought into accord with the results of experiments by means of Vicat's needle.

The simple test proposed by McHarg, of Chicago, which should be carried out by means of a thread to be drawn at fixed intervals of time through a cement cake spread out on a slab of slate, is applicable as a ready test on the building site, but cannot be accepted as an exact laboratory test.

The Association of German Portland Cement Manufacturers intends, therefore, in common with the Testing Institutes in Charlottenburg and Stuttgart, to seek for a new method of determining the time of setting, in which it is to be presumed that precautions will be taken to prevent water escaping from the cement cake during the setting. In the test by means of Vicat's needle, when a tin or rubber ring without a bottom is usually employed for cutting off the water, there is always an escape of water on the glass plate.

But, in whatever method the test for setting is conducted, special importance must be attached to the maintenance of the air, cement and water at an equal temperature. Cement and water must be kept for some hours before the experiment standing together in open vessels in the laboratory. In recording the results, the state of temperature and the humidity of the air must be taken into consideration. For determining the humidity, Saussure-Koppe's hair hygrometer is very often employed and can be recommended, because it permits of the easy determination of the point of saturation and can very conveniently be properly fixed in position.

The calculation of the increase in the temperature during the process of setting can be performed by means of any thermometer whatever, but it is more practical to use a maximum thermometer with a cylindrical tube narrowing at the base and divided into fifths of a degree. Such a thermometer allows the evaluation of tenths of a degree.

It has been repeatedly shown, first by Dr. Tomëi, that many cements which in a fresh condition set slowly, become with a lapse of time quick-setting cements and then again become slow-setting. It is one of those phenomena which arise from the internal constitution of Portland cement and the origin of which cannot, unfortunately, up to the present be explained, but the study of which is of very great importance. The International Association for Testing Materials has already entrusted a special committee with the study of cements with regard to the variation of behavior displayed during the process of setting.

III. Constancy of volume.—"Portland cement shall be of constant volume. The following test shall be considered decisive. A cake of pure cement placed on a glass plate, and protected against drying shall, after a period of twenty-four hours, be put under water for a lengthened time of observation. Under these conditions the cement should show absolutely no deformations or cracks on the edges.

"Explanation.—For carrying out this test the prepared cake of which the time of setting is to be determined should, in the case of slow-setting cement, be placed under water after twenty-four hours, but at all events not before the process of setting is complete. In the case of quick-setting cement this can be done after a shorter lapse of time. The cakes, especially those of slow-setting cement, must, until after the conclusion of the process of setting, be protected from currents of air and sunshine, and this can best be done by keeping them in a closed cupboard or under wet cloths. In this manner fissures due to shrinking, which, as a rule, appear in the middle of the cake and are regarded by the uninitiated as cracks produced by the working of the cement, can be avoided. If, during the process of hardening of the cement under water, deformations or cracks on the edges appear, this points undoubtedly to 'working' of the cement—that is, in consequence of an increase in volume, a splitting of the cement takes place, accompanied by a gradual diminution of the degree of adhesion which the mass had already attained, and finally leads to the complete collapsing of the cement. The phenomena of 'working' are already apparent as a rule on the cake after 3 days; at all events, an observation extending over 28 days is sufficient."

The method of determining the constancy of volume prescribed in the Prussian standards is the most usual—and not only in Germany—because it is the simplest. However, in many quarters it is regarded as insufficient. In particular the objection is raised against this test that it requires too much time for the "working" cement to be recognized, and it is in the rarest cases possible to wait sufficiently long before using the cement to allow a decisive result to be obtained. The plausibility of this objection is indisputable, and a search for a more rapid method of determining the constancy of volume of the cements appears perfectly justified.

Different people have already proposed such rapid methods of testing the constancy of volume. Michaëlis has proposed the flat boiling test, Dr. Heintzel the test with a hot ball, Tetmajer the test of the boiled ball, Maclay a combined hot-water test, Deval a steam test, Prüssing the pressed-cake test, Dr. Erdmenger the test with steam at high pressure.

The result of experiments and data lead to the conclusion that the rapid methods hitherto proposed for determining the constancy of volume are not adapted in all cases to allow of a reliable judgment being formed as to the constancy of volume of a cement in practical use, since numerous cements which partly or entirely fail under the rapid method of determining the constancy of volume are fully equal to answering the purpose for which they are required in many kinds of structures, without their constancy of volume being in the least degree affected.

The hitherto proposed rapid tests appear to me, therefore, not to be suitable as a ready test by which the purchaser can control the constancy of volume of cement delivered to him. This does not, however, exclude the applicability of these tests in laboratories and factories. In three cases one or all of them can be advantageously applied: (1) For roughly testing the products in the factory. (2) For testing such cements which must possess a special degree of constancy for particular purposes or which are required for particularly heavy work (vessels for hot substances, fine cement articles, large structures lying free and exposed to the air, etc.). (3) For testing cement which contains magnesia.

The discovery of a method suitable for determining as speedily as possible the constancy of volume of cement, which shall be also applicable for controlling the cement on the building site, must still be the object of our endeavors. Only exact measurements can give material standards for determining the constancy of volume of the cement and the movements to which it is liable in itself alone or in connection with sand with increasing age and varying humidity.

For this purpose the "touching" apparatus of Bauschinger is in general use. However, the application of this apparatus possesses the disadvantage that the testing staff must be brought before every measurement between two points, and great care must be taken that these points shall be applied always precisely to the same points on the testing staff. It has been attempted to fix these points of contact by means of glass or metal plates suitably prepared, but it has been observed that, in course of time, the brass becomes oxidized and it is very difficult to produce smooth edges on the glass without splitting it. After experimenting with many other kinds of material, the Charlottenburg Testing Institute has finally adopted small plates of agate with very smooth polished edges and has attained, by employing these plates with some care, reliable measurement.

In order to avoid the defects arising from the consecutive putting in and taking out of the staff, Martens has constructed a simple apparatus which allows of a series of testing staffs to be observed at the same time in close connection. The changes in the length of the staffs in this apparatus are measured by means of levels which are able to show the changes in length magnified 200 times. The particularities of the apparatus are described and illustrated in the Reports of the Proceedings of the Association of German Portland Cement Manufacturers, 1899, p. 106. Klebe, in Munich, has proposed, for the purpose of calculating the change of volume of cements, a measuring rod which is inserted between two needles fixed at a certain distance apart in the cement while it is still soft. This apparatus has, however, not been generally adopted. The method of Le Chatelier has been hitherto employed in Germany only in a few instances.

(To be Continued.)

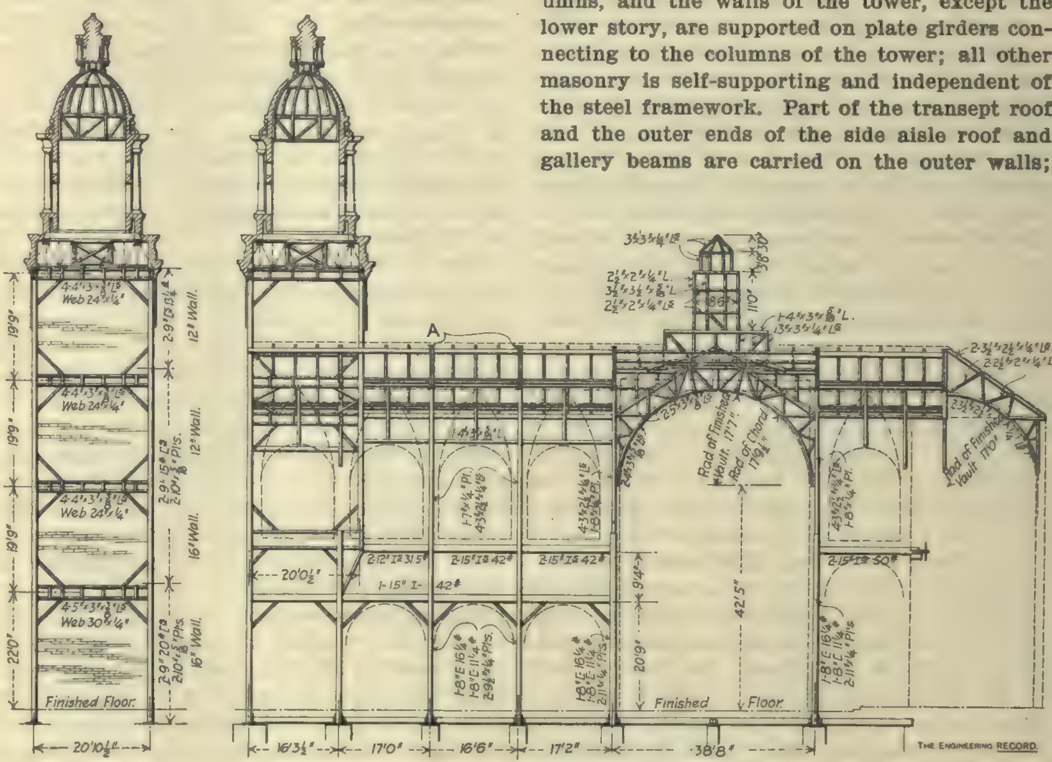
The Accumulation of Sludge in Septic Tanks was studied with care in Manchester, England, last year, and in the annual report of the Rivers Department, under which the sewage disposal system is operated, the final conclusion is thus expressed: "That rather more than one-third of the total suspended solids in the sewage will have to be dealt with as sludge in the septic tank."

Sleeve Joints in Penstocks have been provided in a water-power plant near Jaice, in Bosnia, Austria-Hungary, to allow for changes in length due to expansion and contraction with changes in temperature. The power development includes a dam, a waterway to a forebay, and two pipes from forebay to the power house. Midway down the slope in each of these is the joint. The pipes are about 120 feet long and 5.24 feet in diameter. The total electrical power of the plant is stated to be about 9,260 horse-power.

A Steel-Frame Church.

St. Jerome's Roman Catholic Church at 138th Street and Alexander Avenue, New York, is a 150 x 98-foot stone and brick building with steel columns, framework and roof, which were designed by a structural engineer in collaboration with the architect, so as to adapt the standards of steel construction to ecclesiastic requirements. The nave, 36 feet wide and 120 feet long, terminates in an apse, and has a vaulted ceiling 60 feet above the floor. On each side of it there is a 20-foot aisle with side walls about 32 feet high, and nearly flat roofs, with a gallery floor 22 feet above the main floor. About 76 feet from the gable wall of the church is the axis of the transept, which is about 39 feet wide, and has a vaulted ceiling corresponding to that in the nave, and a low dome on pendentifs over the intersection. At the northwest corner of the building a tower, surmounted by a copper-covered steel frame, dome and lantern, rises to a height of about 125 feet.

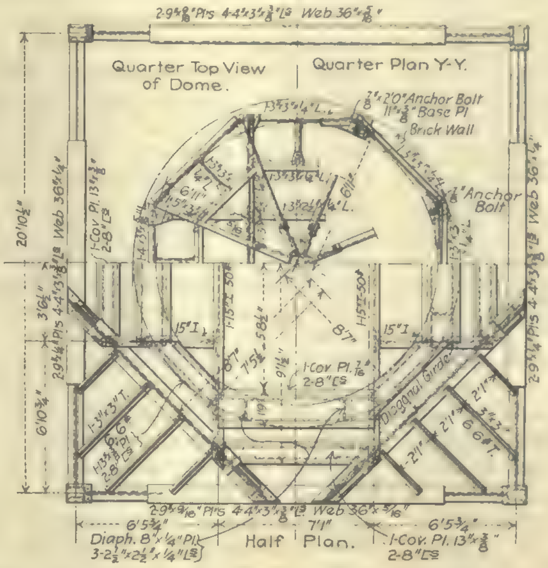
The clere-story walls, about 25 feet high above the aisle roofs, are supported on double longitudinal I-beam girders attached to the main columns, and the walls of the tower, except the lower story, are supported on plate girders connecting to the columns of the tower; all other masonry is self-supporting and independent of the steel framework. Part of the transept roof and the outer ends of the side aisle roof and gallery beams are carried on the outer walls; the remainder of the roof and the gallery floor are carried by ten main columns in the planes of the clere-story walls and two more in one side wall for the tower framing. There is also a short column on each side of the chancel to support the floorbeams of the upper floor of the sacristies. The columns are seated on masonry piers about 3 feet below the first-floor level and the longitudinal 15 and 18-inch I-beam floor girders are riveted to them and support wooden joists across their top flanges. The girders are of from 16 to 19-foot span, and the joists are from 18 to 21-foot span. The longitudinal girders in the gallery floor are I-beams from 15 to 24 inches deep, which are riveted to the columns. The side galleries are connected at the front end by a transverse gallery, with a transverse girder riveted to the end columns on opposite sides of the nave, and supported at two intermediate points on light, one-story columns. All the floors have 3 x 12-inch yellow-pine joists, which are nearly everywhere spaced 12 inches apart on centers. The gallery roof has horizontal longitudinal girders composed of pairs of 15-inch I-beams riveted to the columns, and supporting the ends of 3 x 12-inch spruce joists. On

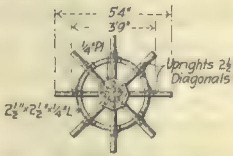


SECTIONAL ELEVATIONS GIVING GENERAL FRAMING PLAN.

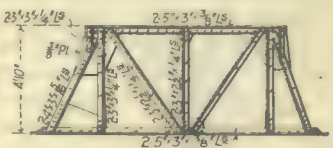
each side of the transept there are transverse girders composed of pairs of 15-inch I-beams.

The roof has six riveted trusses spanning the nave and four spanning the transept. Two of the latter are supported on the masonry walls, while all the remainder are riveted to the tops of the main columns. The trusses are all similar to the one shown in semi-elevation, and have double-pitched top chords in the planes of the rafters and curved bottom chords parallel to the ceiling vault. The end panels of the lower chords are horizontal, and the second panels are continuous with the flanges of curved knee-braces, which extend down a long distance below the tops of the columns and give the trusses the appearance of arches. The trusses are of ordinary riveted construction, with T-shaped members made of pairs of angles riveted together, back to back, on both sides of ⅜-inch gusset connection plates at panel points. The vertical member in the center of the truss is made double and allows central connections for the ridge purlin and the middle longitudinal ceiling girder. The trusses are connected longitudinally by three lines of I-beam purlins and two lines of eaves girders, which latter are made of a channel and angle riveted together. The purlins support 5-inch channel jack rafters, about 4 feet apart, which, in some parts of the roof, are arranged so that alternate ones are in the same planes with the ceiling rafters, which are spaced about 8 feet apart. Where the ceiling rafter and jack rafter are in the same plane they are braced together, as shown, by horizontal and vertical field-riveted angles at the eaves. The ceiling rafters have gusset plates and angle clips connecting them to the longitudinal beams, which are riveted to the vertical members in the main roof trusses.

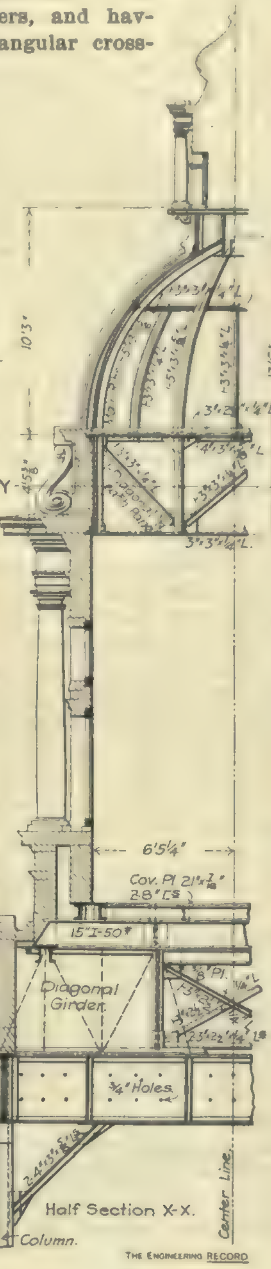




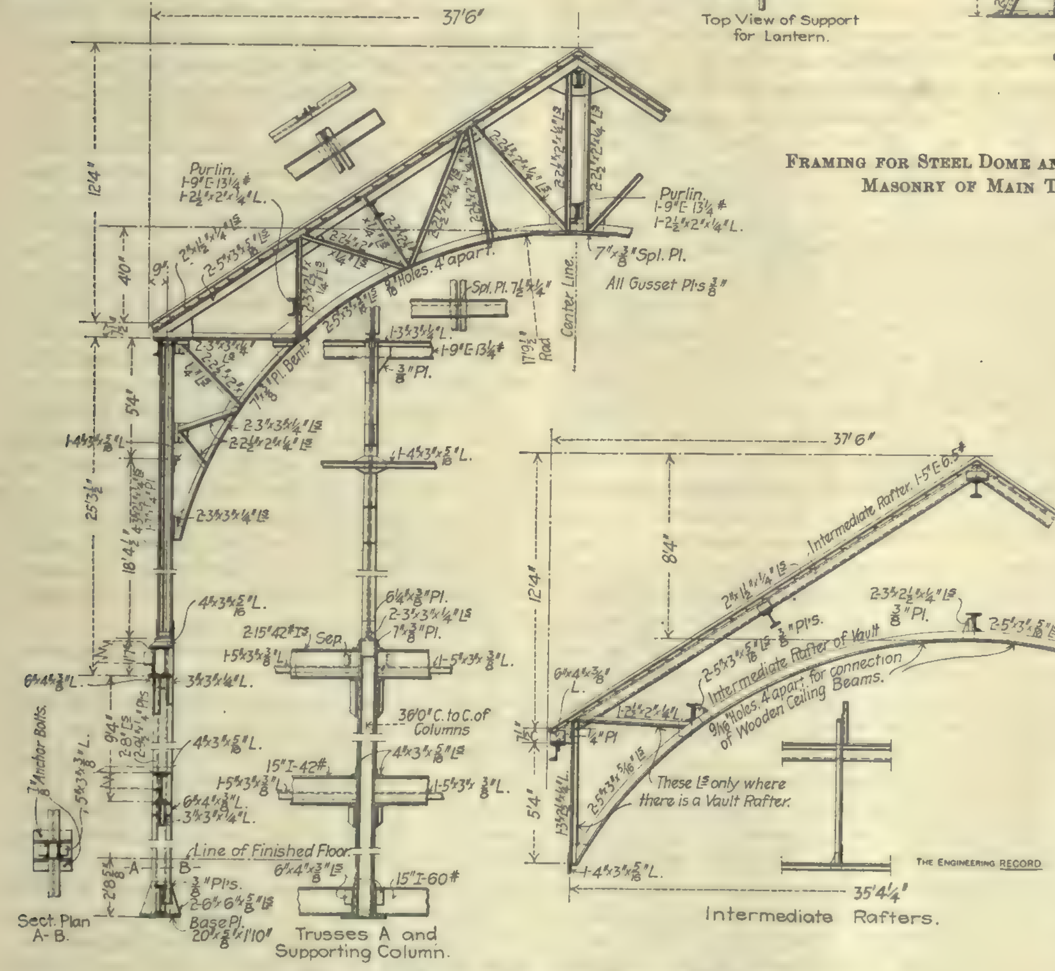
Top View of Support for Lantern.



Diagonal Girder. Outside Elevation.



Framing for Steel Dome and Girders for Masonry of Main Tower.



Transverse Sections showing Framing Details.

The ceiling of the semi-circular apse is spherical in shape, supported from radial trusses like half a main truss, which converge to the center of one of the regular roof trusses, and are supported at their lower ends on the masonry walls, as indicated by the longitudinal sectional elevation. There is a regular roof truss on each side of the square made by the intersection of the nave and transept, and these are carried by the main columns and support the steel framework for a low dome on pendentifs and a superimposed lantern. The corners of the square are cut off by four diagonal lattice girders 4 feet deep, which make alternate sides of a circumscribing octagon from which sixteen radial rafters are carried to the center. The peaks of the transverse roof trusses on opposite sides of the dome are connected by a longitudinal plate girder 25 inches deep, with pairs of 6 x 4-inch flange angles. The ridge girders of the transept are continued to intersection with this girder, which supports their ends over the dome center, and these four girders and the 12-inch inclined I-beams from the tops of the center columns to their intersection, support the framework of the dome and lantern.

The main columns are made in two sections, the lower one extending to the gallery roof girders, and having a closed rectangular cross-section made with two channels and two cover plates. The lower section has a horizontal cap on which is seated the flanged base of the upper section, composed of four angles and a web plate. The flanges of the upper columns have splice plates connecting them with webs of the channels of the lower columns. The first-floor girders are seated on the column base plates and riveted to the columns with side angle-clip connections. The other girders are seated on reinforced angle bracket shelves and have angle connections across their top flanges, but have no web connections to the columns. There is no diagonal longitudinal bracing and no X-bracing in the roof panels, but the columns are knee-braced with pairs of 4 x 3-inch angles to the gallery-floor girders.

The main tower has a rectangular cross-section of about 20 x 21 feet, with a column at each corner. Two of these columns are built into the side wall and the other two are in one of the longitudinal rows in the nave. The lower sections of the latter pair are only 16 feet apart so as to clear a window, and this necessitates the upper section of the second column from the end wall being set on top of a cantilever plate girder which overhangs the lower section 4 feet at the top of the side wall of the aisle, as seen in the general elevation. The tower columns are braced together on every side with plate girders and knee-braces, the arrangement of which is similar on all sides to what is shown in the general elevation, except for variations in the heights of the second and third girders from the bottom, which it was necessary to make irregular to conform to architectural requirements. The bottom plate girders have a 30-inch web and four 5 x 3 x ⅜-inch flange angles in the two wall faces, where they carry brickwork 16 inches thick. The upper girders have a 24 x ¼-inch web and four 4 x 3 x ⅜-inch flange angles. At the top of the square part of the tower plate girders 36 inches deep are web-connected to the tops of the columns and carry on their center lines a rectangular wall about 6 feet high, with a heavy cornice. Diagonal lattice girders about 5 feet deep are seated on the top flanges of the plate girders, and are connected by short girders like top-chord sections, which are parallel to the plate girders and, with the lattice girders, form an octagon on which a wall 5 feet high is carried. Fifteen-inch I-beams seated across this octagonal framework are framed together to support a concentric octagon about 12 feet in diameter, the sides of which are made of pairs of rolled or built channels with wide cover plates, forming a ring on which is built a circular brick wall about 11 feet in inside diameter. This wall forms the upper part of the tower, and is surrounded by detached columns supported on the octagonal wall. On top of the cylindrical brick wall are carried the eight curved steel ribs, made of single 3 x 3-inch angles, which support the copper shell of the dome. Diagonal bracing is placed between the lower or vertical portion of these ribs, which also carry intermediate horizontal angles and intermediate ribs for the copper dome.

The pitched roofs are covered with slate laid on 2 x 1½ x ¼-inch angles riveted to the top flanges of the rafters, roof trusses and jack rafters. Wooden furring strips are bolted to the lower chord flanges of the roof trusses, to the ceiling rafters and to the column brackets, to carry the lathing for the vaulted ceilings. The total weight of structural steel in the building is about 370 tons, which was manufactured by Messrs. Jones & Laughlin for Messrs. R. T. Murray & Brother, contractors for the steelwork. Messrs. Dehli & Howard, New York, were the architects, and Mr. Bernt Berger was consulting engineer and designed the steelwork.

Meeting of the American Society of Mechanical Engineers.

The opening session of the annual meeting of the American Society of Mechanical Engineers was held on the evening of December 3, at the Society's house in New York City, at which time Mr. Samuel T. Wellman delivered the annual presidential address, which was entitled "Early History of Open-Hearth Steel Manufacture in the United States." The second session, on the following morning, was devoted entirely to business matters. The most prominent feature in the report of the Council referred to the proposed increase in the dues of the Society, which increase was, according to the Constitution, to be voted on at the meeting. There was a long discussion on the subject, in which it was brought out that the condition of the Society's treasury was such that expenses had to be reduced or there must be an increase in the dues of members. The Council's proposal was to increase the dues of members and associates from $15 to $25 and those of juniors from $10 to $15. Another proposition, which, although it could not be constitutionally brought to vote at this convention, seemed to meet with some favor, contemplated an increase in the dues of members and associates to $20 only, and of juniors to $12.50, figures being submitted to show that such a course would in a short time wipe out the debts of the Society and enable it to maintain its present expenditures. The Council amendment was finally lost on a vote of 647 against and 191 in favor of it.

On Wednesday evening, the usual reception to members and guests by President Wellman and President-elect Reynolds was held at Sherry's.

The morning session, on December 5, opened with topical discussions and papers on subjects not within this journal's field. An early adjournment was necessary to enable members and guests to attend the dedication ceremonies of the monument to Robert Fulton which had been placed in Trinity churchyard by means of funds contributed by members of the Society. Rear-Admiral George W. Melville, Chief Engineer B. F. Isherwood, Dr. Robert H. Thurston, Rev. Dr. Morgan Dix, Rev. R. F. Crary, a grandson of Robert Fulton, took part in the services.

Among the papers at the evening session of the same day was one describing a "Silent Chain Gear," by Mr. J. O. Nixon, and one by Prof. C. H. Benjamin describing "The Bursting of Small Cast-Iron Fly-Wheels." The latter paper is the record of tests to destruction of sixteen 24-inch cast-iron flywheels, which tests, the author said, confirm the conclusions of the paper on the subject which he presented to the Society at the New York meeting in 1898. For correctly-proportioned wheels of moderate size, the solid rim was stated to be by far the safest form, and requires a peripheral speed of 350 to 400 feet per second to produce rupture. The stress due to bending is so small as to be negligible. Jointing the arms at the rim and bracing the rim by internal webs have no important effect on the strength; joints in the rims are the principal source of weakness, especially if located between the arms, and probably no joint can be made for a rim of solid cross-section which will be more than one-third as strong as the rim itself.

The 2-foot wheels were broken in a shield made of a 3-foot cast-steel ring with a 4 x 6-inch rim section, and of a timber enclosure with front and back of 3-inch oak plank. The cast-steel ring was lined with Norway pine blocks. The wheels were driven by a Dow steam turbine and the speed measured by means of a belted tachometer. Two wheels with solid rims burst at 3,700 and 3,850 revolutions per minute, equivalent to rim speeds of 387 and 403 feet per second. The figures correspond to a centrifugal tension of 14,980 and 16,240 pounds per square inch. The only wheels showing better than these were two having solid rims of an I-section, each with 24 spokes of steel wire, 12 on each side of the central plane. A pair of spokes constituted a loop, fastened at each end to the rim with a thread and nut and passing spirally around the hub in a groove cut for the purpose. The two wheels failed at the same speed, 4,050 revolutions per minute, corresponding to a rim speed of 424 feet per second, a centrifugal rim tension of nearly 18,000 pounds per square inch and a total rim tension of 44,000 pounds.

Prof. D. S. Jacobus then outlined the contents of the preliminary report of the committee appointed to codify and standardize the methods of making engine tests. This was submitted at the Milwaukee meeting, and extracts from it were printed in The Engineering Record of June 8, 1901. The report brought out a brief discussion, which will be considered by the committee before making its final report, which may be expected at the next meeting. The report of the committee on the standardization of engines and dynamos was submitted by Mr. A. L. Rohrer and accepted. This report was printed practically in full in the last issue.

The Friday morning session opened with the reading of Mr. E. W. Naylor's paper on "A New Valve Gear for Gas, Steam and Air Engines," which was largely descriptive in character. It was followed by a description of "The Potter Mesh Separator," by Mr. F. A. Scheffler. He referred to the fact that under certain operating conditions even the best designed boiler is likely to prime or foam badly. The Potter mesh separator, designed to prevent this trouble, is placed in the steam space of the boiler and connected in a manner similar to a dry pipe, or can be connected to the end of the dry pipe and the holes in the latter stopped up. It generally has from 25 to 30 layers of galvanized or copper wire screens placed alternately between rings of cast iron. The area of the screens depends on the size of the boiler outlet. The theory on which the action is based is that the small globules of moisture in the steam are broken up by the first screen and this action is continued through each successive layer until the water is so completely atomized on reaching the outlet chamber, or header, that it flashes into dry steam on the addition of a small amount of heat which, he said, is obtained by the wire-drawing due to the steam and water passing through the screens. The reduction in pressure was said to be about 1 per cent., and the temperature of the steam is increased proportionately. The separator is designed to be placed in any type of boiler equipped with a usual size manhole, and is held by studs screwed into the boiler shell. The connection between the outlets of the separator and boiler is not necessarily steam-tight, nor are the joints between the faces of the rings and screens steam-tight, as these openings are so small, the author said, that any steam which may leak through such spaces is slightly wire-drawn, with the same result that occurs to the steam passing directly through the meshes of the separator. These small openings on the lower part of the separator also provide the means whereby the entrained water returns to the boilers as it trickles down the successive layers of screen. The author recently made tests in a 3,000-horse-power electric plant with and without separator. Water level readings were taken simultaneously with calorimeter readings, a reading every minute for five minutes at ten-minute intervals over several hours. These indicated that at no time did the moisture exceed 2½ per cent., and that the steam issuing from the boilers contained 37½ per cent. more moisture when the separators were not used than when they were used, although the water level in the latter instance averaged materially higher than in the former. In the discussion of the paper, criticisms were made on a number of minor statements made by the author, and it was pointed out by one member that to obtain much superheating by means of wire-drawing a considerable drop in pressure in the steam would have to occur.

Mr. George M. Bond, representing the committee on standard unions, reported that conferences had been held with similar committees of the American Railway Master Mechanics' Association and the Master Car Builders' Association, but no definite agreement had been reached. Mr. C. W. Hunt's paper on "Working Loads for Manila Rope," which is printed in full in this issue, was then read by title. This was followed by a paper on "The Heat Engine Problem," by Mr. C. H. Lucke. The paper called attention to the advantages of a heat engine working on the Brayton cycle, and spoke of the possibilities of design in this direction. The discussion referred to the difficulties that had been met with in the past, due, largely, to the fact that with the low mean effective pressures that obtained with engines working upon this principle the engines had to be large and bulky per unit of power delivered.

Mr. W. C. Johnson's paper was then presented on "Water Power Development at Hannawa Falls," which was printed in abstract in last week's issue, and Prof. Alfred Kingsbury read a paper on the "Effect of Clearance on the Economy of a Small Engine." Tests were made on a 5 1/16 x 7-inch Payne engine made single acting by filling all ports leading to the crank end of the cylinder and modified in respect to clearance by inserting cast-iron rings under the back cylinder head. The clearance varied from 10.82 to 32.5 per cent. and the steam consumption from 51.9 pounds to 55.6 pounds per horse-power per hour. Mr. Henry E. Longwell believed limited clearance to be of decided economic advantage with a variable load and showed curves of steam consumption of Corliss and Westinghouse engines, each tested at various loads, in which the economy of the latter fell less rapidly at light loads than it did with the Corliss engine; the difference in this respect being attributed partly to the increased clearance of the Westinghouse machine.

Indirect Steam Heating in a Residence.

An interesting indirect steam heating apparatus for a residence, replacing a furnace plant which had warmed the building for a number of years, was recently completed in the home of Mr. Charles Scribner, No. 12 East Thirty-eighth Street, New York City. The plant is one depending on the columns of heated air, that is, on the difference in density between cold and warm air, to maintain a circulation through the duct system. A steam boiler of the cast-iron sectional type was installed, and various indirect stacks and some direct radiation fed on a two-pipe system complete the steam end. The indirect stacks are connected on a system of large ducts in the cellar, of the type in which the air is distributed cold to the various stacks, one stack to each flue.

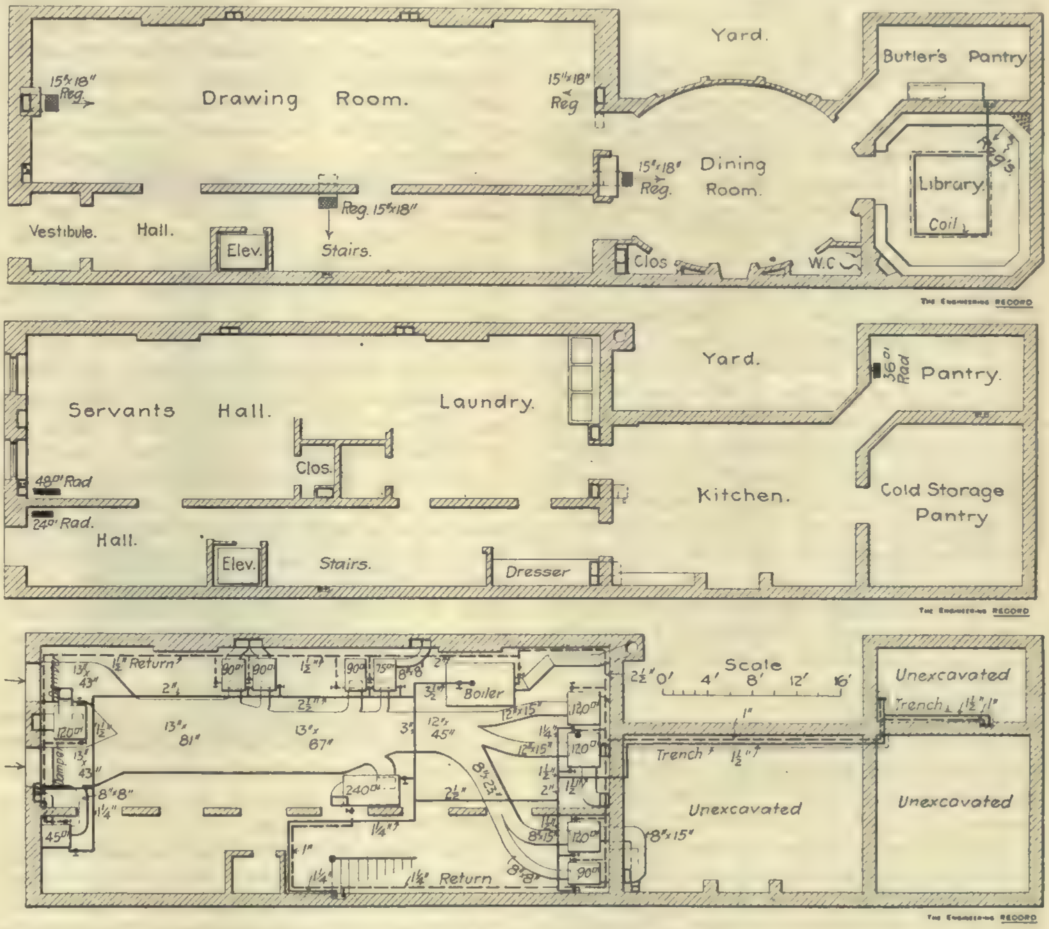
The house is a four-story structure with basement and cellar, 25 feet wide and 92 feet in total depth, having the unpierced side walls characteristic of New York dwellings. In the first story, as indicated in the accompanying illustration, is a drawing room, about 15 x 51 feet in size; alongside which is a hall extending from the entrance vestibule to a dining-room back of the drawing room. Back of this is a library and the butler's pantry, the former containing a glazed ceiling. The second floor contains the main chambers and a sitting room over the dining room; the third floor, three additional chambers and a nursery over the sitting room. In the basement are the laundry, the kitchen and pantries; in the cellar is space for storage, except as taken up for the heating apparatus. Plans of these two stories are also given in the accompanying drawings.

Referring to the cellar plan, it will be seen that the fresh air is admitted through two openings at the front or north wall. Two ducts from these, each fitted with a balanced shut-off damper, unite a short distance within the cellar into a duct 13 x 81 inches in cross-section, which is carried toward the rear of the cellar, feeding branches to the various indirect radiator stacks spaced around the cellar near the bases of their respective flues. Indirect radiation is provided for the front portion of the house only, and the rear portions of the cellar were unexcavated and contain no air ducts. The branch ducts enter the radiator casings at the bottom, in the usual way, toward one end, and the warm-air connection from the casing to the flue is taken out from the top toward the opposite end. The casings, which are of No. 24 galvanized iron, are large enough to leave 8 inches of space above the stack and 6 inches below it. Wherever possible the air flues of the former furnace plant were utilized in the new plant, but it was necessary to cut a number of chases in which to locate some of the ducts and such risers as were necessary to the direct radiation. In other cases, flues were built against walls, covered over with a metal lath and plaster furring; this construction is indicated, for example, in the two flues on opposite sides of the doorway between the laundry and the kitchen in the basement.

In all there are 1,200 square feet in indirect radiation, distributed over eleven flues and warming ten different rooms. Four of the flues go to the first floor, and in size have a cross-section which in square inches is one and one-half times the number of square feet of surface in the indirect radiator stack from which they receive fresh air, except that which feeds a register in the main hall; this flue has an area of 240 square inches running from an indirect radiator of 240 square feet of surface, a ratio of 1 to 1, the flue having a comparatively direct path from casing to register. Three flues feed two chambers and the sitting room on the second floor. In this case the area of flue in square inches is, in two flues, 0.88 of the number of square feet in the indirect stack; in the third, that for the sitting room, the ratio of area to heating surface is 1.00, the room being a large one, containing a considerable amount of glass window surface and requiring, according to the basis of design, 120 square feet of surface. Four flues feed three chambers and the nursery on the third floor. In all these cases the flues were conveniently made 8 x 8 inches in size. One of the front chambers has 90 square feet of indirect surface allotted to it in the basement, and the other, which is much smaller, has but 45 square feet; the ratios of flue area and heating surface are thus 0.71 and 1.42, respectively. A chamber behind the larger front one, and of about the same size, has, on account of its more protected location, but 75 square feet of heating surface, making the flue area and heating surface ratio 0.85. In all cases the gross register area is 1.5 times the flue area, except the floor register in the sitting room, which is 1.6 times the flue area, making the net register area about 1.12 times the flue area, except for the sitting room, where it is 1.2 times. The cold-air branch duct to the indirect casings is, in every case, equal in size to the warm-air connection from casing to flue. The apparatus is under thermostatic control, twelve thermostats in all controlling the ten rooms heated by indirect radiation, the library radiation and the hot-water tank.

The direct radiation includes a steam plate warmer in the butler's pantry, a hidden steam heating coil arranged to act as a direct-indirect radiator and a heating coil in the space between the glazed library ceiling and the library skylight roof, to prevent cool downward air currents in that room and to melt snow collecting on the upper light. The plate warmer comprises 40 square feet of surface. The hidden heating surface for the library comprises 54 square feet of surface, occupying a triangular space in one corner of the room, the entire inside of the space, including floor and ceiling, being lined with galvanized iron. The air passes into this space through a register in the baseboard of the bookcases, and after rising through the space enters the room through a 12 x 13-inch register near the ceiling, with a curved deflector behind the register. The idea was to secure as large an inlet and as large an outlet opening as possible, with as great a distance between the two as possible to effect largest volume of circulation of the air. The library ceiling skylight coil consists of three lines of 1-inch pipe. The valves for this, as well as for the hidden surface in the library corner, are located in the butler's pantry.

The boiler is a Mott Sunray boiler, and is located as shown in the cellar plan. It supplies a 3½-inch main, which is subdivided into a 2½-inch line and a 3-inch line. The former supplies 510 square feet of indirect surface and 120 square feet of direct radiation; the latter 690 square feet of indirect surface and about 200 square feet of direct radiation. All radiation is



Indirect Steam Heating in a Residence.

connected on two pipes, and the return mains are run around the outside cellar walls, as indicated, pitching toward the boiler, into which they return directly, the steam apparatus being a gravity one. The pipes carried through the unexcavated portion of the cellar are enclosed in a trench consisting of 4-inch brick sides on 6 inches of concrete and a stone flag covering.

The heating apparatus includes also a hot-water tank, 5 feet long and 30 inches in diameter, constructed of boiler steel, galvanized, and tested to withstand 150 pounds pressure. The steam coil for heating the water consists of 2-inch galvanized pipe. During summer, when no steam is used, a 24-inch Mott Sunray water heater is substituted for the hot-water tank.

The alterations mentioned were made from plans of Mr. Ernest Flagg, of New York, and the work described was done under the direction of Mr. O. F. Semsch, engineer for the architect. Messrs. Blake & Williams, of New York, were the contractors.

LETTERS TO THE EDITOR.

Asphalt Paving Specifications.

Sir: Frequent reference has lately been made in the public prints to the specifications now in use in the Department of Highways of the City of New York for asphalt paving. It has been stated that these specifications are so drawn as to favor the material exclusively controlled by what is commonly called the "Asphalt Trust," and that they set up standards which are fallacious, arbitrary, and of no real significance. The specifications referred to were, in their essential particulars, prepared in the Department of City Works of the City of Brooklyn in 1896; were adopted by several other cities; and in 1898 became the specifications of the Department of Highways of the City of New York. Under these specifications contracts were made for paving with asphalt at prices so low as to attract the attention of many of the cities of the United States.

I believe that these specifications are logical in their theory and arrangement, and are so framed as to permit the use of any asphalt suitable for street paving purposes. The theory of the specifications is this:

A standard pavement mixture is described, enumerating the physical and chemical characteristics of an asphalt which it has been demonstrated will make a satisfactory pavement. In the same manner are described the fluxing material to be added in order to make the asphaltic cement, the mineral matter which forms the bulk of the wearing surface, the way in which these ingredients shall be mixed, and the manner in which they shall be laid upon the street. In describing this standard pavement, the characteristics of the asphalt are those of the lowest grade of material on the market which it has been demonstrated will make a satisfactory pavement. Among the requirements are the following: The refined asphalt shall contain not less than 55 per cent. of bitumen soluble in carbon bisulphide, of which bitumen at least 68 per cent. shall be soluble in Pennsylvania petroleum naphtha of a specific gravity of 72 degrees Beaume; it shall soften at from 189 to 192 degrees Fahrenheit; it shall have a specific gravity of approximately 1.38, and shall be free from all manner and form of adulteration. After the evaporation of the solvent, the pure bituminous matter, soluble in carbon bisulphide, shall be adhesive, malleable and ductile at temperatures ranging from 70 degrees Fahrenheit to its liquifying point.

While neither name nor locality is mentioned, it is evident to anyone familiar with the subject that the material described is what is ordinarily known as Trinidad asphalt, and it may be safely said that there is no other asphalt which has been successfully used for street pavements which does not more than fulfil the requirements named in this specification.

Following the description of the pavement and the manner in which it is to be laid, is a paragraph entitled "General Requirement," printed in heavy type, which provides that whatever asphalt may be used, certain general results must be obtained. This paragraph is such an important part of the specification that I quote it in full:

"(20) General Requirement.—The asphalt for use under this contract shall be one agreeing in composition and properties with that described in the foregoing section, or one having composition and properties which are equivalent or superior thereto, as determined by the Commissioner of Highways; but whatever may be the character of the asphalt used or the manner of manipulation and laying, the pavement obtained must and shall conform to the following general requirements: The pavement when laid shall not be so soft as to be unfit for travel on the hottest days of summer, nor so hard as to disintegrate from the effects of frost. When laid, it shall be equal in consistency, surface and durability to the standard pavement made as hereinbefore described. It shall contain no water nor appreciable amount of light oils nor matter volatile at a temperature under 250 degrees Fahrenheit. It shall yield, when extracted with bisulphide of carbon and after evaporation of the solvent, not less than 9 nor more than 12 per cent. of pure bituminous matter. The extracted bituminous matter shall have a fire test of 350 degrees Fahrenheit, and shall not possess any marked acidity to caustic potash. All of the mineral matter shall pass a 10-mesh (per linear inch) sieve and not less than 15 per cent. shall pass a 100-mesh per linear inch sieve, while the remainder shall be graduated between these limits. If rock asphalt be used, the mineral matter shall be that which occurs in the natural product. In case of repairs, it will be required that such repairs shall match in color the original pavement and be made with a pavement mixture equal to the above described."

The above paragraph is, in my judgment, and is intended to be the real specification, the sections attached containing simply a description of a sample or standard pavement which is known to be satisfactory.

I feel justified in saying that no specification has been drawn which is more fair and free from prejudice than the one I have described.

Attention has frequently been directed to a provision contained in the preliminary notice to bidders, which requires that if a bidder purposes to use any material not heretofore used on streets paved by the Department of Highways, he must file, in addition to the samples required from all bidders, a copy of the specifications under which this material has been used, and a certificate showing some other city or cities where at least 10,000 square yards of pavement made of this material have been in use for at least two years. This certificate is to be "signed and duly acknowledged by the chief municipal officer having charge of such work in the city or cities where such pavement has been laid, and by the city engineer under whose direction it was laid."

It is not my purpose to discuss this provision, as it is not a part of the specifications originally prepared in Brooklyn. What I have said refers only to the specifications proper, which I think have been unfairly criticised, simply because they have been either wilfully misunderstood or not carefully read.

Yours truly, N. P. Lewis,
Brooklyn, Dec. 7. Engineer of Highways.

The Limiting Height of Earth Dams.

Sir: The investigations of Messrs. Croes, Sweet and Smith on the amount and position of the water of percolation in earth dams, referred to in recent issues of The Engineering Record, again call attention to the nature of the core which should be placed in such earth embankments. The masonry core-wall is essentially an American feature of dam construction, and it is held as little short of heresy, at least among the younger members of the profession, to regard it as equalled in any respect by a good puddle core. The very mention of such a view at a meeting of the American Society of Civil Engineers on the night of a dull discussion will let loose immediately a flood wave of debate which only an imperative call from the lunch rooms below will stop. Nevertheless, it would be interesting to hear from Mr. Croes and his associates what their views are regarding the best type of earth dam, and particularly the nature and construction of the cores. In some respects their recent investigations concerning the permeability of earth to water indicate that the accepted idea of a masonry core-wall is considerably different from its actual condition. Such a core-wall has two purposes; the prevention of burrowing through the embankment by animals and the prevention of percolation. Its first purpose is unquestionably attained by any wall, but the second can only be attained, even in a moderate degree, by the construction of a far better quality of masonry than is usually adopted. Moreover, engineers well acquainted with masonry dams are familiar with the fact that such structures show water on their down-stream faces in many cases. This is occasionally denied, but an examination of a really good collection of views of masonry dams will show that the front of a large number of the structures is marked by the discoloration of water which has "sweated" through the joints. On the other hand, engineers who have inspected many of the waterworks tunnels under the Great Lakes, during their construction, will recall the surprise with which they first viewed the hard dry earth through which the work was progressing, apparently unaffected by the water above, although compressed air was not used. In view of these facts, may it not be desirable to combine, more than is now the custom, the merits of the masonry and puddle cores? Years ago this was done, or advocated, to some extent, but of late the intention seems to be to rely on the masonry core for all purposes except stability. In view of the surprising amount of water shown to be present in the dams of the Croton valley, which diminishes the usually accepted theories of their stability, it might be well in future designs of high earth dams to consider a return to good puddle for tightness and a restriction of the masonry to an amount and position in the embankment which will confine its purpose to the prevention of burrowing by animals. A discussion of this subject at the present time, when the results of the recent examinations of earth dams by test wells are fresh in the minds of engineers, would surely be timely.

Very truly yours,
Chicago, December 10. Englishman.

A Direct-Current Three-Wire System of distribution at 460 volts has been adopted for the supply of electric lights by the Battersea Borough Council of London, Eng., which recently opened a new power station. The lamps are served by current at 230 volts pressure. The plant has a capacity to supply 45,000 8-candle-power lamps, besides street illumination representing about 17,000 8-candle-power lamps and 240 arc lamps.

The New England Water-Works Association Meeting.

The December meeting of the New England Water-Works Association was held at Young's Hotel, Boston, at two o'clock, Wednesday afternoon, December 11. The attendance was about one hundred. In the absence of the president, Mr. F. H. Crandall, of Burlington, Vt., the chair was occupied by former President Horace G. Holden, of Nashua, N. H.

The only paper presented was on "Swamp Drainage for Watershed Improvement," by Mr. Edward S. Larned, of the engineering staff of the Metropolitan Water Board. It was illustrated by lantern slides and described the work of the Metropolitan Water Commission in connection with one of its watersheds where trouble with discoloration of the water was experienced. The cause of this appearance of the water was found to be the numerous small swamps located within the watershed, where water, standing for long periods, attained the color of chocolate. A system of ditching was therefore decided upon, which has already been described in The Engineering Record. Although several thousand feet of ditches were constructed, the total cost to the Water Commission of securing property rights from landowners and for damages, real or fancied, did not amount to fifty dollars. Much of the land thus drained had been very appreciably improved, a good growth of grass in some cases now being secured by the owner where previously the land had yielded nothing whatever.

The ditches consisted of a trough, 11 inches wide, made of 2-inch planks laid on sleepers at the necessary depth. The sides, which were sloping, were then paved part way to the top with stones, secured either while excavating the work or from adjacent pastures, or in some instances at a cost of ten cents per load from farmers, who were also paid for hauling them. The work was done by day labor. The expense of cleaning the ditches, which is performed twice a year, was stated to be insignificant; while the cost of maintainance is also surprisingly low.

Mr. Freeman C. Coffin, chairman of the committee on "Standard Specifications for Cast-Iron Pipe," next presented the report of the committee, reviewed editorially last week. Upon Mr. Coffin's motion it was voted to set aside the rules of the association, which forbid any but members from taking part in the discussion and to open the discussion to any person interested in the subject in hand. Representatives of the United States Cast-Iron Pipe & Foundry Company and of R. D. Wood & Company spoke on behalf of the manufacturers of cast-iron pipe, stating that the latter had not yet had the opportunity of fully discussing all the items in the committee's specifications and asking for an extension of time.

Letters expressing opinions and offering suggestions were read from Mr. Louis H. Knapp, engineer of the Buffalo, N. Y., Water Department, from Mr. F. A. McGinnis, of the Boston City Engineer's Department, and from Mr. Emil Nuebling, engineer of the Reading, Pa., water-works.

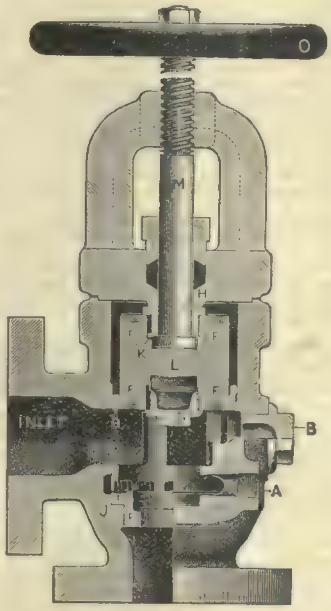
It was voted to continue the discussion of this report at the January meeting, the committee in the meantime being requested to confer further with manufacturers.

On motion of Mr. Charles W. Sherman it was voted to indorse the use of the blank form for summary of statistics, which the committee on "Uniform Statistics" had had printed, for the purpose of compiling statistics for the year 1901. This form is practically the same as that used by the society for the last fifteen years or so.

A New Blow-Off Valve.

The accompanying cut shows a cross-section of a new blow-off valve brought out by the Lunkenheimer Co., Cincinnati, after two years' experimental service. In general form it resembles the usual angle-body valves employed on boiler blow-offs, but a study of the illustration will show that the advantages of this shape of body have been supplemented with an arrangement of parts for keeping the seat for the disk free from scale. For this purpose a brass casing, D, is placed inside the body and held in position by the seat, E, which is screwed down on an inside flange with which it is provided. Around the bottom of this brass casing is an annular passage, C, connecting with an opening, A, into which a steam pipe is tapped. This pipe is provided with a suitable valve, and, when it is open, it is evident that the steam will blow across the face of the seat and remove all sediment which has collected on it during the blowing-off.

In closing the valve from the position shown in the illustration, the disk is screwed down in the usual manner, gradually cutting off the greater part of the flow of water and sediment. As soon as it passes the lower edge of the opening in the casing, the steam pipe connected to the inlet A should be opened, so that the steam will clean the seat to which the main disk is approaching. As soon as the disk is seated, the passage of the steam is stopped and the steam valve can be closed at leisure; in fact, the steam valve can be left open all the time if desired.



The Duro Blow-off Valve.

These valves are made in three sizes, 2, 2½ and 3 inches, and with screw, flange and screw, and flange ends, and for heavy boiler pressures the flange ends are made extra heavy if desired.

An Electrician on Electrolysis.

About a month ago, Mr. C. H. Wordingham, M. Inst. C. E., formerly city electrical engineer of Manchester, England, was installed as chairman of the Manchester Section of the Institution of Electrical Engineers. On that occasion he delivered an address on various aspects of electric undertakings, particularly those referring to the distribution and use of electricity in cities. One of these features was the problem of electrolysis of underground conductors, which is attracting as much attention in Great Britain as the United States, and has been made the subject of various rules issued by the Board of Trade. Of these rules and the conditions they are intended to enforce, Mr. Wordingham spoke as follows, according to the "Journal of Gas Lighting":

During the past year much commotion has been caused by the action of certain gas and water companies in the matter of possible danger from electrolysis arising from the operations of traction systems. On the one hand, the gas and water companies, not satisfied with protecting their property, have sought to impose conditions which would make it commercially impossible for electrical engineers to carry out their work; while on the other, electrical engineers have sought to repudiate responsibility altogether.

Immense sums of money belonging to communities or to individual shareholders are invested in gas and water pipes laid underground, on the due maintenance of which depends the distribution of such a vital commodity as water, and of such a universally employed agent as gas. There arises a new industry which necessitates the passing of electric currents through the soil in which these pipes are laid. It is known that under certain conditions these currents may damage the valuable property already in existence. Is it to be wondered at if those responsible for such property become alarmed, and seek to insure themselves against loss if damage should occur? It is urged that if the promoters of electric traction comply with certain arbitrary regulations drawn up by the Board of Trade when the state of knowledge of the subject was far less complete than now, they should be exempt from all liability for damage caused, no matter how great this may be.

Is this position consistent with common fairness? The gas and water companies have, with the sanction of Parliament, expended their money in order to meet public wants. Is it just that another company—who no less, but no more, than they serve the public—should be allowed to conduct their operations in such a manner as to destroy their property? All parties should be granted the free use of the soil; but no one of them should be allowed to damage any other.

The only reasonable position is that the traction companies should be allowed to carry out their work in the manner sanctioned by the Board of Trade; but if damage can be proved to have been done by them, then they should bear the cost. If the traction companies have the confidence in the Board of Trade regulations which they profess to have, they certainly cannot object to this, because they will do no damage. On the other hand, if they do the damage, they ought to pay for it.

It is objected that many bogus claims for ordinary corrosion will be made on the electrical companies. This may be so. But, after all, the onus of proof of damage lies upon the gas and water companies; and the electrical engineering profession has not hitherto proved itself lacking in either ingenuity or ability, and may safely be relied upon to take care of itself. At all events such a consideration ought not to affect the broad question.

In this controversy, the disastrous effect to electric traction generally that would arise from a wholesale destruction of gas and water pipes, if such destruction should take place, seems to have been lost sight of; and those who point out the danger and enforce attention to it now are far greater benefactors to the profession than those who vociferate that there is no danger, and urge on traction companies to what might be ultimate ruin. There is no doubt that, if the danger is recognized now, it can very well be avoided; for a much lower limit of drop of potential than that allowed by the Board of Trade can easily be worked to,

Personal and Obituary Notes.

Mr. Cass Gilbert, as the result of a competition, has been selected as architect for the Essex County Court House, at Newark, N. J.

Capt. James J. Meyler, Corps of Engineers, U. S. A., died December 11 at Newark, N. J., of pneumonia. He was graduated from West Point as second in the class of 1887. For the past four years he was in charge of harbor improvements at Los Angeles, Cal.

Mr. Marvin W. Kingsley, M. Am. Soc. C. E., for 28 years in the Water-Works Department of Cleveland, has opened offices in the Rose Building in that city for the practice of engineering pertaining to the construction of water-works and buildings and to submarine work.

Lieut.-Col. Henry M. Adams, Corps of Engineers, U. S. A., has been appointed a member of the Mississippi River Commission. Lieut.-Col. David P. Heap and Lieut. Robert P. Johnston, of Corps of Engineers, have been appointed members of the California Debris Commission.

Lieut.-Col. Charles W. Raymond, Corps of Engineers, U. S. A., Major B. H. Harrod, civil member of the Mississippi River Commission, and John Bogart, have been delegated by Pres. Roosevelt to represent the United States at the ninth international congress of engineers at Dusseldorf, Germany, in June, 1902.

William Rich Hutton, one of the best-known civil engineers in the country, died at Clopper, Md., on December 11. He was born in Washington on March 26, 1826, and spent many years in that city. For a long time he was the chief engineer of the Chesapeake & Ohio canal, and had lately been writing a historical sketch of this famous enterprise for The Engineering Record. He was connected with the Washington aqueduct in the period of both its design and construction, serving at one time as its chief engineer, and his paper on this work, printed in The Engineering Record of July 29, 1899, is the only detailed reliable technical description of it ever made public. One interesting feature of his professional career was connected with surveys in California soon after gold was discovered there, and he partially prepared some notes on this work which, it is to be hoped, will ultimately pass into the possession of a historical society. One great enterprise with which he was closely connected in a very responsible manner was the design of the Kanawha movable dam in West Virginia. At the time the work was undertaken, his professional standing was such that he refused to be ranked as a U. S. assistant engineer, and consequently received no rank at all. Mr. Hutton also assisted years ago in the design of parts of the Capitol at Washington, and thereby acquired a close connection with architectural work which he maintained to the end of his career. He was associated in one professional capacity or another with many water supply and sewerage works, served as chief engineer of the Hudson River tunnel for some time, and designed the beautiful Washington arch bridge over the Harlem River in New York. He was a member of many technical societies, a painstaking student of subjects without as well as within his profession, and the possessor of charming personal traits which won for him a wide circle of friends.

The Covering of a Basin of the Eden Park Reservoir in Cincinnati is now under discussion, as something that may be done to meet the objection to storing filtered water in open reservoirs, and, in this particular case, to prevent the accumulation of a sooty scum on the surface of the water. The latter difficulty is at present met by employing a man to row over the basin and skim off the matter.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv aud xxiii.

WATER.

Albany, N. Y.—Bids are wanted Dec. 16 for furnishing water meters and parts of meters. Isidore Wachsman, Clk. of the Board of Contract & Supplies.

Kansas City, Mo.—Bids are wanted Dec. 20 for 3 water tube or internally fired boilers, as advertised in The Engineering Record.

Philadelphia, Pa.—Bids are wanted Dec. 18 for furnishing cast iron water pipe, special castings, filtering materials and underdrains for Upper and Lower Roxborough filters, and sand washers for Lower Roxborough filters; also for trenching and pipe laying. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Water.

Chicago, Ill.—Bids are wanted Dec. 31 for furnishing the following water-works supplies, required during the year: Brass castings for hydrants, stop valves, cast iron rings and covers for hydrant chambers, special castings and cast iron pipe as follows: 80 pcs. of 4-in., 3,000 pcs. of 6-in., 700 pcs. of 8-in., 100 pcs. of 12-in. and 300 pcs. of 16-in., internal diameter. F. W. Blocki, Commr. of Pub. Wks.

Riverdale, Ill.—The date for receiving bids for a quarter million gallon power pump, a 15-H.-P. gasoline engine, an elevated steel tank, one or more driven wells, and other material and labor for a water-works system, not including pipe line, has been extended from Dec. 10 to Dec. 23. August C. Reich, Village Pres.; Sturtevant & Todd, 1208 Fisher Bldg., Chicago, Ill., Engrs.

Richmond, Va.—W. P. De Saussure, Attorney at Law, writes that the city's water supply is to be filtered, at a probable cost of $1,000,000. S. B. Mosby, of Richmond, Engr. in Charge.

Bridgeport, N. J.—A water supply for this place is said to be under consideration.

Boyertown, Pa.—The Town Council has passed an ordinance authorizing the issue of $35,000 bonds for the construction of a system of water-works. Wm. H. Fox, Town Clk.

Utica, N. Y.—The Common Council on Dec. 6 passed, over the Mayor's veto, the resolution granting to the Whitestown Water-Works Co. a franchise to lay water mains in Utica.

St. John, N. B.—Wm. Murdoch, Engr. & Supt., Water & Sewerage Dept., writes that it is proposed to extend the water mains to the suburb of Milford at a cost of $12,000. Work to be done by day labor, if at all.

Sherrard, Ill.—Press reports state that this place proposes to put in a system of water-works and has passed appropriating ordinance.

Waukomis, Okla. Ter.—The proposition to issue water-works bonds is said to be under consideration.

Tempe, Ariz.—It is stated that $30,000 bonds have been sold, the proceeds to be used for the construction of an electric light and water plant.

Quanah, Tex.—The proposition to issue $8,000 water bonds is stated to have carried.

Hutchinson, Kan.—Engr. C. H. Evans, of Chicago, Ill., is stated to have been selected to appraise the water, light and power plants, with a view to the purchase of same by the city.

Modesto, Cal.—Bids will be received for the completion of the Modesto Canal, estimated cost $284,000. W. R. High and T. K. Beard, Directors of the Modesto Irrigation District. Rob't H. Goodwin, 240 Montgomery St., San Francisco, Cal., Engr.

Port Dickinson, N. Y.—Village Clk. E. H. Smith writes that water-works are to be constructed at a probable cost of $10,000. Engr. in Charge, S. M. Bird.

Madisonville, O.—D. Edw. Sauer, Clk. Water-Works Trustees, writes that the proposed water-works improvements include the addition of one 125-Kw. alt. current dynamo, one 100-lt. arc direct current dynamo, one 200,000-gal. water tower, one 250-H.-P. engine, and approximately 15,000 ft. of water mains. Cost, $25,000. Engr., T. C. Finch. Bids will be received until Dec. 23 for the boiler, engine and dynamos.

Ft. Robinson, Neb.—See "Government Work."

Sloan, Ia.—Mayor M. B. Hilts writes that on Dec. 2 it was voted to issue $3,600 bonds for water-works.

Rockville Center, L. I., N. Y.—Water bonds to the amount of $10,000 were sold Dec. 10.

Merrimac, Mass.—The citizens are considering the question of establishing water and light plants.

Jamestown, N. Y.—City Engr. F. N. Dalrymple writes that the cost of water-works is being investigated and the city proposes either to purchase the present plant or to build a new one.

Lake Providence, La.—Through error a water item in last week's issue appeared as Lake Providence, R. I., instead of Lake Providence, La.

Wilmont, Minn.—Bids are wanted Dec. 27 for drilling a 6-in. well. It is stated that bids for a water and sewer system will be taken in February. M. B. Haynes, Engr., Mankato, Minn.; C. W. Mead, Village Recorder.

Columbus Grove, O.—Clk. Chas. Killen writes that bids will probably be received in January, 1902, for the construction of a new pumping station, estimated to cost $30,000. G. L. McKibben, Engr. in Charge.

Mankato, Minn.—Press reports state that the Board of Public Works will secure prices on water pipe at once.

Biddeford, Me.—The Artesian Water Co. has been incorporated with a capital stock of $50,000. Promoters: Leroy Haley, R. B. Siedel, Biddeford; C. W. Harmon, Old Orchard.

Los Angeles, Cal.—The Hermosa Beach Water Co., of Los Angeles organized for the purpose of acquiring and maintaining a system of water supply for Hermosa Beach and surrounding country, has filed articles of incorporation. Capital stock, $200,000. The directors are: Warren Gillelen, P. M. Green, John D. Pope, John R. Haynes and J. A. Pulham.

Crystal Falls, Mich.—It is stated that the Common Council has decided to enlarge the water-works and electric light plants. Estimated cost, $20,000.

Florence, Colo.—The City Council has instructed a special committee to purchase 22 acres of land, south of the city, for the proposed reservoir, which is to have a capacity of 50,000,000 gals.

Fort Collins, Colo.—A new reservoir company has been incorporated by John Lloyd Gray, Edward H. Hall and George W. Bailey, all of Fort Collins, the objects being to locate, construct, maintain and operate reservoirs and irrigating ditches in the counties of Larimer and Weld. Capital stock, $10,000.

Woodbury, N. J.—The contract for a new pump for the water-works has been awarded to the Camden Iron Wks. for $6,600.

Yonkers, N. Y.—The city is reported to have purchased 50 acres of land, including Woodlands Lake, the waters of which it is proposed to use for an additional city supply.

Long Beach, Cal.—Press reports state that the Alamitos Beach Water Co. is planning to improve its service. Work proposed is said to include the laying of about 7 miles of 4 and 8-in. pipe.

Dalton, O.—The Council has under consideration the question of improving the pumping station.

Clayton, Mo.—The County Clerk writes that the Aerial Electric & Manufacturing Co., B. Greensfelder, Attorney, Security Bldg., St. Louis, Mo., has been granted a franchise to operate a water-works system in St. Louis County.

Lakewood, R. I.—The taxpayers have voted to accept the charter granted by the General Assembly, which incorporates the village as the Lakewood Fire District. The Chas. J. Jager Co., of Boston, has offered to install a pumping station, with driven wells, pipe line and hydrant system, for $18,535.

Mounds, Ind. Ter.—The Mounds Light, Oil, Fuel & Water Co. has been incorporated, with a capital of $25,000. W. R. Casteel, T. R. Adams, G. M. Reynolds and others are the directors.

Questa, New Mex.—The Rio Colorado Canal Co. has filed incorporation papers, the incorporators being Henry John Young, Gerro; Ezra Stoner, Redding, and others. The company intends to build an irrigation canal out of the Rio Colorado, Taos County. The capital is $300,000. The headquarters are to be at Questa.

Ithaca, N. Y.—Prof. Gardner S. Williams, of Cornell University, is said to be preparing plans for the proposed changes and improvements to be made by the Ithaca Water Co. in its system of supply and distribution.

Birmingham, Ala.—The Jefferson County Sanitary Commission has decided to engage an expert sanitary engineer and to have the Birmingham water supply and the sanitary system thoroughly investigated.

Fayette, Miss.—The contract for constructing water-works is stated to have been awarded to P. H. Porter, of Louisville, Ky., for $12,250. The contract for the deep well was let to the Andrews Artesian Well Co., of New Orleans, at $3 per ft.

Emporia, Kan.—Local press reports state that the City Council has decided to construct a dam on Neosho River, about 9 miles north of the city. Estimated cost, $8,000.

Dillon, Mont.—Ivan Williams, of Spokane, estimates the cost of putting in a water system at $22,000.

Sacramento, Cal.—Local press reports state that the Water-Works Co. proposes to place a new intake in the river near the pump house.

Gloster, Miss.—Bonds to the amount of $23,000 have been sold; the money to be expended in the construction of water-works and an electric light plant.

Gunnison, Colo.—The proposition to build water and gas works has been voted upon favorably by the electors.

Springfield, O.—City water mains will be extended at once to the Children's Home. Estimated cost, $4,000. Geo. Weist, Supt. of Water-Works.

Spokane, Wash.—The City Council has under consideration a proposition to purchase a new pump at a cost of about $5,000.

Wilkinsburg, Pa.—The Wilkinsburg Water Co. has been organized, with a nominal capital of $1,000. R. A. and Jas. Balph are attorneys for the new company.

Minneapolis, Minn.—The city has taken out building permits for the construction of foundations for the Northeast pumping station; estimated cost, $40,000. Total cost of building is estimated at $100,000.

Arthur, Ill.—E. M. Fleming, Village Clerk, writes that bids will be received Dec. 17 for constructing water-works, to cost about $7,500. J. F. Martin, Engr. in Charge.

Ridgefield, Conn.—Bids are wanted by the Ridgefield Water Supply Co. until Dec. 20 for constructing a well. Plans and specifications may be obtained from Shedd & Sarle, 146 Westminster St., Providence, R. I., at a cost of $1.

Richmond, N. Y.—Bids are wanted Dec. 26 for furnishing, delivering and laying water mains in Central and Amboy Aves., Church St. and Broadway, Borough of Richmond. Wm. Dalton, Commr. of Water Supply, N. Y. City.

Charlotte, Mich.—Water bonds to the amount of $20,000 and sewer bonds to the amount of $30,000 have been sold.

Winters, Tex.—The Winters Water-Works Co., of Winters, has been incorporated with a capital stock of $10,000. Incorporators: J. H. Grant, F. L. Pierce, G. W. Murray, Walter Murray.

Niobrara, Neb.—Press reports state that Arnold C. Koenig, of Grand Island, Neb., has filed application on behalf of the Niobrara Irrigation & Water Power Co. to use the Niobrara River in Knox Co. for an irrigation canal. The proposed cost of dam is $50,000; of race, $45,000; machinery, $80,000, and buildings, $10,000.

Marshall, Mo.—City Clk. A. R. James writes that on Dec. 10 it was voted to issue $70,000 bonds for the construction of water-works and an electric light plant.

Stafford Springs, Conn.—At the annual borough meeting, held recently, it was voted to accept the amendment of the borough charter authorizing the purchase and control of the water-works.

Springdale, Ark.—The Water-Works Board is stated to have employed A. L. Dabney, of Joplin, Mo., to make the survey and draw plans for water-works.

Sioux Falls, S. D.—The South Dakota Water Co. is reported to be planning improvements to its system, estimated to cost $30,000. G. E. Hoffmaster, Auditor of the company.

Baltimore, Md.—Bids are wanted Dec. 18 (not Dec. 31, as previously stated) for furnishing and delivering to the Water Board such supplies as may be required during the year ending Dec. 31, 1902, including lead-lined iron pipe, cast iron pipe and fittings, brass castings, valves, clamps, and water meters, cement, etc. Alfred M. Quick, Water Engr.; Thos. G. Haven, Pres. Bd. of Awards.

Muskogee, Ind. Ter.—The Secretary of the Interior has approved bond issue by the city of Muskogee for $150,000 for construction of water-works and $25,000 for sewers.

Pittsburg, Pa.—The Filtration Committee has approved plans prepared for 60 per cent. of the work to be done on the filtration plant and has taken favorable action on the ordinance now before the Council for the letting of a contract for not more than $1,500,000. J. Guy McCandless, Dir. Pub. Wks.; John Upperman, Chmn. Filtration Com.; Morris Knowles, Resident Filtration Engr.

Cienfuegos, Cuba.—Press reports state that the Municipal Council of Cienfuegos has voted to reject all bids made to sewer and pave the city and to build water-works therefor, including the proposition made by Michael J. Dady, of Brooklyn, to construct a sewer and aqueduct at a cost of $2,700,000.

SEWERAGE AND SEWAGE DISPOSAL.

Darby, Pa.—An ordinance is before the Boro. Council, granting the United Sewerage Co. the right to construct and maintain a sewer along Cobb Creek in Darby. It is stated that this company proposes to construct a sewer about 20 miles in length, to carry sewage from Bryn Mawr, Ardmore, Haverford and other towns to tidewater.

Merida, Yucatan, Mex.—Consul Thompson is quoted as having reported from Progreso, Mex., that within a year the city of Merida will construct drainage works and pavements.

La Grange, Ga.—The Mayor writes that 5 or 6 miles of sewerage is soon to be put in.

Columbus, O.—City Engr. Julian Griggs writes that Thompson's subdivision sewers, to be built at a cost of $3,800, will include 500 ft. of 24-in. brick and 1,751 ft. of 8 to 20-in. pipe sewers.

Portland, Ind.—Bids are wanted Dec. 16 for constructing a sewer in Pine Alley. Horace Antrim, City Clk.

Coshocton, O.—Bids are wanted Dec. 16 for constructing 2,725 cu. ft. of 10-in. pipe sewer in a portion of Locust St. F. F. Wagner, City Clk.

Philadelphia, Pa.—Bids are wanted Dec. 16 for constructing a main sewer. Wm. C. Haddock, Dept. of Pub. Wks., Bureau of Surveys.

Philadelphia, Pa.—Bids are wanted Dec. 19 for repairing sewers, draining pipes, inlets, inlet necks, manholes and well holes, and cleaning sewers, drain pipes and inlet works, during the year 1902; for furnishing labor, tools, etc., for general repairs to sewers; for furnishing and delivering terra cotta pipe, manhole covers, grates and iron gutter plates, iron pipe, etc. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Highways.

Providence, R. I.—Bids will be received by the Commissioner of Public Works until Dec. 18 for furnishing and delivering the following materials for sewer work: 1,200 ft. of 15 and 4,500 ft. of 12-in. straight pipe, in 3-ft. lengths; 5,000 ft. of 8 and 2,000 ft. of 6-in. straight pipe in 2-ft. lengths; 30 ft. of 12 x 8-in. branch pipes, 1,800 ft. of 12 x 6-in. branch pipes, 100 pcs. of 8-in. ⅛ bends, 500,000 to 1,000,000 hard body bricks, 150 inlet curbstones for catch basins, etc. Rob't E. Smith, Commr.

Topeka, Kan.—Bids are wanted Dec. 23 for constructing a 6-in. 2-ring brick sewer in a portion of Jackson St. J. H. Squires, City Clk.

West Homestead, Pa.—The Borough Council has decided to issue $38,000 bonds for sewer improvements, and $12,000 bonds for a city hall.

Marion, Mass.—In a recent report on sewerage for this town Freeman C. Coffin, of Boston, recommends the separate system and intermittent sand filtration. Total estimated cost of system, including streets selected by the Sewerage Committee for present construction, $22,497. If the system is extended into other streets the cost is estimated at about $32,000. B. A. Conro, Chmn. Sewerage Com.

Guelph, Ont.—City Engr. James Hutcheon writes that preliminary plans have been made for a sewerage system, but nothing has yet been done toward construction.

Atchison, Kan.—The City Council has passed a resolution declaring it necessary to build sewers in South Atchison. Estimated cost, $36,692. Fred Giddings, City Engr.

Traverse City, Mich.—City Clk. C. W. Beers writes that the construction of new pipe sewers is contemplated. J. H. Bloomshield, Bay City, Mich., Engr. in Charge.

Newark, N. J.—Bids are wanted Jan. 16 for building Section 1 of the Joint Outlet Sewer, for Newark, Irvington, So. Orange, Summit, W. Orange, Millburn and Vailsburgh, as advertised in The Engineering Record.

Des Moines, Ia.—The City Council has passed resolutions of necessity for several sewers.

Sault Ste. Marie, Mich.—Local press reports state that the Board of Public Works has let the sewer contract recently abandoned by J. E. Whalen to J. H. Green & Sons, of Appleton, Wis., at a price approximately $71,065.

Gloucester City, N. J.—The Council has decided to borrow $10,000 with which to make needed sewer extensions.

Decatur, Ill.—The contract for the Milam drainage ditch in Macon County, is reported to have been let to the Mattoon Bridge & Dredging Co. for $9,690. There will be required 17,040 ft. of 12 to 26-in. tile.

New York, N. Y.—Bids are wanted Dec. 24 for constructing brick, vitrified salt-glazed stoneware pipe, and vitrified pipe sewers in portions of numerous streets in the Boroughs of Manhattan and the Bronx; these contracts call for the excavation and removal of 32,375 cu. yds. of rock. Jas. Kane, Commr. of Sewers.

Brownwood, Tex.—It is stated that bids are wanted Jan. 1 for constructing 9,000 ft. of sewers. H. B. Hardeman, City Engr.

Rossville, Ill.—Chas. Cottingham, of Danville, Ill., is reported to have surveyed a route for a sewer which this city proposes to build, at a cost of $3,500.

Toledo, O.—Riggs & Sherman, of Toledo, have been engaged to prepare plans for a new sewerage system for the infirmary.

Saugerties, N. Y.—Village Clk. Charles Vedder writes that at the election held Dec. 10 it was voted to appoint a separate Board of Sewer Commissioners.

Armourdale, Kan.—The citizens have under consideration plans for a system of sewers.

Brooklyn, N. Y.—Bids are wanted Dec. 24 for constructing 1,071 ft. of 18, 140 ft. of 15, and 3,126 ft. of 12-in. vitrified stoneware pipe sewers in portions of 3 streets, Boro. of Brooklyn. Jas. Kane, Commr. of Sewers, N. Y. City.

Ft. Wayne, Ind.—Bids are wanted Dec. 19 for constructing a 12 and 15-in. vitrified clay pipe sewer in portions of several alleys. A. M. Schmidt, Clk. Bd. Pub. Wks.

Fresno, Cal.—Local press reports state that City Engineer Teilman is making necessary surveys and estimates for a sewerage system for the additions. Estimated cost, $15,000.

Cienfuegos, Cuba.—See "Water."

Abilene, Kan.—It is proposed to construct a sewerage system at a cost of $11,000.

Wheaton, Ill.—Mayor J. S. Pieronnet writes that the city intends to construct a system of sanitary sewerage in 1902. Bids will probably be received in March or April. Estimated cost, $75,000.

Muskogee, Ind. Ter.—See "Water."

Marion, Ind.—Bids are wanted Jan. 3 for constructing a sanitary sewer of salt-glazed vitrified pipe, together with the necessary laterals, Y's, etc. C. G. Robbins, City Clk.

Indianapolis, Ind.—City Engineer Nelson estimates the cost of constructing Kenwood Ave. sewer at $7,175 and the cost of sewer in alley north of Sanders St. at $8,500.

Charlotte, Mich.—See "Water."

Kankakee, Ill.—Plans have been prepared by City Engineer Gregg for a 36-in. pipe sewer 5,200 ft. in length, for the State Insane Hospital. Appropriation, $25,000.

Meriden, Conn.—In his annual report Superintendent Downs recommends the placing of another 18-in. iron pipe under the Quinnipiac River at Hanover.

Chicago, Ill.—Wm. S. MacHarg, Consulting Engr., Intercepting Sewers, writes that the following bids were opened Dec. 6 by the Department of Public Works, for designing, furnishing and erecting 4 pumping engines to pump sewage and storm water: Camden Iron Works, Camden, N. J., $119,911; Allis-Chalmers Co., Milwaukee, Wis., $120,000. The engines called for are as follows: Two triple-expansion horizontal condensing engines, each direct-connected to one submerged centrifugal pump to discharge 75 cu. ft. per second; two triple-expansion, horizontal condensing engines, each direct-connected to one submerged centrifugal pump to discharge 250 cu. ft. per second.

BRIDGES.

Cleveland, O.—The cost of constructing a viaduct at Clark Ave. has been estimated by the City Engineer at $1,500,000. The plans call for a viaduct, to be 8,000 ft. long from approach to approach, the bridge proper to be 7,000 ft. long and have a 40-ft. roadway, 8-ft. walks on either side; it will require about 14,000 lbs. of steel.

Marietta, O.—The American Bridge Co. is reported to have secured the contract for the superstructure of bridge across Ohio River, at Marietta, for about $250,000. 5,000,000 lbs of steel will be required.

Towanda, Pa.—Press reports state that the Lehigh Valley R. R. Co. will construct a bridge across Susquehanna River, at Towanda.

Abrams, Pa.—The Reading Ry. Co. is said to be contemplating the construction, next year, of a bridge across Schuylkill River, between Abrams and Bridgeport.

Oshkosh, Wis.—See "Paving and Roadmaking."

Rhinelander, Wis.—The members of the Board of Public Works and the Special Committee of the County Board will recommend to the Council the acceptance of the bid of Milwaukee Bridge Co., Milwaukee, to rebuild Davenport St. bridge, for $6,500.

Lawrence, Mass.—See "Electric Railways."

Altoona, Pa.—The construction of a bridge at 14th St. is being considered.

Manitowoc, Wis.—The City Council has decided to construct a bascule bridge at State St.

Houghton, Mich.—It is stated that bids will be asked at once for the construction of a bridge across Sturgeon River, near Otter Lake.

Shamokin, Pa.—The viewers appointed to consider the construction of a bridge at Market St., Shamokin, have reported in favor of said bridge.

Cincinnati, O.—Bids are wanted Dec. 30 for constructing the superstructure of a plate girder bridge at Marshall Ave. Geo. F. Holmes, Clk. Bd. Pub. Service.

Philadelphia, Pa.—Bids are wanted Dec. 19 for furnishing labor, tools, machinery, etc., for general repairs to bridges, for furnishing and delivering iron or steel portable highway culverts, etc. Wm. C. Haddock, Dir. Dept. Pub. Wks. Bureau of Highways.

Danville, Ill.—M. A. Neville, Engr. Maintenance of Way, South and Delaware Sts., Indianapolis, Ind., writes that the Peoria & Eastern Ry. Co. proposes to construct a bridge over Vermilion River at Danville. Plans to be ready in a few weeks. Probable cost $108,000.

Buffalo. N. Y.—Bids are wanted Dec. 24 for constructing the superstructure of a bascule bridge at South Michigan St., across the City Ship Canal. R. G. Parsons, Sec'y Bd. Pub. Wks.

Buffalo, N. Y.—Bids are wanted by the Grade Crossing Commissioners until Dec. 20 for constructing the substructure, including the masonry, paving and other work necessary for constructing piers, abutments of and approaches to a viaduct at Louisiana St. Frank V. E. Bardol, Ch. Engr., Bureau of Engineering.

Quincy, Mass.—City Engr. Hamilton Flood writes that the Fore River Ship & Engine Co., of Quincy, is interested in the proposed construction of the Wellington bridge, at a probable cost of $100,000. Engr. in Charge, P. L. Hildreth, 32 B'way, New York.

Wichita, Kan.—The City Engineer has been instructed to prepare plans and estimates of the cost of constructing a steel viaduct on First St., to cross the tracks of three railways, which occupy as many different streets. Probable length of viaduct, 1,400 ft.

Shamokin, Pa.—The Grand Jury of Northumberland County Court on Dec. 5 confirmed the favorable report of viewers for a bridge to cross Shamokin Creek at Market St.

Woonsocket, R. I.—The City Council is considering the appropriation of $32,000 for the widening of Globe bridge.

Brooklyn, N. Y.—The United Engineering & Contracting Co. has received the contract to construct a bridge across Newtown Creek from Manhattan Ave. to Vernon Ave., Borough of Queens, for $547,047. For list of bids received see The Engineering Record of Dec. 7.

Richmond, Ind.—See "Business Buildings."

Montgomery, Pa.—The viewers appointed to report on the construction of a bridge near Montgomery are in favor of constructing said bridge.

Denver, Colo.—Engineer Long of the Board of Public Works has completed plans for a steel bridge to be constructed at Lawrence St., at a probable cost of $40,000.

Brockton, Mass.—The Common Council has passed an order for $10,000 to construct a bridge at Ames St.

Boston, Mass.—The Rockland Granite Co. is reported to have secured the contract to furnish the cut granite for the upper stone work on the 8 piers, for the bridge to be constructed from Boston to Cambridge. Contract price said to be $91,900.

New Castle, Pa.—The December Grand Jury has sent presentments to the court providing for the expenditure of about $250,000 for new bridges. The Jury recommends the construction of a viaduct, having a 950-ft. span, across Neshannock River; a viaduct at Gardner Ave., and the widening of Pittsburg St. bridge.

Peoria, Ill.—The construction of a steel viaduct across the Rock Island & Peoria Ry. tracks, in Peoria Heights, is being considered.

St. Joseph, Mich.—Press reports state that the issue of bonds for the construction of a bridge across St. Joseph River will be submitted to a vote of the people.

Perryville, Ark.—The American Bridge Co. is stated to have secured the contract to construct a steel bridge across Fourche la Fave River, near Perryville, for $9,290.

Good Thunder, Minn.—It is stated that the Chicago, Milwaukee & St. Paul Ry. Co. proposes to construct a steel bridge across Maple River.

London, Ont.—Local press reports state that the County Council has decided to construct 2 bridges, at a probable total cost of $27,000; one at Muncey, the other on town line between Dunwich and Aldboro.

Lewisburg, Pa.—The State Board of Property has notified the Commissioners of Northumberland and Union Counties that it is willing to co-operate for the construction of a bridge across Susquehanna River at Lewisburg.

Passaic, N. J.—F. R. Long & Co. are stated to have received the contract for constructing Monroe St. bridge.

Wilmington, N. C.—The Board of Audit and Finance has approved the action of the Board of Aldermen in appropriating $4,500 for constructing a steel bridge at 5th St.

Mainville, Pa.—Press reports state that the Reading Ry. Co. is having plans prepared for a 450-ft. steel viaduct to be constructed near Mainville, which will replace a wooden trestle recently damaged by fire.

Morgantown, W. Va.—Walker Bros., Charlestown, are stated to have received the contract to construct a steel bridge connecting Morgantown with the suburb of Seneca, for $12,000.

Lafayette, Ind.—The County Commissioners have approved plans for a steel bridge at Brown St., and have decided to ask the County Council for an appropriation of $31,000 to construct said bridge.

Beattyville, Ky.—Special Commr. H. L. Wheeler writes that the contract for constructing a 381-ft. iron bridge will be let Jan. 6, 1902.

Grove City, Ill.—Press reports state that early in the spring the Peoria & Pekin Union Ry. Co. will construct a steel bridge across Lick Creek, near Grove City. M. L. Morris, Engr., Peoria.

Findlay, O.—The construction of a bridge at Cory St. is being considered.

Sanatoga, Pa.—Viewers, appointed by the courts of Chester and Montgomery Counties, have agreed to recommend the construction of an inter-county steel bridge, 428 ft. long, across Schuylkill River, near Sanatoga Station, to cost about $28,000.

Denver, Colo.—The Council will be asked, by the Mayor, to appropriate $6,000 to repair the 16th St. bridge.

Sioux Falls, S. D.—It is stated that bids will be received by the County Auditor until Jan. 9 for constructing a steel bridge in the Third Ward.

St. Louis, Mo.—The following bids were opened Dec. 6 by the Board of Public Improvements, for removing the present superstructure of Chouteau Ave. bridge across the tracks of the St. Louis & San Francisco Ry., and building a new superstructure in its place, including an extension of present abutments: Bidders all of St. Louis:

Items and quantities.	Fruin & Colnon.	Oliver J. Barwick.	Hill & O'Meara Con. Co.	Geisel Con. Co.	Fruin & Bambrick Con. Co.
Exca., 1,000 cu. yds.	$1.00	$.50	$1.00	$.75	$.35
Concrete walls, 700 cu. yds............	6.00	5.00	5.20	6.00	5.20
Con. arches, includ. protec. of steelwk, 165 cu. yds.........	10.00	8.50	18.50	9.50	9.00
Br. pvt. on sand, per square of 100 ft., 20	15.00	15.00	17.50	15.00	19.00
Concr. parapets, 25 cu. yds............	18.00	17.00	20.00	16.00	6.00
Granitoid walks, 2,000 sq. ft..........	.30	.28	.24	.28	.19½
Steelwork in place, 330,000 lbs..........	.05½	.046	.046	.0422	.048
Totals	$26,350	$21,868	$24,203	$21,704	$22,235

Sherbrooke, P. Q.—Bids were opened Nov. 12 for a highway bridge 295 ft. long, with 32-ft. roadway and two 5-ft. sidewalks, which are of interest as showing the comparative weights and costs on different designs. John W. Burke, C. E., New York, states that the bridge is over a gorge with rocky sides affording foundations for cantilever or arch bridges with little masonry, while the abutments for truss spans cost $3,000 more than in other designs. The following tenders were received: A, National Bridge Co.; B, Dominion Bridge Co.; C, Canadian Bridge Co.; D, Hamilton Bridge Wks. Co. The arch bridge tender of the first company was accepted.

Cantilever bridge.	A.	B.	C.	D.
Lump sum................	....	$18,456	$20,240	$21,850
Per lb., cts..............	....	4.5	4.6	4.75
Weight, lbs..............	....	410,000	440,000	460,000
Truss bridge.				
Lump sum................	$14,000	$13,161	$14,910	$14,238
Per lb., cts..............	4.385	4.1	4.26	4.25
Weight, lbs..............	305,300	321,000	350,000	335,000
Arch bridge.				
Lump sum................	$18,800	$18,450*	$20,470	$21,375
Per lb., cts..............	4.646	4.5	4.6	4.75
Weight, lbs..............	404,600	410,000	445,000	450,000

*This arch is 190 instead of 200 ft.; trusses only about 21 ft. c. to c. for 42-ft. floor. Full-length bridge would cost about $19,258.

PAVING AND ROADMAKING.

St. Paul, Minn.—The Board of Public Works has recommended that Payne Ave. be paved with asphalt.

The lowest bid received Dec. 2 for improving and boulevarding Fuller St. is stated to have been from Fielding & Shepley, of St. Paul, at $8,725.

Milwaukee, Wis.—Citizens residing in the vicinity of Eleventh Ave. viaduct have petitioned the Council for a new pavement for the viaduct.

Ballston, Spa, N. Y.—The Saratoga County Supervisors have adopted resolutions to improve the highway between Ballston Spa and Saratoga Springs and also between Saratoga Springs and Schuylerville, under the State aid law.

Toledo, O.—The contract for paving a portion of Superior St. has been awarded to the Cleveland Trinidad Paving Co., bid submitted by Jas. Sheehan, Toledo, at $1.47 per yd. for resurfacing, total $9,918.

Petersburg, Ind.—Co. Aud. W. H. Scales writes that the contract for constructing 24 miles of rock or gravel road in Pike Co. has been awarded to Frank Jean, of Worthington, Ind., for $64,628.

Harrison, N. J.—Clarence T. Van Deren, Chmn. of the Street & Highway Committee, writes that the contract for paving First St. with oblong granite block, 27,000 sq. yds., set in concrete foundation, 300 ft. of new curb and 200 ft. of old curb set in concrete, etc., has been let to B. M. & J. F. Shanley Co., of Jersey City.

New Orleans, La.—City Comptroller V. Tryogue writes that H. C. Spinks, of New Orleans, bid $1.45 per sq. yd. for rock asphalt and $5.25 per. cu. yd. for cement concrete, bids opened Dec. 21, for work on Jefferson St.

Merida, Yucatan, Mex.—See "Sewerage and Sewage Disposal."

Yonkers, N. Y.—In his inaugural address Mayor Walsh recommends that authority be secured to issue $30,000 bonds for paving.

Baltimore, Md.—Press reports state that the city engineer has prepared plans for $150,000 worth of paving to be laid during 1902.

Providence, R. I.—The Board of Aldermen has concurred with the Common Council in appropriating $100,000 for the purpose of widening South Main St.

Des Moines, Ia.—The City Council has provided for the improvement of Kingman Boulevard by the building of a double driveway, with a parkway down the center.

Berwick, Pa.—See "Electric Railways."

Albany, N. Y.—A resolution before the County Board of Supervisors provides for the issue of $250,000 bonds for the improvement of county roads which have not yet been improved.

Cohoes, N. Y.—London Road, for a distance of 4 miles between Newtonville and Cohoes, is to be improved next year at a cost of $38,800. County's share of cost, $19,400.

Elmira, N. Y.—A correspondent writes that about 7,000 yds. of asphalt and 10,000 yds. of brick paving, both on concrete, has been planned for next spring.

Philadelphia, Pa.—Bids are wanted Dec. 19 for paving streets with Trinidad Lake or Bermudez Lake sheet asphalt, and with vitrified fire clay bricks or blocks; for the maintenance of unpaved and macadamized public highways, small bridges, drains and steps, during the year 1902; for repairs to paved streets during the year 1902; for furnishing and delivering bricks and bar sand, cement, paving sand and gravel, grading, paving, repaving or repairing sidewalks, etc. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Highways.

Zanesville, O.—Bids are wanted Dec. 16 for furnishing material and labor for paving with vitrified brick, putting in new and redressing and resetting old curbing, etc., on a portion of East Elm St. C. H. Bainter, City Clk.

Bond Hill, O.—Paddock Road improvement bonds to the amount of $26,626 have been sold.

Washington, Ia.—Bids are wanted Dec. 16 for parking, curbing, grading and paving with asphalt on a concrete foundation portions of several streets; in all 9,300 sq. yds. of paving, and 2,500 ft. of curb and gutter. Hugh H. McCleery, City Clk.

Bellevue, Pa.—An ordinance, providing for the issue of $40,000 bonds for street improvements, has passed second reading in the Council.

Oshkosh, Wis.—The Common Council has passed a resolution providing for the issuance of $20,000 bonds for the improvement, with brick or asphalt, of a number of streets and the building of an iron bridge over Sawyer Creek.

Sullivan, Ind.—The Board of Commissioners of Sullivan County is reported to have awarded the contract for building 15 miles of macadamized road in Turman Township to Alkire & Martin and Dodds & Miller. Contract price, $28,000.

Lawrence, Mass.—See "Electric Railways."

Traverse City, Mich.—City Clk. C. W. Beers writes that about 8 blocks of pavement is to be laid, probably brick. J. H. Bloomshield, of Bay City, Mich., Engr. in Charge.

Canton, Ill.—City Engr. Geo. W. Chandler writes that the Board of Local Improvements has awarded the contract for paving North 3d Ave. to M. Heckard & Sons, at the following prices: excavation, 19 cts. per cu. yd.; stone curbing, 40 cts. per lin. ft.; brick pavement, $1.15 per sq. yd.; total, $10,234.

Seattle, Wash.—A plan to grade and sidewalk 25 miles of streets on Queen Anne hill is under consideration by the City Council. The work, if ordered, will cost approximately $250,000.

Ellisburg, N. Y.—Bids are wanted Dec. 20 for constructing 4,131 ft. of macadam highway. C. I. Holley, Highway Commr.

Boston, Mass.—Bids are wanted Dec. 16 for completing a macadam roadway in W. Selden St., Dorchester Dist., Boston. Guy C. Emerson, Acting Supt. of Streets.

Cincinnati, O.—Bids are wanted Dec. 28 for improving Skillman road in Sycamore Township. Eugene L. Lewis, Co. Aud.

Toledo, O.—Bids are wanted Jan. 10 for block pavement on portions of Ontario and Church Sts. John E. Connell, City Clk.

Beaumont, Tex.—Special Engr. Merritt W. Yeater writes that the following bids were opened Dec. 3 for about 30,000 sq. yds. of pavement and 9,000 lin. ft. of curbing. Bidders: A, Parker-Washington Co., San Antonio, Tex.; B, Irwin Bros., Greenville, O.; C, Rob't C. Stowie, Ft. Worth, Tex.; D, Barber Asphalt Paving Co.; E, T. H. Micklejohn & Co., San Antonio; F, Nelson Paving Co., San Antonio:

Items.	A.	B.	C.	D.	E.	F.
Thurber brick per sq. yd.	2.08½	$2.20	$2.30	.....	$2.17	.....
Coffeyville br.	2.08½	2.24	2.26	.....	.....	.....
Pittsburg br.	2.08½	2.29	2.50	.....	.....	.....
Rock asphalt	2.17	.....	.....	.....	2.35	2.25
Sheet asphalt	2.50	.....	.....	2.79	.....	.....
Stone curb, per lin. ft.	.50	.....	.75	.60	.....	.60
Br. curb, per lin. ft.	.50	.70	.55	.60	.60	.55
Con. curb, per lin. ft.	1.00	.....	.60	.70	.....	.....
Br. mas., per cu. yd.	12.50	25.00	10.50	13.00	15.00	12.00
Tel. macadam	1.75	.....	.....	.....	.....	.....

POWER PLANTS, GAS AND ELECTRICITY.

Seattle, Wash.—The contract for lighting the city for the year 1902 has been awarded to the Seattle Electric Co., of Seattle, as follows: 175 enclosed arcs, 6.6 amp. at 78 volts, $72 each per year; 1,400 30 c. p. incandescent lamps at $15 per year; total, $33,600.

Wildwood, N. J.—The Council is stated to have granted the Five Mile Beach Gas Co. a franchise to construct and operate a gas plant.

West Concord, Minn.—Geo. N. Phelps is stated to have petitioned for a franchise for an electric light plant, which he proposes to install in connection with his mill.

Auburn, N. Y.—The contract for constructing the plant of the Citizens' Light & Power Co. is reported to have been awarded to Jas. E. Gibson, representing the National Gas & Construction Co., of Philadelphia, Pa.

Newfane, N. Y.—The Newfane Electric Co., of Newfane, has been incorporated with a capital of $1,000. Directors: C. T. Raymond and J. H. Eilers, of Lockport, and Jos. Robinson, of Newfane.

Nashville, Ill.—The Council is stated to have passed a resolution providing for the construction of an electric light plant. Alderman Wiese, Chmn. Com.

Crystal Falls, Mich.—See "Water."

Baltimore, Md.—The Council has passed an ordinance granting Richard B. Fentress and Summerfield B. Medairy, of Norfolk, Va., permission to lay conduits in the streets of this city for the transmission of hot and cold air.

Yosemite Valley, Cal.—Bids are wanted by the Commissioners to Manage the Yosemite Valley & Mariposa Big Tree Grove, Claus Spreckles Bldg., San Francisco, until Dec. 30, for furnishing labor and material for the construction and installation of an electric light and power plant in the Yosemite Valley; also for constructing transmission lines for electric light and power and equipping the hotel and buildings in said valley. Bids will be received separately or as a whole. J. J. Lennon, Secy.; C. L. Cory, Consulting and Superv. Engr.

Marshall, Mo.—See "Water."

Bath, Me.—The Sagadahoc Light & Power Co. is stated to have secured the contract for lighting the city for 3 years, at $75 per year for each light, all night service. The contract provides for 60 lights of 1,200 c. p.

Hudson, N. Y.—It is stated that a committee has been appointed to secure estimates for a municipal lighting plant. Wm. Wortman, Clk. of Com.

Duluth, Minn.—The Black River Falls Co., of Duluth, has been incorporated, with a capital of $50,000, to furnish electric light and power in St. Louis County. Incorporators: W. C. Sargent and W. M. Burgess.

Newport, Me.—It is reported that the Smith Sturtevant Co. is in the market for a complete electric light plant.

Peoria, Ill.—The City Council on Dec. 3 adopted a resolution providing for the appointment of a committee to devise ways and means for the construction of a municipal electric light plant.

Orion, Mich.—The Orion Light & Power Co. has been incorporated, with a capital of $25,000, by John H. Winters, Oliver H. Law and others, all of Detroit.

St. Louis, Mo.—Local press reports state that plans have been completed for a power plant, to cost about $2,000,000, to be erected by the Citizens' Electric Light & Power Co. at the foot of O'Fallon St.

Tempe, Ariz.—See "Water."

Upper Sandusky, O.—H. E. Hill and J. W. Barber, of Marion, are stated to have petitioned the Council for a franchise to construct a steam heating plant.

Madisonville, O.—See "Water."

Walla Walla, Wash.—The Mill Creek Light & Power Co. has been incorporated, with a capital of $250,000, by Edwin S. Isaacs, Walter S. McCalley and Gilbert Hunt, to construct electric generating works at a point on Mill Creek, about 10 miles above Walla Walla, and furnish power for the electric street railway, for which E. S. Isaacs recently received a franchise, and such other industries as may desire to use electric power for street and other lighting. An engineer who made a survey estimates that 1,000 H. P. can be developed and brought to the city by the expenditure of $100,000.

Springfield, Mass.—It is stated that the Springfield Gaslight Co. will construct a new receiver on State and Water Sts., to hold 750,000 cu. ft. of gas, and also lay new mains.

Merrimac, Mass.—See "Water."

Bessemer, Ala.—The Birmingham Light & Power Co. is stated to have purchased the plant of the Bessemer Electrical Co. at Bessemer, and will expend about $250,000 in putting in a lighting and power station to furnish electricity to the city, and also operate two electric railways between Birmingham and Bessemer.

Huntsville, Ala.—The city is stated to have directed the Committee on Lights on investigate the feasibility of establishing an electric light plant.

Pleasantville, Pa.—A water power company is stated to have been formed here with a capital of $100,000, by P. D. Wanner, C. Taylor Leland and others.

Woodbine, Ia.—The citizens are stated to have voted to grant a franchise to the Woodbine Htg. & Lighting Co.

Bear Lake, Mich.—It is stated that R. F. Kleckner and Eugene Steele will construct an electric light plant, with a capacity of about 1,200 lights.

Lacyville, Pa.—A. L. Vandervort and M. S. Cornell are reported interested in the construction of an electric light plant.

Wrightsville, Pa.—It is stated that the mill property owned by Henry James, of Baltimore, at the lower end of Wrightsville, with all necessary rights, has been purchased by Henry McElroy and Henry Birnstock, of Wrightsville, and will be converted into an electric light plant.

Orange, Va.—The town authorities are reported to be negotiating for an electric light plant.

New Martinsville, W. Va.—The New Martinsville Electric Light, Heat & Power Co. is stated to have been formed, with a capital of $50,000, to construct an electric plant. Directors, Frank Hall and N. C. Hamilton.

Iron Mountain, Mich.—There is talk of constructing a municipal electric light plant here.

Whittier, Cal.—City Clk. Walter E. Butler writes that the bid of the Edison Electric Co., submitted Dec. 2, has been accepted for electric light and power franchise.

Syracuse, N. Y.—Bids are wanted Dec. 16 for furnishing the following apparatus, materials and construction: Motor generators, wire, fixtures, labor and material needed for the installation of storage battery and central energy system; also for the labor and material needed for the installation of a return wire on the first circuit, North Side. Rob't H. Jones, Clk. Bd. of Contract & Supply.

Princeton, Wis.—Teske & Zierke, of Princeton, are reported to have secured a franchise for an electric light plant.

Mounds, Ind. Ter.—See "Water."

Waukegan, Ill.—A. L. Hendee, S. D. Talcott and others are stated to have petitioned the Council for a franchise for an electric light plant.

Gloster, Miss.—See "Water."

Brighton, Ia.—The question of establishing an electric light plant is reported to be under consideration by the Council.

Gunnison, Colo.—See "Water."

Elyria, O.—An electric light company is reported being organized, with a capital of $150,000, by W. F. Carr, C. H. Gale and others.

Buffalo, N. Y.—The Supervisors are stated to have awarded the contract, for supplying and installing an electric generator and motor at the Consumption Hospital, to McCarthy Bros. & Ford, at $8,385.

ELECTRIC RAILWAYS.

Lawrence, Mass.—The Aldermen are stated to have granted permission to the Boston & Northern St. Ry. Co. (H. S. Newell, Div. Supt., Lawrence) to extend its line, on condition that the company pave a portion of Broadway, construct an iron bridge over the Shawsheen River on Loring St. and pay the proportionate cost of a new bridge over the Boston & Maine tracks on South Union St.

Windber, Pa.—The Council is stated to have granted a franchise to the Johnstown Passenger Ry. Co. A. H. Walker, Ch. Engr., Johnstown.

Livonia, N. Y.—The Highway Commissioners are stated to have granted the Rochester, Corning & Elmira Electric Ry. Co. a right of way through Livonia.

Batesville, Ind.—The Batesville Traction Co. has been incorporated to construct an electric railway from Shelbyville through Greensburg to Batesville; capital, $10,000. Incorporators: Louis Zoller, Sherman P. Minear and others.

Seattle, Wash.—The City Council is stated to have granted Jacob Furth and M. H. Young a franchise for a street railway line in the southern part of the city.

Rochester, N. Y.—The State R. R. Commissioners are stated to have granted a franchise to the Monroe County Electric Belt Line R. R. Co. Merton E. Lewis, Attorney.

Akron, N. Y.—The Town Board is stated to have granted a franchise to the Buffalo & Williamsville Electric R. R. Co. C. A. Blecher, Ch. Engr., Williamsville.

Westfield, N. Y.—The Lake Shore Traction Co. has been incorporated with a capital of $280,000 to construct and operate an electric railroad 28 miles long, from Westfield to Silver Lake. Directors: Arthur C. Wade, Jamestown; A. B. Ottaway, Westfield, and others.

South McAlester, Ind. Ter.—The Council is stated to have granted a franchise to Chicago parties for an electric railway extending from South McAlester to McAlester, Krebs, Alderson, Carbon and Haileyville, a distance of about 40 miles. Work is to be commenced within 6 months. The general offices, power house and machine shop will be located in South McAlester.

Trenton, N. J.—A press report states that the Trenton & New Brunswick R. R. Co. has been incorporated with a capital of $1,000,000, to construct a line about 23 miles in length, between Milltown and Trenton, which is a portion of the proposed third rail electric system between Philadelphia and New York. Incorporators: S. L. Mead, Merchantville; R. C. Mason, Camden, and others.

Pasadena, Cal.—The Los Angeles & Pasadena Electric Ry. Co. is stated to have petitioned the County Supervisors for a franchise to construct and operate a single or double track extension of its system in Pasadena. G. E. Pillsbury, Ch. Engr., Pasadena.

Barberton, O.—It is stated that the Northern Ohio Traction Co. will extend its line from Barberton to Wadsworth in the spring. Chas. Currie, Gen. Mgr., Akron.

Davenport, Ia.—Wm. Kimball, Winnecke Bldg., is stated to have completed preliminary surveys for the proposed electric railway, to be constructed between Davenport and Iowa City.

Evansville, Ind.—The Evansville & Mt. Vernon Traction Co. has been incorporated, to construct an electric railway from Evansville to Mt. Vernon. Incorporators: Geo. Ford, New Harmony, Fred'k P. Leonard, Mt. Vernon, and others.

Portland, Mich.—The Council is stated to have granted a franchise to Bingley R. Fales, of Detroit, representing the Hawkes-Angus Co., for an electric railway through Portland from Lansing to Grand Rapids.

Kenton, O.—The Hardin County Commissioners are stated to have granted the Tiffin & South Western Electric Ry. Co. a franchise to construct a line from Marseilles to this city.

North Attleboro, Mass.—Theron I. Smith, of North Attleboro, a director of the Cumberland & North Attleboro St. Ry., writes that it is proposed to construct an electric railway between this place and Cumberland.

Streator, Ill.—An interurban road will be built in the spring; length 16 miles.

Chattanooga, Tenn.—The Chattanooga Electric St. Ry. Co. and the Chattanooga Rapid Transit Co. will be combined under one management January 1, 1902. The latter buys out the former. W. R. King, Supt.

Silver Creek, N. Y.—The Dunkirk & Point Gratiot Traction Co. is stated to have petitioned the Village Trustees for a franchise. J. Wagner, Ch. Engr., Dunkirk.

Lewiston, Me.—Contracts are now being let and work will begin early in the spring on the Lewiston, Winthrop & Augusta Ry.

Columbus, O.—The Southern Ohio Traction Co., F. J. J. Sloat, of Hamilton, Gen. Mgr., is reported to have petitioned the State Board for a lease of about 3 miles of the towpath of the Miami & Erie Canal between Middletown and Franklin for an electric railway.

Silver City, N. M.—The City Council is stated to have granted L. P. Deming and T. W. Carter, of New Haven, Conn., and M. W. Porterfield, of Silver City, a franchise to construct an electric railway connecting the mining camps of Santa Rica, Fierro, Hanover, Central, Pinos Altos and the Burro Mountains with Silver City.

Piqua, O.—The Council is stated to have granted a franchise to the Western Ohio Ry. Co. F. D. Carpenter, Gen. Mgr., Cleveland.

Brownsville, Pa.—The Brownsville & California St. Ry. Co. is reported incorporated to construct a line from Brownsville to Bridgeport, West Brownsville and California, a distance of about 7 miles; capital, $24,000. Incorporators: Sam'l H. Pearsol, John L. Bakewell, and others, all of Brownsville.

Berwick, Pa.—The Council is stated to have granted a right of way through the borough to the Columbia & Montour Electric R. R. Co. It is stated that the company will macadamize the portion of road used by them.

Stroudsburg, Pa.—A charter is stated to have been granted to the Minisink Ry., with a capital of $60,000, to construct an electric railway from the Court House in this town, through the Water Gap, to Portland. Incorporators: Chas. Shuman, Bath; E. Hilderbrand, Portland, and others.

Sioux Falls, S. D.—The Central Heating, Lighting & Power Co. has petitioned the Council for an electric railway franchise.

Chicago, Ill.—A press reports states that the Chicago & Indiana Air Line Ry. Co. has been incorporated, with a capital of $1,800,000, to construct an electric railway between Chicago and South Bend, Ind. Directors: W. O. Orton and G. W. Bryson, South Bend; Sam'l Insull, Chicago, and others.

Portland, Me.—The State R. R. Commissioners have approved the location of the Portland & Brunswick St. Ry. Co., the line to run from Brunswick through Freeport and Yarmouth to Portland. Work will begin in the spring.

Binghamton, N. Y.—It is stated that the Binghamton Ry. Co. will extend its line from Binghamton to Union Center and Maine next spring. J. P. E. Clark, Gen. Mgr., Binghamton.

Dayton, O.—The contract for constructing the Dayton, Piqua & Covington Electric Ry. is stated to have been awarded to the Chase Construction Co., of Detroit, Mich.

Litchfield, Conn.—T. H. McKenzie, of Southington, is reported interested in the construction of an electric railway about 11 miles in length, from Litchfield to Watertown. Cost of construction to be about $175,000.

Stoughton, Wis.—The Council is stated to have granted a franchise to the Madison & Janesville Interurban Ry. Co. P. L. Spooner, Pres.

Leavenworth, Kan.—H. M. Levan, of Lawrence, and associates are stated to have petitioned the Leavenworth County Commissioners for a franchise through the southern part of the county. The line is to run from Argentine, Kan., to Lawrence.

Elwood, Ind.—The Council is stated to have granted the Central Traction Co. a franchise through the city for a line from Elwood to Indianapolis by the way of Atlanta.

Mt. Holly Springs, Pa.—A press report states that the Carlisle & Mt. Holly Electric R. R. Co. will construct a power plant near Mt. Holly Springs, to operate its lines, and supply electric power and light to Mt. Holly and places between there and Carlisle. C. Faller, Supt., Carlisle.

Gloversville, N. Y.—The Council is stated to have granted a franchise to the Mountain Lake Electric R. R. Co. A. J. Keith, Mgr., Gloversville.

Canastota, N. Y.—The Directors of the Canastota & Morrisville Ry. Co. are stated to have voted on Dec. 3 to increase its capital from $200,000 to $300,000, and also to negotiate the sale of bonds and make contracts for the building and equipment of the road.

Bath, N. Y.—The Rochester & Elmira Electric Ry. Co. is stated to have secured a right of way through Bath.

Springfield, O.—H. J. Crowley, Gen. Mgr., and C. L. S. Tingley, Sec'y, of the American Ry. Co., are stated to have decided to recommend improvements to the line, which will cost about $30,000.

Madisonville, O.—The Council is stated to have granted the Cincinnati & Columbus Traction Co. a franchise through the village.

Richmond, Ind.—It is stated that the Richmond St. & Interurban Co. will construct a line next spring, from Milton to Connersville. J. W. Lantz, Mgr., Richmond.

Concord, N. H.—The Directors of the Concord & Montreal R. R. are stated to have decided to construct a line about 1 mile long to the Mt. Pleasant House. Benj. J. Kimball, Pres. Bd. Dir.

Dekalb, Ill.—A press report states that the Rockford-Belvidere electric line is to be extended to Dekalb. G. B. Shaw, Vice-Pres. American Trust & Savings Bank of Chicago, is reported interested.

Cleveland, O.—The Tuscarawas Traction Co. is reported to have been organized here, with capital of $350,000, for the purpose of consolidating the Tuscarawas Electric Co. and the Tuscarawas R. R. Co. The new company will build from Canal Dover to Strasburg.

Victory, N. Y.—It is stated that the Hudson Valley Ry. Co. proposes to extend its road from its main line south of Schuylerville to Victory. J. H. Armstrong, Ch. Engr., Glens Falls.

Cedar Rapids, Ia.—The Cedar Rapids, Iowa City & Southern Ry. Co. has been incorporated, with a capital of $100,000, by Wm. G. Dows, Isaac B. Smith and Wm. J. Greene, of Cedar Rapids, to construct an electric railway from Cedar Rapids to Iowa City.

Eaton Rapids, Mich.—The City Council is stated to have granted W. Watkins, representing the Michigan Traction Co., of Grand Rapids, a franchise for an electric railroad through the city. The road will extend from Grand Rapids to Jackson.

Midland, Mich.—Herbert H. Dow and others of this place are reported to have secured a 30-year franchise for an electric railway from St. Louis to Bay City, 40 miles.

RAILROADS.

Philadelphia, Pa.—The contract for constructing a tunnel adjoining the old Portage tunnel on the main line of the Pennsylvania R. R., near Gallitzin, is stated to have been awarded to P. F. Brendlinger.

Washington, D. C.—The Washington Terminal Co. has been incorporated with a capital of $5,000,000, to provide for the elimination of certain grade crossings in the District of Columbia and the construction of new railroad terminals in Washington, as well as tracks for the Baltimore & Ohio Railroad. Among the incorporators are G. L. Potter, and J. M. Graham, Gen. Mgr. and Ch. Engr., respectively, of the Baltimore & Ohio R. R., both of Baltimore, Md., and Geo. P. Harlow, of Alexandria, Va.

Guthrie, Okla, Ter.—It is stated the Choctaw Ry. Co. will extend its line to this city at once, from Hartshorn, I. T., a distance of about 140 miles.

Memphis, Tenn.—The Memphis & St. Louis Ry. Co. has been incorporated with a capital of $500,000 by Seth S. Barnes, Lawrence Fischer and others, all of New Madrid, Mo., to construct a standard gauge railroad from a point on the St. Louis & Memphis R. R., near Paw Paw Junction, to Gray's Point in Scott County, a distance of 50 miles.

Phoenix, Ariz.—It is stated that preliminary surveys have been completed for the Phoenix & Eastern R. R., to connect with the Phelps-Dodge system at Benson, to be built by F. Murphy and associates.

Toledo, O.—The Ohio & Michigan Air Line R. R. Co. has been incorporated with a capital of $1,000 to construct a line from Toledo, where the principal office is to be, to Monroe, Mich. Incorporators: Rob't Crasser, S. M. Hildreth and others, all of Cleveland.

Joplin, Mo.—The Council is stated to have granted the Missouri, Kansas & Northwestern R. R. Co. a franchise to enter the city.

Richmond, Ind.—The Cincinnati, Richmond & Muncie R. R. Co. is stated to have filed notice of an increase of its capital stock from $850,000 to $2,656,000. It is the intention of the company to build its lines from Cincinnati to North Judson, and thence run its cars into Chicago over another line. The road is now in operation to Muncie. H. L. Jackson, Ch. Engr., Richmond.

Oneonta, N. Y.—It is stated that the Unadilla Valley R. R. will be extended to Oneonta on the south and to Utica on the north. Henry H. Shepard, Supt., New Berlin, N. Y.

Burk's Falls, Ont.—The Directors of the Maganetewan Ry. Co. are stated to have decided to enter into an agreement with the Grand Trunk Ry. (J. Hobson, Ch. Engr., Montreal, Que.), whereby the latter will construct the line. The proposed line runs from Burk's Falls, on the G. T. R., to the head of navigation on the Maganetewan River. The charter also provides for an extension to Sault Ste. Marie. Jas. Sharpe, Burk's Falls, and H. W. Cooper, Montreal, Que., are among the directors.

Traverse City, Mich.—The Traverse City, Leelanau & Manistique Ry. Co. has been incorporated to construct a railroad from Traverse City to Northport, a distance of 30 miles; capital, $500,000. Incorporators: N. M. Kaufman, Marquette; C. E. Murray, Traverse City, and others.

South Bend, Ind.—The Council has granted a franchise to the Indiana, Illinois & Iowa R. R. Co. to extend its line through the southern part of city. F. C. Raff, Gen. Supt., Kankakee, Ill.

The Grand Trunk Western Ry. Co. has petitioned for permission to construct double tracks through the city. J. Hobson, Ch. Engr. Montreal, Que.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Bradford, Pa.—Competitive plans and specifications will be received until Jan. 10 for the reconstruction of the city hall, as advertised in The Engineering Record.

New Roads, La.—Bids are wanted Jan. 10 for furnishing material and erecting a court house at New Roads. G. Montfort, Clk. of the Police Jury.

Milwaukee, Wis.—Bids are wanted Dec. 18 for erecting fire engine houses in the 21st, 22d and 23d wards. Chas. J. Poetsch, Commr. of Pub. Wks.

Washington, Ind.—Bids are wanted by the Carnegie Public Library Board until Jan. 2 for erecting a library, to cost about $20,000. Patton & Miller, Archts., 115 Monroe St., Chicago. Ill.; W. R. Gardiner, Pres.

Pittsburg, Pa.—Bids are wanted Dec. 20 for erecting a police station No. 2, on Center Ave. and Devilliers St. A. H. Leslie, Dir. Dept. Pub. Safety.

Norristown, Pa.—Andrew Carnegie is reported to have given this city $50,000 for a public library.

Seattle, Wash.—P. J. Donohue and Jas. J. Donnellan, of Seattle, are stated to have completed plans for a $60,000 Catholic Church to be erected on Ranier Heights.

Newark, N. J.—The plans of Cass Gilbert, 1123 B'way, New York, N. Y., have been accepted for the Essex County Court House, to cost about $950,000.

Topeka, Kan.—The contract for the ornamental iron for the Kansas State Capitol is stated to have been awarded to the Flour City Ornamental Iron Works, Minneapolis, Minn., for $30,000.

Carrollton, Mo.—The lowest bid received on Dec. 4 for erecting the Carroll County Court House is stated to have been submitted by Scott & Son, of Lancaster, for $53,000.

Mexico City, Mexico.—Stearns & Castor, Stephen Girard Bldg., Philadelphia, Pa., are stated to have completed plans for a Lutheran Church to be erected here, to cost about $75,000. Rev. W. Ellsworth, Pastor. It is stated that most of the material to be used in the construction will be purchased in the United States.

Raybrook, N. Y.—A press report states that Raybrook has been selected as the site for the proposed State Consumptive Hospital, for which $150,000 has been appropriated by the State.

Ottawa, Ont.—The contract for the new observatory to be erected on the Experimental Farm is stated to have been awarded to Viau & Lachance, of Hull, for about $75,000.

Los Angeles, Cal.—It is reported that competitive designs will be called for by the Board of Supervisors for a new system of hospital buildings for Los Angeles County. Total cost of remodeled and rebuilt system estimated at $200,000.

Jackson, Miss.—The contract for heating the Capitol is stated to have been awarded to the Frank Butler Co., of Greenville, Miss., for $26,527, and Frank Adams & Co., of St. Louis, Mo., are stated to have secured the contract for electric wiring, at $13,200.

Ludington, Mich.—It is stated that plans have been completed for a $30,000 church for St. Simon's R. C. congregation.

Lawrence, Kan.—The Douglas County Commissioners are reported to have under consideration the erection of a court house.

Sisseton, S. D.—The Commissioners of Roberts County are stated to have decided to issue $50,000 bonds for the erection of a court house and jail and the purchase and equipment of a county poor farm, and bids for the bonds will be received Jan. 8.

Boston, Mass.—The contract for erecting a municipal building for Ward 16 has been awarded to the Morrill & Whiting Construction Co., 35 Freeport St., at $96,960.

Lufkin, Tex.—The Angelina County Commissioners are stated to have adopted plans for a court house, to cost about $40,000.

Baltimore, Md.—Bids are wanted Dec. 20 for erecting a brick addition to the Bayview Asylum. Thos. G. Hayes, Pres. Bd. of Awards.

West Homestead, Pa.—See "Sewerage and Sewage Disposal."

Poughkeepsie, N. Y.—Bids are wanted Dec. 20 for erecting a court house and jail. Jas. H. Kipp, Chmn. Bldg. Com.; Wm. J. Beardsley, Archt., 42 Market St., Poughkeepsie.

Oak Summit, N. Y.—Bids are wanted Dec. 20 for erecting a county alms house at Oak Summit. Jas. H. Kipp, Chmn. Bldg. Com.; Wm. J. Beardsley, Archt., 42 Market St., Poughkeepsie.

Jacksonville, Fla.—Bids will be received by the County Commissioners until Jan. 10 for erecting a court house. P. D. Cassidey, Clk. of Bd.; Holmes & Lawton, Archits., Bay & Bridge Sts.

Chicago, Ill.—Bids are wanted Dec. 16 for erecting an engine house. P. F. Kirtle, City Ck.

New Lewisville, Ark.—F. W. Gibbs, of Little Rock, is reported to be preparing plans for a $40,000 court house for Lafayette County.

Syracuse, N. Y.—Bids are wanted Dec. 16 for furnishing material and installing plumbing work in the station house, West End Police Precinct. Rob't H. Jones, Clk. Bd. Contract & Supply.

Trenton, Mo.—The citizens of Grundy County are stated to have voted Dec. 10 to erect a $60,000 courthouse and jail.

Aberdeen, S. D.—The Brown County Commissioners are stated to have selected Kinney & Detweiler, of Austin, Minn., to prepare plans for a $65,000 court house.

BUSINESS BUILDINGS.

Rutland, Vt.—Arthur H. Smith, 72 Crescent St., has prepared plans for a new union station to be built here in the spring by the Rutland R. R. Co. Cost, $100,000.

Kansas City, Mo.—Wm. F. Waller, of the real estate firm of W. L. Powell & Co., Whitney Bldg., is reported interested in the construction of a 12 or 16-story office building to be erected near the Junction, to cost about $1,000,000.

Worcester, Mass.—The freight house of the Boston & Maine R. R. Co., north of Lincoln Sq., is stated to have been destroyed by fire Dec. 7.

Toronto, Ont.—Bids are wanted Jan. 31 for leasing a portion of the St. Lawrence market, and for the privilege of installing and operating therein a cold storage plant. Wm. Burns, Chmn. Com. on Property.

Parkersburg, W. Va.—The plans of H. Hannaford & Son, Hulbert Blk., Cincinnati, O., are stated to have been accepted for a 10-story office building to be erected here by a syndicate, of which Senator J. N. Camden is a member.

Jacksonville, Fla.—E. H. Glidden is stated to be preparing plans for a building for the Mercantile Exchange Bank, to be erected on Forsyth and Laura Sts.

Birmingham, Ala.—Stone Bros. & Weston have prepared plans for a 10-story office building to be erected at 1st Ave. and 20th St. Cost, $200,000. Owner, W. H. Woodward. Contractors, John Griffith & Son.

Richmond, Ind.—The P. C. C. & St. L. Ry. will build a new passenger depot, to cost about $30,000, and a new $80,000 bridge to cross Whitewater River at Richmond. Work on depot to commence at once. Thos. Rodd, Ch. Engr., Pittsburg, Pa.

Cleveland, O.—It is stated that John Hartness Brown will erect a theater on the site of the Stillman Hotel on Euclid Ave.

San Jose, Cal.—Local press reports state that competitive plans will be received by the Building Committee of the Board of Trustees of the I. O. O. F. until March 8, for an Odd Fellows Home Building, to cost about $80,000.

Philadelphia, Pa.—F. T. Mercer, 717 Walnut St., is stated to be preparing plans for a 3-story building 200 x 125 ft., for Giswanger Bros., pork packers, to be erected on 36th St., to cost about $78,000.

Lead, S. D.—It is stated that the Fremont, Elkhorn & Missouri Valley Ry. Co. will erect a depot here. E. C. Carter, Ch. Engr., Chicago, Ill.

Waukesha, Wis.—The Waukesha Springs Sanitarium, under construction and nearing completion, is reported to have been destroyed by fire on Dec. 3.

Beaumont, Tex.—It is stated that bids are wanted Dec. 18 for erecting a 3-story office building, 86 x 120 ft., at Pearl and Washington Sts. U. O. Long, Archt., 11 Kyle Bldg., Beaumont.

Augusta, Ga.—Frank P. Milburn, Columbia, S. C., is stated to have been selected to prepare plans for a union depot to be erected here at a cost of $150,000.

Ottumwa, Ia.—It is stated that the Chicago, Rock Island & Pacific Ry. Co. will erect a brick freight depot. H. E. Scott is the local agent.

Port Huron, Mich.—Bids will soon be asked for the construction of a new Masonic temple.

New York, N. Y.—The 5-story building at 198 B'way, occupied by the Dennison Mfg. Co., was burned Dec. 12.

Charlotte, N. C.—Bids are wanted by the Piedmont Realty Co. until Dec. 20 for erecting an office building. Address, Stuart W. Cramer, Chmn. Bldg. Com.; Hook & Sawyer, Archts., Piedmont Bldg.

Chicago, Ill.—Henry K. Holsman, 153 La Salle St., is stated to have prepared plans for an office building to be erected on State St. and Garfield Boulevard for A. B. Mulvey, to cost $20,000.

Robt. T. Newberry, 171 La Salle St., has prepared plans for a 5-story warehouse to be built at 363-371 Indiana St. for the McCormick estate, John C. Fetzer, agent; cost about $45,000.

Ritter & Mott have prepared plans for a 2-story storage building, 266 x 159 ft., and a 1-story beam house, 62 x 55 ft., to be erected at 777-801 Campbell Ave., for Jos. T. Ryerson & Son, at a cost of $75,000.

DWELLINGS.

Covington, Ky.—Jas. D. Hearne will build flats at 5th and Garrard Sts. Cost, $15,000.

Dalton, Pa.—W. H. Miller, of Ithaca, N. Y., is preparing plans for a stone residence, about 300 ft. long (fireproof throughout), to be built at Dalton. Owner, E. I. Fuller, of Scranton.

Richmond, Va.—E. O. Meyer, of Richmond, is about to build a $30,000 residence in Albemarle County, near Richmond. D. Wiley Anderson, 914 E. Main St., Architect.

Reading, Pa.—Geo. L. Gerhard, 619 Penn Ave., is reported to be preparing plans for a 5-story apartment house, 32 x 150 ft., to be erected on 9th and Chestnut Sts.

Detroit, Mich.—A. C. Varney & Co., Newberry Bldg., are preparing plans for a 4-story apartment house for E. S. Traver, to be erected on the north side of Sibley St., to cost $17,000.

Berkeley, Cal.—It is stated that plans are being prepared for a stone residence to be erected on the Ridge Road for Mrs. Phebe A. Hearst.

Chicago, Ill.—Henry L. Newhouse, 4630 Prairie Ave., has prepared plans for a 3-story building of six suites, to be erected at 4822 Grand Boulevard, at a cost of $30,000.

SCHOOLS.

Brooklyn, N. Y.—Bids are wanted Dec. 23 for installing a ventilating and heating apparatus in school No. 132. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Salt Lake City, Utah.—W. E. Ware, Hooper Bldg., is stated to have completed plans for the University Club Building, to cost about $30,000.

Wooster, O.—The main building of the University of Wooster is reported to have been destroyed by fire Dec. 11.

Houston, Tex.—Local press reports state that the School Board will receive bids Dec. 21 for erecting a 3-story brick school in the 3d Ward, to cost about $18,000; also an addition to the Cascara school. H. C. Cooke & Sons, Archts.

Waxahachie, Tex.—D. Mahoney is stated to have secured the contract for erecting the Trinity University for $48,000.

Milwaukee, Wis.—Competitive plans and outline specifications will be received by the Board of Public Works until Jan. 31 for a school to be erected at Galena and 14th Sts. Chas. J. Poetsch, Commr. of Pub. Wks.

Columbus, O.—Bids are wanted Dec. 16 for erecting a school near Havens Corners, Franklin County. A. A. Rhodes, Clk. of Bd.

Abbeville, La.—Bids are wanted Dec. 20 for erecting a brick school, to cost about $10,000. J. R. Kitchell, Chmn. Bldg. Com.

Victor, Colo.—Bids are wanted Dec. 16 for erecting a school in Dist. No. 30, Huerfano Co. G. M. Tombling, Sec'y.

Harrisburg, Pa.—The School Directors are stated to have selected the plans of C. Howard Lloyd, 15 S. 2d St., for a 24-room school to be erected in the 10th Ward.

Oneida, N. Y.—The citizens are stated to have voted to erect a $36,000 school.

McKeesport, Pa.—The School Board is stated to have decided to erect a $40,000 school in the 10th Ward.

Richmond, Va.—Carl Ruehrmund, 2 N. 10th St., has prepared preliminary drawings for a new high school to cost about $50,000.

Jersey City, N. J.—Bids are wanted Dec. 26 for erecting school No. 2, including the ventilating and heating. Jas. J. Wiseman, Clk. Bd. Educ.

Niagara Falls, N. Y.—The Kellogg Iron Works, of Buffalo, are stated to have secured the contract for the structural steel work of the new high school, for about $15,000.

Raleigh, N. C.—The North Carolina Board of Agriculture has decided to erect two buildings at the A. and M. College, to cost about $25,000.

Montgomery, Ala.—The Herron St. school is stated to have been destroyed by fire Dec. 4.

Brooklyn, N. Y.—The following bids were opened Dec. 9 by the Com. on Bldgs., Bd. of Educ., N. Y. City, for the erection of school 139, Boro. of Brooklyn: Rutan & Heningham, $126,446; John Thatcher & Son, $127,600; Geo. Hildebrand, 1004 B'way, $119,747 (awarded); Tolmie & Kerr, $128,810; Louis Wechsler, $131,500; P. J. Walsh, $125,000; Wm. & Thos. Lamb, $124,874; Wm. P. McGarry, $126,872; Thos. Cockerill & Son, $126,500; Peter Cleary, $124,593.

STREET CLEANING AND GARBAGE DISPOSAL.

Canton, O.—The contract for constructing a garbage furnace has been awarded to the American Incinerating Co., of Toledo, for $17,400.

Brooklyn, N. Y.—Bids are wanted Dec. 18 for the removal of night soil, offal and dead animals from the Borough of Brooklyn. John B. Sexton, Pres. Bd. of Health, N. Y. City.

Rochester, N. Y.—The following bids for the collection, removal and disposal of garbage for 1902 were opened Dec. 6 by the Board of Contract & Supply: G. Wilbur Burne, Rochester, $23,840; C. Henry Perry, $24,900; Thos. Holahan, $26,300; M. W. Conway, $26,300; Wm. T. Kohlmetz, $26,880; Bantel & Hartung, $27,400.

Butte, Mont.—The City Board of Health has recommended to the Council the establishment of a new crematory.

Kenton, O.—Local press reports state that the City Clerk has been authorized to receive bids for a new garbage contract.

GOVERNMENT WORK.

West Point, N. Y.—Bids are wanted Jan. 14 for the construction of officers' mess and quarters, as advertised in The Engineering Record.

San Francisco, Cal.—The following bids were opened Dec. 7 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for constructing a pile and concrete quay wall at the Navy Yard, Mare Island, Cal.; prices are per lin. ft. for about 560 ft.: Cotton Bros., Oakland, $119; Healy, Tibbets & Co., San Francisco. $97.83, Atlantic, Gulf & Pacific Co., San Francisco, $94.32.

Cleveland, O.—Arnold W. Brunner, of New York, is preparing plans for Cleveland's federal building. Plans will probably be completed before April 1.

Ft. Robinson, Neb.—Bids are wanted Dec. 23 for furnishing and setting pump, in connection with boiler, at Ft. Robinson, for water system at that post. John W. Pullman, Ch. Q. M., Omaha, Neb.

Mobile, Ala.—Bids are wanted Dec. 26 for making repairs at Bayou St. John Light Station, La. Lieut.-Col. A. N. Damrell, Corps Engrs., U. S. A.

San Juan, Porto Rico.—Bids will be received at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., until Jan. 18 for constructing an elevated cable railway for handling coal at the Naval Station, San Juan. Appropriation, $40,000. Mordecai T. Endicott, Ch. of Bureau.

Ft. Banks, Winthrop, Mass.—Bids are wanted Jan. 8 for construction, electric wiring, steam heating and plumbing one double set of N. C. O. quarters. W. W. Hamilton, Q. M.

Milwaukee, Wis.—The following bids were opened Dec. 11 at the Treasury Dept., Washington, D. C., for the construction of a stone and brick wagon shed for the U. S. Post-Office, etc., at Milwaukee: N. M. Manson, Milwaukee, $23,779; E. G. Roberts, Milwaukee, $24,950; Gen. Construction Co., Milwaukee. $26,770; Henry Ferge, Milwaukee, $25,556; Angus & Gindele Co., Chicago, $25,853.

Washington, D. C.—Bids are wanted Jan. 6 for furnishing the signal corps with 150 miles of deep sea cable. A. W. Greely, Ch. Signal Officer, War Dept.

Reedy Island Quarantine, via Port Penn, Del.—Bids are wanted Dec. 17 for removing a water tank from a trestle and to furnish and erect a new water tank for the use of the Marine Hospital Service at Reedy Island Quarantine. T. F. Richardson, Asst. Surgeon, M. H. S., in command.

San Juan, Porto Rico.—Bids are wanted Jan. 18 (extension of date) for constructing 2 coaling towers with necessary coal handling machinery at the Naval Station, San Juan. Estimated cost, $20,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Ft. Meade, S. Dak.—Bids are wanted Jan. 7 for erecting a cavalry stable, blacksmith shop and 4 stable guard houses at Ft. Meade. Geo. E. Pond, Ch. Q. M., St. Paul, Minn.

MISCELLANEOUS.

Caraquette, N. B.—Bids are wanted Dec. 20 for constructing the Caraquette wharf. Fred. Gelinas, Sec'y Dept. of Pub. Wks., Ottawa, Ont.

Philadelphia, Pa.—Bids are wanted Dec. 16 for extending branch of Merion Creek, through private property from terminus near Overbrook Ave. to City Ave. Wm. C. Haddock, Dir. Dept. of Pub. Wks., Bureau of Surveys.

Philadelphia, Pa.—Bids will be received by the Commissioners of Fairmount Park until Dec. 20 for supplies for 1902, including the following: Bricks, cement, cast iron, plumbers' supplies, metallic shingles, terra cotta pipe, sprinkling wagons, broken trap rock and screenings, etc. Jesse T. Vogdes, Ch. Engr. & Supt.

Philadelphia, Pa.—Bids are wanted by the Department of Public Safety until Dec. 19, for funishing to the various bureaus, supplies, including the following: Patent pavement, plumbing supplies, conduits, brass castings, iron and steel, manhole covers, dredging, etc. Abraham L. English, Dir.

Caldwell, Idaho.—Bids will be received by the Board of Directors of the Pioneer Irrigation District, Caldwell, until Jan. 16, for $167,555 bonds. Rees H. Davis, Sec'y.

Springfield, O.—City Engineer Sieverling is said to be making surveys for the straightening and dredging of Buck Creek. The Park Board proposes to ask the Legislature for authority to sell $60,000 bonds for this improvement.

Sea Isle City, N. J.—The Council has under consideration an ordinance granting a franchise to erect an ocean pier to Chas. Collmer, Philip Haiback, Chas. Strickler and others, of Philadelphia. The pier will be completed before July 1 and cost about $20,000.

Pointe-a-la-Hache, La.—A petition has been signed by property owners, asking for a levee 35 miles long, to protect their lands from storm salt water. It is stated that the levee will cost over $100,000.

New Orleans, La.—Bids are wanted Jan. 7 for constructing a wharf at Market St. Hugh McCloskey, Pres. Bd. Port Commrs.

West Superior, Wis.—Press reports state that Jones & Adams, of St. Paul, will build and operate a coal dock on St. Louis Bay. Cost, about $150,000.

Montreal, Que.—Bids are wanted Dec. 16 for furnishing supplies, among which are the following, for use on numerous canals: cast and wrought iron, cement, etc. Ernest Marceau, Supt. Engr., 1709 Notre Dame St., Montreal.

Providence, R. I.—Bids are wanted Dec. 16 for furnishing and delivering about 5,000 bbls. of Portland and 7,000 bbls. of natural cement for use in the sewer, water, highway and bridge departments during the season of 1902. Rob't E. Smith, Commr. of Pub. Wks.

Santa Barbara, Cal.—At a recent city election it was voted to levy a tax of 5 cts. per $100 valuation, for park improvements.

NEW INDUSTRIAL PLANTS.

Wolf Bros. & Co., Cincinnati, O., makers of shoes, are erecting a 7-story and basement, 72½ x 156-ft. factory and are in the market for two 100-H.-P. boilers, a 150-H.-P. automatic engine and a 50 to 150-H.-P. generator.

W. J. Whitehurst, 10th and Byrd Sts., Richmond, Va., will erect a 2-story and basement, 60 x 118-ft. sash factory, a 30 x 40-ft. engine and boiler house, and install a 100-H.-P. power plant.

T. K. Hudgens, Laurens, S. C., will erect a 2-story, 30 x 60-ft. factory and install a 6-H.-P. engine and a dynamo for about 30 lights.

The Federal Lead Co., Union Trust Bldg., St. Louis, Mo., contemplates erecting a new smelter plant at Alton, Ill., details for which have not yet been settled.

The Schwing Lumber & Shingle Co., Ltd., Plaquemine, La., will install shingle machinery, including a 60-H.-P. boiler and a 50-H.-P. engine, and build a dry house having a capacity of 1,000,000 to 1,200,000 shingles.

The Myers Clay Mfg. Co., Toronto, O., wants bids for opening coal and clay mines, and will soon be in the market for building and machinery.

F. A. Straus & Co., 93 & 95 Greene St., New York City, expect to place an order in about two months for a 300-H.-P. electric power plant for their Trenton, N. J., factory.

The Charles Warner Co., Wilmington, Del., will erect a 60 x 120-ft. storage building and a warehouse 120 ft. square, at Philadelphia. An electric power plant of about 150 H.-P. will be installed.

The Kerry Mill Co., Seattle, Wash., will next spring erect a saw-mill having a daily capacity of about 40,000 ft.

The Empire Couch Co., Middleport, N. Y., is erecting a 2-story, 40 x 140-ft. factory at Medina, N. Y., to be operated by electricity.

The Berkeley Springs, W. Va., Shovel, Stamping & Tool Co. is breaking ground for a 65 x 200-ft. factory, and will install a 100-H.-P. engine and a 125 to 175-H.-P. boiler.

The Washington Ice Co., 704 14th St., N. W., Washington, D. C., will let contract by Jan. 1 for a 100-ton plant.

The Norfolk Jupiter Steel Branch of the United States Steel Co. will erect a plant at Norfolk, Va., main building 160 x 300 ft., requiring a 100-H.-P. power plant. Duplicate mills will also be erected at Seattle, Wash., and Beaumont, Tex. W. J. Wilson, 616 Lewis Block, Pittsburg, Pa., consulting engineer.

BUSINESS NOTES.

The plant of the Penberthy Injector Co., Detroit, Mich., which was destroyed by an explosion, will not be rebuilt at present. The company has rented temporary quarters, where it will begin manufacturing at once.

The firm of Hudson & Whitney, 141 Broadway, New York, has been formed by M. A. Hudson and H. S. Whitney, formerly with Manning, Maxwell & Moore, and is now representing J. E. Lonergan & Co., Philadelphia; Standard Gauge Mfg. Co., Syracuse, and the Penberthy Injector Co., Detroit.

On Jan. 1 the Sandford & Stillman Co., 26 Exchange Place, Jersey City, will be dissolved. Arthur E. Sandford will form a new company, with offices in Hoboken and Newark, to engage in bridge building, deep river work and contracting. The present business of the Sandford & Stillman Co. will be continued by F. M. Stillman as the F. M. Stillman Co., bridge and dock builders.

The Alberger Condenser Co., 95 Liberty St., New York City, has been organized to make condensing apparatus, vacuum pumping machinery and cooling towers, including both surface and jet condensers, having steam or power air and circulating pumps, and an application of the central condensing system. Louis R. Alberger, formerly with Henry R. Worthington, is general manager; Geo. Q. Palmer, manager of the Quintard Iron Works, of New York, is vice-president.

The large hydraulic dredge "J. Israel Tarte," tested at Toronto on Nov. 25, was built for the improvement of the St. Lawrence route by the Polson Iron Works, from designs by A. W. Robinson. It has a steel hull 160 x 42 x 12 ft. 6 ins., and is designed to dredge clay from 50 ft. deep at the rate of 2,000 cu. yds. per hour, and deposit it 2,000 ft. distant. It is capable of making a cut 300 ft. wide. Mr. Robinson has just completed a smaller dredge of 600 cu. yds. per hour capacity for British Columbia, which is now in service, and he is now at work on designs for a large dredge for the Maritime Provinces, which is intended to work in hard material in 56 ft. of water.

PROPOSALS OPEN.

Bids Close		See Eng. Record.
	WATER-WORKS.	
Dec. 16.	Meters, Albany, N. Y	Dec. 14
Dec. 17.	New York, N. Y	Oct. 19
Dec. 17.	Arthur, Ill	Dec. 14
Dec. 18.	Baltimore, Md	Dec. 14
Dec. 18.	Philadelphia, Pa	Nov. 16
Dec. 18.	Lake Providence, La	Dec. 7
Dec. 18.	Pipe etc., Philadelphia, Pa	Dec. 14
Dec. 20.	Well, Ridgefield, Conn	Dec. 14
Dec. 20.	Boiler Kansas City, Mo Adv., Eng. Record, Dec. 14.	Dec. 14
Dec. 21.	Port Huron, Mich	Dec. 7
Dec. 23.	Ft. Robinson, Neb	Dec. 14
Dec. 23.	Riverdale, Ill	Dec 14
Dec 24.	Tunnel, etc., Cincinnati, O Adv., Eng. Record, Nov. 23 to Dec. 14.	Nov. 23
Dec. 26.	Richmond, N. Y	Dec. 14
Dec. 26.	San Jose, Cal	Dec. 7
Dec. 27.	Wilmont, Minn	Dec. 14
Dec. 31.	Chicago, Ill	Dec. 14
Dec. —	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. 31.	Minneapolis, Minn	Dec. 7
Jan. —	Columbus Grove, O	Dec. 14
Jan. —	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2
	SEWERAGE AND SEWAGE DISPOSAL.	
Dec. 16.	Portland, Ind	Dec. 14
Dec. 16.	Coshocton, O	Dec. 14
Dec. 16.	Philadelphia, Pa	Dec. 14
Dec. 17.	Marion, Ind	Dec. 7
Dec. 18.	Providence, R. I	Dec. 14
Dec. 19	Philadelphia, Pa	Dec. 14
Dec. 19.	Nashville, Tenn	Dec. 7
Dec. 19.	Ft. Wayne, Ind	Dec. 14
Dec 23.	Pueblo, Colo	Dec. 7
Dec. 23.	Topeka, Kan	Dec. 14
Dec. 24.	New York, N. Y	Dec. 14
Dec. 24.	Brooklyn, N. Y	Dec. 14
Dec. 26.	Omaha, Neb	Dec. 7
Jan. 1.	Brownwood, Tex	Dec 14
Jan. 3.	Marion, Ind	Dec. 16
Jan. 16.	Newark, N. J Adv., Eng. Record, Dec. 14.	Dec. 14
	BRIDGES.	
Dec. 17.	Topeka, Kan	Nov. 30
Dec. 19.	Philadelphia, Pa	Dec. 14
Dec. 20.	Memphis, Tenn	Nov. 30
Dec. 20.	Viaduct, Buffalo, N. Y Adv., Eng. Record, Dec. 7, 14.	Dec. 7
Dec. 20.	Substructure, Buffalo, N. Y	Dec. 14
Dec. 21.	Cincinnati, O	Dec. 7
Dec. 24.	Buffalo, N. Y	Dec. 14
Dec. 27.	Harrisburg, Pa	Nov. 30
Dec. 30.	Cincinnati, O	Dec. 7
Dec. 30.	Cincinnati, O	Dec. 14
Jan. 6.	Beattyville, Ky	Dec. 14
Jan. 8.	Victoria, B. C Adv., Eng. Record, Nov. 16 to Dec. 7.	Nov. 16
Jan. 9.	Sioux Falls, S. D	Dec. 14
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept. '02.	Bridge plans, St. Petersburg, Russia	Sept. 21
	PAVING AND ROADMAKING.	
Dec. 16.	Zanesville, O	Dec. 14
Dec. 16.	Washington, Ia	Dec. 14
Dec. 16.	Boston, Mass	Dec. 14
Dec. 18.	Buffalo, N. Y	Dec. 7
Dec. 19.	Nashville, Tenn	Dec. 7
Dec. 19.	Philadelphia, Pa	Dec. 14
Dec. 20.	Ellisburg, N. Y	Dec. 14
Dec. 21.	Cincinnati, O	Dec. 7
Dec. 27.	Pittsburg, Pa	Dec. 7
Dec. 28.	Cincinnati, O	Dec. 14
Dec. 31.	National Military Home, O	Dec. 7
Jan. 10.	Teledo Oo	Dec. 14
	POWER, GAS AND ELECTRICITY.	
Dec. 16.	Syracuse, N. Y	Dec. 14
Dec. 18.	Lake Providence, La	Dec. 7
Dec. 18.	Cleveland, O	Dec. 7
Dec. 19.	New York, N. Y	Nov. 30
Dec. 19.	Brooklyn, N. Y	Nov. 30
Dec. 23.	Franchise, San Leandro, Cal	Nov. 23
Dec. 23.	Engine, dynamo, etc., Madisonville, O.	Dec. 14
Dec. 30.	Yosemite Valley, Cal	Dec. 14
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
Jan. 2.	New Ulm, Minn	Dec. 7
Jan. 22.	New Orleans, La Adv., Eng, Record, Nov. 30 to Dec. 14.	Nov. 30
	GOVERNMENT WORK.	
Dec. 17.	Water tank, Reedy Is. Del	Dec. 14
Dec. 17.	Creston, Ia Adv., Eng. Record, Nov. 9, 16.	Nov. 9
Dec. 17.	White Earth, Minn	Nov. 30
Dec. 21.	Washington, D. C	Nov. 9
Dec. 21.	Baltimore, Md Adv., Eng. Record, Nov. 30.	Nov. 30
Dec. 23.	Portland, Ore	Dec. 7
Dec. 23.	Ft. Robinson, Neb	Dec. 14
Dec. 26.	Mobile, Ala	Dec. 14
Dec. 26.	Ft. Morgan, Ala	Dec. 7
Dec. 27.	Hardwood floors, Washington, D. C Adv., Eng. Record, Nov. 30 to Dec. 14.	Nov. 30
Dec. 27.	Elevator enclosures, Washington, D. C. Adv., Eng. Record, Nov. 30 to Dec. 14.	Nov. 30
Dec. 28.	Bremerton, Wash	Nov. 30
Dec. 28.	Repairing light station, Mobile, Ala	Dec. 7
Dec. 30.	Depot, Mobile, Ala	Dec. 7
Jan. 4.	Bremerton, Wash	Nov. 30
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23 to 30.	Nov. 23
Jan. 6.	Cable, Washington, D. C	Dec. 14
Jan. 7.	Ft. Meade, S. D.	Dec. 14
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 8.	Baltimore, Md Adv., Eng. Record, Nov. 30, Dec. 7.	Nov. 30
Jan. 8.	Bldg., Ft. Banks, Winthrop, Mass	Dec. 14
Jan. 14.	Portland, Ore.	Nov. 23
Jan. 14.	West Point, N. Y Adv., Eng. Record, Dec. 14.	Dec. 14
Jan. 18.	Cable Ry., San Juan, Porto Rico	Dec. 14
Jan. 18.	Coal towers, etc., San Juan, Porto Rico.	Dec. 14
	BUILDINGS.	
Dec. 16.	Engine house, Chicago, Ill	Dec. 14
Dec. 16.	School, Victor, Colo	Dec. 14
Dec. 16.	School, Columbus, O	Dec. 14
Dec. 16.	Plumb., police station, Syracuse, N. Y.	Dec. 14
Dec. 17.	Library, Mankato, Minn	Nov. 23
Dec. 18.	Pub. bldg., Toronto, Ont	Dec. 7
Dec. 18.	Office bldg., Beaumont, Tex	Dec. 14
Dec. 18.	Engine houses, Milwaukee, Wis	Dec. 14
Dec. 19.	Town Hall, Warren, O	Nov. 30
Dec. 19.	Public building, Springfield, Ill	Nov. 30
Dec. 20.	Office bldg., Charlotte, N. C	Dec 14
Dec. 20.	Court house, Des Moines, Ia Adv., Eng. Record, Nov. 16, 30.	Nov. 16
Dec. 20.	Htg. public bldg., Rossland, B. C.	Dec. 7
Dec. 20.	Church, Carbondale, Ill	Dec. 7
Dec. 20.	Alms house, Oak Summit, N. Y	Dec. 14
Dec. 20.	Court house, Poughkeepsie, N. Y.	Dec. 14
Dec. 20.	Asylum addition, Baltimore, Md	Dec. 14
Dec. 20.	School, Abbeville, La	Dec. 14
Dec. 20.	Police station, Pittsburg, Pa	Dec. 14
Dec. 21.	School, Houston, Tex	Dec. 14
Dec. 21.	School, Newbury, Wis	Dec. 7
Dec. 23.	School, New York, N. Y	Dec. 7
Dec. 23.	Htg. school, Brooklyn, N. Y.	Dec. 14
Dec. 26.	School, Jersey City, N. J	Dec. 14
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
Jan. 1.	School, Hamilton, O	Dec. 7
Jan. 2.	Library, Washington, Ind	Dec. 14
Jan. 10.	Court house, Jacksonville, Fla	Dec. 14
Jan. 10.	Court house, New Roads La	Dec. 14
Jan. 10.	City hall plans, Bradford, Pa Adv., Eng. Record, Dec. 14.	Dec. 14
Jan. 13.	Jail, McRae, Ga	Dec. 7
Jan. 15.	Church, Pensacola Fla	Nov. 30
Jan 15.	Court house, Reidsville, Ga	Dec. 7
Jan. 31.	Bus. bldg., Toronto, Ont.	Dec. 14
Jan. 31.	School plans, Milwaukee, Wis	Dec. 14
Feb. 1.	Library, Muncie, Ind	Nov. 23
Feb. 1.	University bldg., Stanford University, Cal	Dec. 7
Feb. 8.	Hospital plans, Washington, D C	Dec. 7
Mar. 8.	Plans I. O. O. F. bldg., San Jose, Cal	Dec. 14
	MISCELLANEOUS.	
Dec. 16.	Cement, Providence, R. I	Dec. 14
Dec. 16	Montreal, Que	Dec. 14
Dec. 16.	Philadelphia, Pa	Dec. 14
Dec. 17.	Garb. disposal, Buffalo, N. Y	Dec. 7
Dec. 17.	Cement, etc., Montreal, Que	Dec. 7
Dec. 18.	Garb. disposal, Brooklyn, N. Y	Dec. 14
Dec. 19.	Port. cement, Washington, D. C. Adv., Eng. Record, Dec. 7.	Dec. 7
Dec. 19.	Supplies, Philadelphia, Pa	Dec. 14
Dec. 20.	Park supplies, Philadelphia, Pa	Dec. 14
Dec. 20.	Wharf, Caraquette, N. B	Dec. 14
Dec. 20.	Mohawk R straightening, Utica, N. Y. Adv., Eng. Record, Dec. 7, 14.	Dec. 7
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Jan. 6.	Library, Niagara Falls, N. Y	Nov. 23
Jan. 7.	Drainage ditches, Bloomfield, Mo	Dec. 7
Jan. 7.	Wharf, New Orleans, La	Dec. 14
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 2

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Report of the Isthmian Canal Commission.—II.

In the last issue of The Engineering Record comment was made on some general features of the Isthmian Canal Commission's report, recently made public, the discussion of the purely engineering features being reserved for this issue. As the text of the report has been printed as Senate Document 54, 57th Congress, first session, and can doubtless be obtained on application to Senators, it is unnecessary to print it in these pages.

There are certain salient features of the Panama and Nicaragua routes which will impress engineers, if not others, at sight. The total length of the Nicaragua route is 183.66 miles, while the length of the Panama route is 49.09 miles, making the Nicaragua route not far from four times as long as the Panama. About 70 miles of the Nicaragua route lie in Lake Nicaragua, while nearly fourteen miles of the Panama route are in the artificial lake formed by the proposed great Bohio dam. It also appears that these two portions of open-water navigation are not precisely what they seem to be at the first blush. Lake Nicaragua is about one-third the size of Lake Erie, and its greatest depth is about 160 feet, but according to the report of the Commission large amounts of excavation, soft on the easterly side and rock on the westerly side, must be made in this lake in order to afford the prescribed minimum depth of 35 feet. In the artificial Lake Bohio, on the Panama route, similar work of excavation must be done in order to secure the required minimum depth.

The summit level in each case is maintained by a great dam, the foundation problems of which are not to be lightly considered. The dam required to be built on the Nicaragua line is at a point called Conchuda, a little over fifty miles from the lake and not far from the same distance from the sea, and is founded on bed rock 80 to 85 feet below the water surface in the river. Its foundations are designed to be executed by the pneumatic process, with which American engineers are very familiar. At the same time the sinking of caissons, even to a depth of 80 or 85 feet below water surface in a river subject to great and sometimes sudden floods, does not by any means belong to the lightest class of engineering operations. This dam is to be almost entirely of concrete masonry, and will take the flow of the river over its crest whenever water is to be wasted. There is a low saddle in the hills on the Costa Rica side of the river, and about one-half mile from it, in which a concrete masonry dyke must be built, and over which the surplus waters will also waste. It appears that both the main dam and the dyke are to carry Stoney gates or gates of similar type for the purpose of discharging any desired amount of water, it being the purpose of the Commission to hold the level of Lake Nicaragua between the elevations of 104 and 110 feet above the sea.

On the Panama route, on the other hand, the foundations of the dam present a more serious aspect. At the deepest point these foundations will rest on bedrock 128 feet below the water surface, and, as in the case of the Conchuda dam, they are to be sunk by the pneumatic process. Engineers will at once reflect that that depth has not yet been reached in pneumatic work and the Commission so observes; but it states that the situation at the site of the Bohio dam is such that with suitable measures the actual head of water to be encountered in sinking these foundations will be materially less than 128 feet as a maximum, so that the work may be accomplished without exceeding the limits of pressure already reached in pneumatic foundation work. The Commission does not state just what method is to be followed in order to accomplish this result, but possibly depressing the sub-surface elevation of water by pumping may be contemplated, as resort has been made to such measures in other places.

The Bohio dam is radically different in type from that proposed for the Nicaragua route in that it is an earth dam, but with a heavy masonry core, 30 feet thick in its lower portions, carried to bedrock. It is not the intention of the Commission to waste any water over this dam. A low saddle has been found by the engineers of the New Panama Company, some three miles distant from the dam site, on which a masonry dyke carried to bedrock may be built with comparative cheapness. This dyke would afford a long crest or overflow weir 2,000 feet in clear length, over which the famous Chagres floods may harmlessly flow without ever exceeding a depth of about 6 feet. This waste weir has the distinct advantage over that at Conchuda, as pointed out by the Commission, in that no regulating gates or other appliances are needed. The regulation is automatic and consists in simply discharging water over this masonry weir with an increasing rate of flow as the flood level rises; while enough water will be impounded below the crest to meet all the needs of evaporation and canal operation.

These two great regulating dams and dykes may be considered as the dominating engineering features of the two proposed lines of canal. The estimated cost of the Conchuda dam and wasteway is, in round numbers, about six million dollars; but the estimated cost of the great Bohio dam and the spillway rises in round numbers to about seven and a half millions.

The summit level on the Nicaragua route has a maximum elevation of 110 feet, but may fall to 104 feet above the level of the sea. Panama has a little advantage in this respect, as its highest summit level will not exceed 92 feet, and it may fall below 85 feet above the sea. The locks that are required to overcome these elevations are but little less interesting than the dams from an engineering point of view. They are designed to have a usable length of 740 feet and a clear width of 84 feet. These dimensions somewhat more than meet the provisions of the law under which the Commission act, which require a canal affording passage for the largest vessels afloat. These locks are massive structures with steel miter gates of usual type. On the Nicaragua route there are four locks on the Atlantic side, and the same number on the Pacific slope, with levels varying from 18½ to 37 feet. On the Panama route there are but two locks ranged in flight on the Atlantic side at Bohio, each with a maximum lift of about 45 feet, and three on the Panama side. A tidal lock is required at the Pacific end of the Panama canal, inasmuch as the mean range of tide between high and low water is about 20 feet, whereas it is about 8 feet at Brito, the Pacific terminus of the Nicaragua route, and less than a foot at the Atlantic ends of both routes.

The language of the Commission is very explicit as to one or two points which have been of crucial importance to the Panama route in the past. Instead of being apprehensive as to the effect of the Chagres floods the Commission appears to regard those surpluses of drainage as fortunate, in that they afford the requisite water for the operation of the canal and are capable of simple and safe control. This will probably be a revelation to some engineers, who formerly, at least, took a somewhat different view of the flood flows of the Chagres.

In the concluding chapter the Commission observes that the Nicaragua route has nearly 1,600 degrees and 26½ miles more curvature than the Panama. This is a serious feature in the comparison of alignments. Civil engineers at least will appreciate the advantage of a canal line as straight as practicable, although curvatures with as large radii as those found on the Nicaragua line are not particularly serious. Doubtless the friends of the Panama route will find considerable comfort in this particular feature of the Nicaragua line. Objections to it however, are more fancied than real in this instance, as the canal has a bottom width of 150 feet, with side slopes in firm earth of one on one and one-half, making the surface width 255 feet. In such a waterway, with a depth of 35 feet, there are few ships that would slacken their speed for many of the curves in the Nicaragua canal.

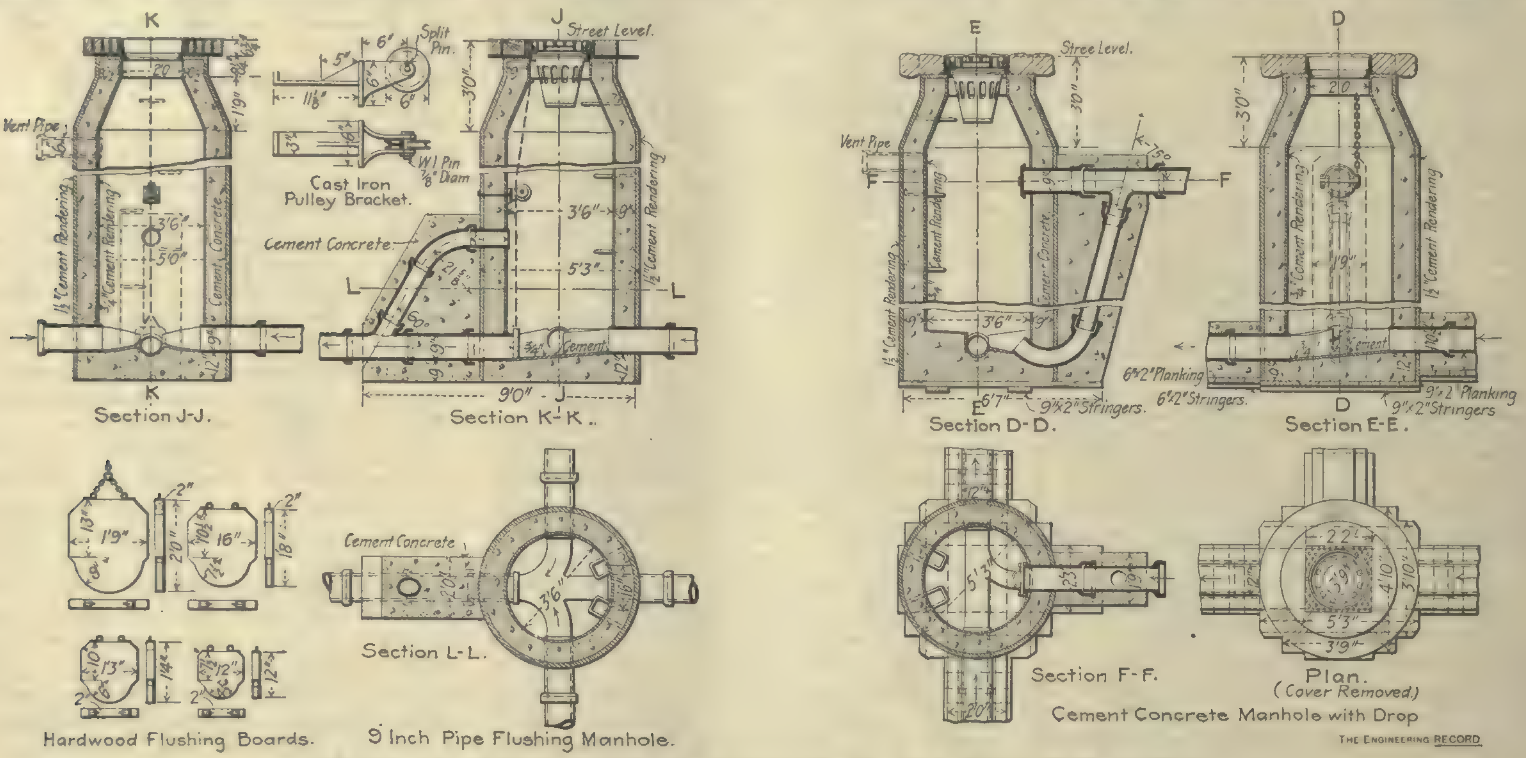
In choosing a minimum depth of water of 35 feet, even in the harbors at low tide, the Commission has evidently taken the statute liberally, but if it is the purpose of the United States Government to build a ship canal to be entered and passed at all times by the heaviest ships afloat, it is the part of wisdom both to avoid anything like scant dimensions and to provide canal entrances that can be used at all stages of the tide.

The Annual Summary of leading articles in The Engineering Record during the last twelve months has been printed, and readers who desire copies for card indexing or other purposes can obtain them without charge on application.

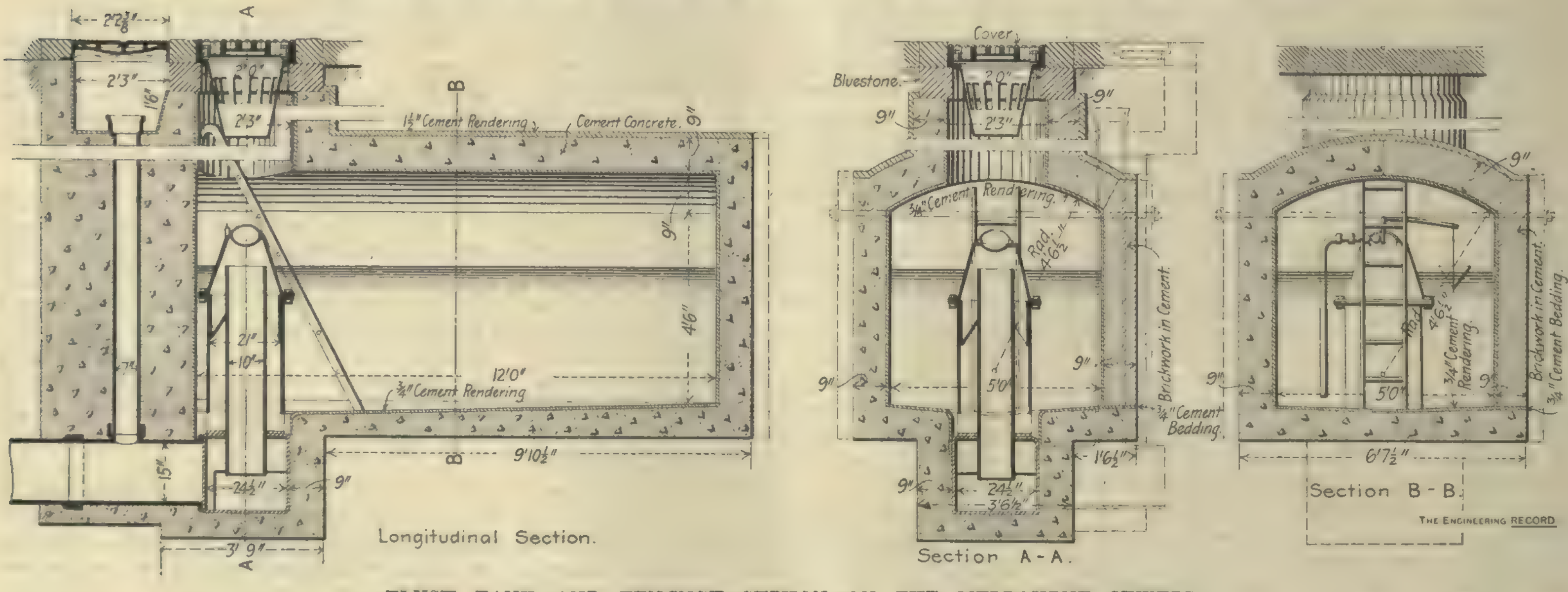
The Injury to Water Mains in St. Paul by electrolysis has become so great that a formal notice of the matter was sent by the Water Board on December 12 to the local street railway authorities. This notice was prepared by the city attorney, and opens with a statement of the damage disclosed by a recent investigation of the condition of the pipes. The Board directs the company to prevent any further damage, although it recommends no remedy, and gives notice that non-compliance will be followed by legal proceedings. Notice is also given the company that it will be held liable for all damage sustained by the St. Paul water system by reason of stray electric railway currents.

The Melbourne and Metropolitan Sewerage System.

Long after the city of Melbourne, Victoria, had acquired a large population and was well supplied with water, it was wholly lacking in suitable means of drainage and sewerage. In 1881, a committee of the City Council called attention to the disastrous effect of the lack of such works on the health of the community. At that time an area of upward of 200 square miles, with over 50,000 buildings and a population of nearly a quarter of a million, had no other means of drainage than the Yarra River, which was in a condition comparable with that of the Chicago River in this country, before the opening of the drainage canal. Many attempts were made to arouse sufficient public interest in the subject to bring about the construction of adequate sewerage works, but it was not until some years later that a sanitary commission was appointed. This commission retained Mr. James Mansergh, M. Inst. C. E., to visit the city and report on the best system of drainage and sewerage to relieve the serious condition of affairs. He submitted many plans, which were eventually turned over to the Melbourne and Metropolitan Board of Works, organized in December, 1890. In July of the following year Mr. William Thwaites, M. Inst. C. E., was appointed engineer-in-chief of the Board, and he had the working plans so far outlined by May, 1892, that construction could then be formally begun. A number of articles on various features of this great undertaking have appeared from time to time in The Engineering Record, but it is proposed in this issue to give a general account of the extent and leading features of the work. The information is obtained from articles by various engineers connected with the Board, printed in a special number of "The Building, Engineering and Mining Journal," of Melbourne.



DETAILS OF SPECIAL TYPES OF MANHOLES ON THE MELBOURNE SEWERS.



FLUSH TANK AND TEN-INCH SYPHON ON THE MELBOURNE SEWERS.

The sewers are on the separate system; they are designed on the basis of 30 cubic feet of sewage per capita daily from a population of 1,000,000 people. The scheme provides sewerage facilities for nine cities, seven towns, three boroughs, five shires and part of another shire. These cover an area of about 103,000 acres and had a population of 469,680 on December 31, 1898.

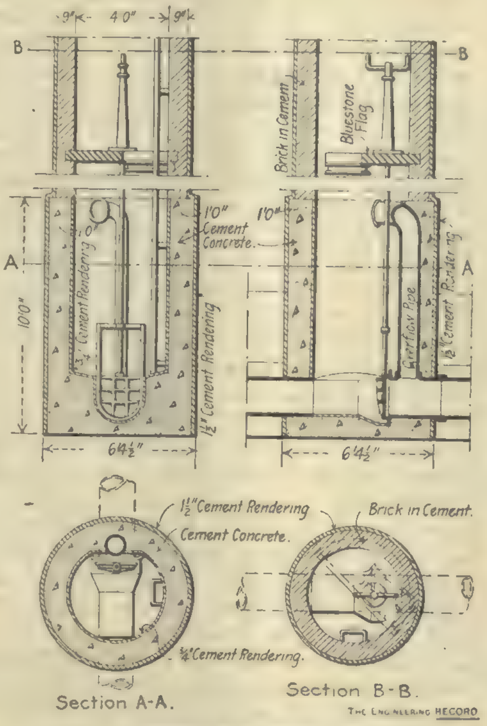
The first work of the Board was a careful survey of the properties to be drained. The results of these surveys were plotted on a scale of 40 feet to the inch, which was large enough to show the location of all the conduits of any kind, with their attachments, in the streets. The elevation of the lowest floor and of the cellar of every house was recorded on these sheets, and the street elevations at every 100 feet were also given. All the designing of the sewerage reticulation was done on lithographed copies of these plans. Plans on a scale of 160 feet to the inch were compiled from these original plans for assistance in designing the general sewerage scheme of a district.

The smaller sewers are vitrified pipes, made in the colony and required to pass the following specifications: "Each pipe shall pass a wooden dummy ⅜ inch less than the specified inside diameter of the pipe. The dummy is the full length of the pipe, including a projection for the socket. A ring of an internal diameter ¼ inch larger is to pass over the outside of the pipe from end to end, except the socket. All pipes shall be subjected to a head of 30 feet of water without leaking or weeping, and be repeatedly struck by a wooden mallet while under pressure. The pipes shall bear a cross-breaking strain, when supported in a cradle on bearers 18 inches apart, of 1,000 pounds at the center." The joints in these pipes are made with a gasket and 1:2 Portland cement mortar.

The tables of Baldwin Latham were employed in calculating the capacity of the sewers. No sewer is intended to have a velocity below 3 feet per second, and a preference has always been given to the use of large pipes. In one of the towns in the district, where the ground water is within 2 feet of the surface, the minimum depth of cover is 5 feet; elsewhere a minimum of 8 to 10 feet has been adopted. All pipe sewers are laid on straight lines between manholes, and there are inspection shafts wherever necessary. Flushing gates have been provided at frequent intervals, and an illustration of one of these is shown among the accompanying cuts. It will be noticed that an overflow is arranged behind the gate as a relief in case the gate is left down. Where the pipe sewers join at different elevations, special drop manholes are provided to reduce the splashing of the sewage to a minimum. All manhole covers have cast steel covers and either cast iron or cast steel frames. Ventilated covers are used, but vent columns are also employed, ranging from 30 to 80 feet in height. The ventilation is stated to be satisfactory.

Automatic flushing syphons are constructed at all dead-ends. The tanks hold 200, 400, 600, 800 and 1,000 imperial gallons, and can be emptied in two to four minutes by an automatic syphon of the Field type. These syphons are 6, 9 and 10 inches in size. In order to make certain that a vacuum is obtained inside the syphons, an ordinary cellar pump connected with the water main is provided. This pump is worked by a float, which, when the tank is full, opens the water supply valve and sets the exhauster in action. The vacuum is thus perfected and the contents of the tank rapidly discharged into the sewer. When a district is first connected, all the syphons are fixed to discharge every two hours, but as more houses become connected they are set for longer intervals by slightly closing the supply tap. These flush-tanks are reported to have worked with entire satisfaction.

The sewage from all parts of the city is conducted to two pumping stations arranged side by side so they can be worked independently or together. The ultimate capacity of the two stations is 20 engines of 300 horse-power each. For the present the installation in each plant will be six engines. Those in one station pump against a total head of 109 feet, exclusive of friction, and those in the other against a head of 101 feet. The sewage is screened before entering the pump wells and the screenings are subjected to steam in a Johnson dryer, which transforms them into a practically odorless fibrous mass.



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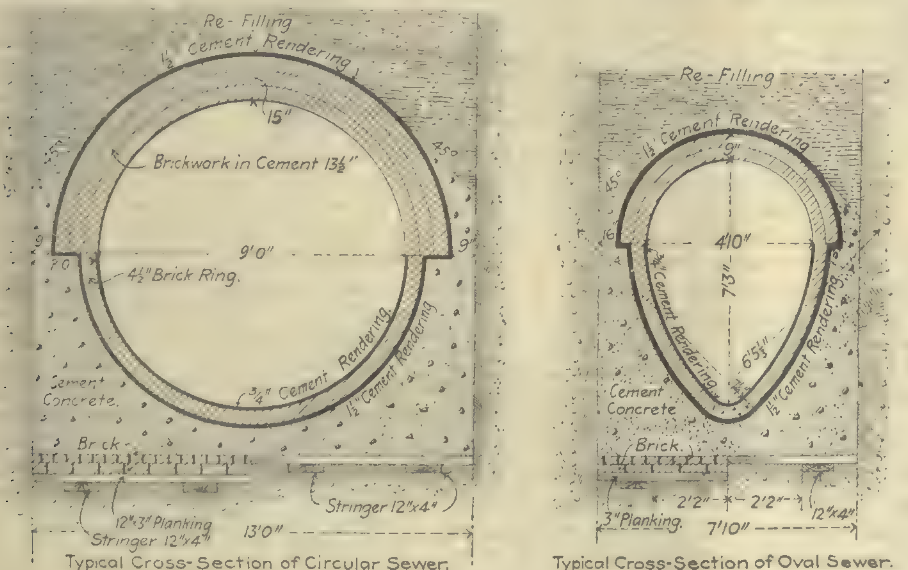
PENSTOCK MANHOLE.



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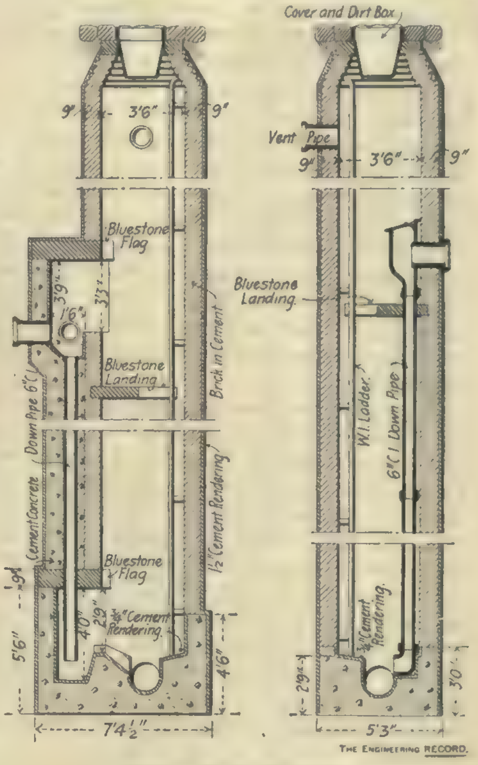
SECTIONS OF LARGE SEWERS OF THE MELBOURNE SYSTEM.

The engine rooms are 113 x 58 feet, the boiler rooms 93 x 50 feet, and the coal bunkers 93 x 26 feet. The bunkers hold 750 tons each and have a railway siding by which the coal is discharged from the cars directly into the bins. The pumping engines are of the triple expansion condensing Worthington type, with 16¾, 26⅛ and 44⅛-inch cylinders, and a 36-inch stroke. Internally fired return tubular boilers are used and a Green economizer is employed. The stack is 166 feet high and 8 feet in diameter.

The volume of sewage now reaching the station does not require the number of force mains provided by the plans for the complete system, and at the present time but two have been laid, 72 and 48 inches in diameter respectively. They are 2¾ miles long and discharge into the outfall channel leading to the sewage farm. The pipes are constructed of ¼-inch wrought iron plates and were dipped in hot asphaltum before being laid. The 4-foot pipe was laid in 30-foot lengths, with wrought iron spigot and bell joints set up with gasket and lead in the usual way. The 6-foot pipes were laid in 15-foot lengths, every third joint being bell and spigot and the others flanged and bolted.

The outfall sewer is a semi-circular channel 11 feet in diameter and 15¾ miles long, with a fall of 2 feet to the mile. Wherever it is near the main highway or the fill over the top is more than 5 feet, it has been arched over; elsewhere it is open. It is built of concrete with brick lining and has several aqueducts along its line. At its head, where it receives the discharge from the force main, a building has been constructed for deodorizing the sewage. The odor was very offensive at first at this place, but has been overcome by burning sulphur and forcing the resulting gas into the sewage by means of a Root blower. A similar station has been constructed about five miles from the farm.

The sewage farm is a tract of 8,847 acres, of which 7,227 acres are available for irrigation, 915 for grazing, 357 for tree plantations and the remainder for highways, buildings and like purposes. On account of the extremely bleak character of the site, one of the first operations was to begin planting trees for the future protection of the stock and crops. The main lines of these plantations are now well established. A jetty was built out into the bay on which the farm is located, and a light railway running along this jetty can be extended about the farm, as its cultivation renders desirable.



THE ENGINEERING RECORD.

SPECIAL DROP MANHOLE.

The land has been divided into blocks which have been broken up to a depth of 18 to 20 inches by means of steam plows. The areas have been underdrained by mole plows or tiles and leveled by grading machines and scrapers. The sewage from the outfall sewer is carried through the prepared blocks in a concrete-lined channel, gradually rising above the ground on an embankment. The channel is 3 feet 9 inches in radius at the upper end and 1½ feet at the lower end adjoining the sea front. The section is a quadrant of a circle, with 1:1 slopes. At every 10 chains, side channels take off the sewage in semi-circular cast-iron pipes; each of these carriers supplies 20 acres of ground, of which 18 acres can be cultivated. The effluent from the underdrainage system is collected eventually by a main drain running along the seashore and discharging into the bay.

The disturbance of the surface soil in grading, the brackishness of the sub-soil water all over the Metropolitan area, lowering which is part of the work for which the Board was established, and the large amount of salt in the soil of the farm itself, have caused considerable difficulty and delay in getting these graded blocks into a suitable condition for irrigation. When the crops become properly established the effect of the sewage upon them in the promotion of growth is very evident. The effect of the sewage on the land is to wash out the salt present in the latter; this amount is very heavy, for, whereas only 236 grains were obtained from the sewage entering the farm, the amount in the effluent increased to 413 to 712 grains. At the present time several thousand sheep are grazing on the farm, and it is expected that 50,000 to 60,000 will eventually be sold from it annually. It is also believed that dairies will be established on some of the dry blocks, where the fodder grown on the irrigated blocks will be consumed. A considerable area of the farm is already leased, and in view of the experience on the Adelaide farm, a considerable income from this source is expected. At present the cost of running the farm is about $1 per capita annually, but this expense can probably be materially cut down in a few years if the works are as well managed as at present.

From the point of view of the constructing engineer, the most interesting feature of these works was the large amount of tunneling made necessary by the peculiar local conditions. A description of the tunneling operations, with and without shields and with and without compressed air, was published in The Engineering Record on October 15 and 29, 1898, and on April 8, 1899, there was printed a description of the unusually difficult subaqueous work on what is known as the North Yarra system. As a supplement to those articles, some notes in Mr. Thwaites' paper may appropriately be reproduced here.

A peculiar accident occurred on a small tunnel driven with shields and lined with cast iron and concrete. While traversing a locality where an old river course formerly existed, the shield dropped off the lining and sank several feet into the drift sand. Compressed air was resorted to and a chamber was opened out in the drift about 8 feet high. The shield was lifted up, put back on the end of the cast-iron lining, and Portland cement concrete was placed below it on the drift, so that it could be driven forward bit by bit until the more solid sand on the other side of the old water course was reached.

Another interesting piece of work was on the eastern bank of the Yarra River. The tunnel was started here away from the river by driving needles ahead of the finished work. The rear end of the needles was supported by the completed lining and the front end by the ground into which the tunnel was being driven. After driving about 264 feet in this manner, the method was found to be too slow, and, as the material penetrated had changed to a wet slurry, filling one of the old watercourses of the Yarra, a cast-iron lining and a shield were adopted. The cast-iron shell was used for nearly 700 feet, to a point where a shaft had previously been sunk. When this shaft had reached the invert elevation of the proposed sewer, the bottom blew up, totally wrecking the timbering. When this spot was reached in the tunneling operations the shield sank and the slurry forced its way into the heading. Every inch gained had to be retained and lined with concrete as quickly as possible before advancing again. In passing this place, the shield dropped 3½ feet in a distance of 28 feet. This section of the sewer was joined with a section also driven by a shield approaching in an opposite direction. This second shield likewise dropped 2 feet in a distance of 18 feet in approaching this shaft.

Trouble has been occasionally experienced with gases given off by the material through which the work was being carried on. At one place where a shaft was sunk, the material penetrated was sand at first. Before the bottom was reached, however, strong black silt was encountered, in some cases having a very powerful odor and affecting the eyes of the men, causing extreme pain and blinding them at times so as to make it necessary to lead them home. Another case occurred where a shield was being driven to a connection with an inverted syphon. The work was being carried on under compressed air, and the contractors eventually ordered more compressing plant in order to prevent an accumulation of foul air at the face. Work was suspended while the new plant was being installed and no danger was anticipated. Nevertheless, some of the men entered the air lock during the Christmas holidays and lost their lives through a very heavy inburst of foul gas.

Another interesting piece of work was an inverted syphon 5 feet in diameter and 320 feet long, made of wrought-iron plates. A trench was dredged in the river bottom to a depth of 12 feet or so, and broken stone was piled along it in places by divers to form a support for the tube. The latter had been constructed in a trench on the south bank of the river in a line with the trench in the river itself. The pipe was riveted up in a single length, with blank plates at each end. Wrought-iron columns 24 inches in diameter were riveted to each end of the tube; they were of such a length that when the tube was in its right position their mouths would be above water. The original intention was to have three or four pairs of barges with derricks fixed between their ends. As the tube was hauled forward from the trench on the river side, into which water was allowed to enter after the pipe was finished, the latter would have been supported at points 50 to 60 feet apart by the tackle on these scows. After being hauled across the river water would have allowed to enter the columns so as to overcome the buoyancy of the pipe, which would have been lowered into place by the tackle on the barges. This method was not carried out, as the river traffic could not be blocked long enough for the purpose. It was thought that by pulling the pipe across by heavy tackle on each side of the river and a gradual filling of the pipe, the latter could be made to sink evenly into place, but the tackle on the south bank of the river was weaker than the other and that side accordingly sank faster. This soon put such a heavy strain on the tackle that it broke. The southern end of the pipe fell to the bottom of the river, the northern end rose unsupported out of the water, the pipe broke into three nearly equal sections and fell into the trench in the bottom of the river. Divers found that the fractures were through the riveting and that the tube was not very much out of position. With the assistance of barges borrowed from the harbor authorities, the three sections of the pipe were brought to a proper line and level on the bottom of the river. Thick india-rubber strips were wrapped around the ends of the tubes so as to overlap them, and these strips were then bound fast by wrought-iron straps, drawn together with bolts by divers. Afterward plastic concrete was placed around the pipe inside of retaining walls formed by Portland cement concrete in bags. Eventually wrought-iron saddles were placed over the tube and weighted with old rails. Finally concrete was laid over the pipe and the same material was used in lining it.

A Curious Accident happened recently to a 35-horse-power walking-beam engine at the works of the Phenix Iron Foundry, Providence, R. I. The engine was built over half a century ago and has been in operation ever since, except while a new cylinder was being put in place. The accident was in the walking beam, which broke apart. One part was flung around by the connecting rod, impelled by the energy of the 12-foot flywheel, while the other part was shaken up and down by the frantic movements of the piston rod, relieved of its customary load. Fortunately no one was injured, although the engine was wrecked beyond repair.

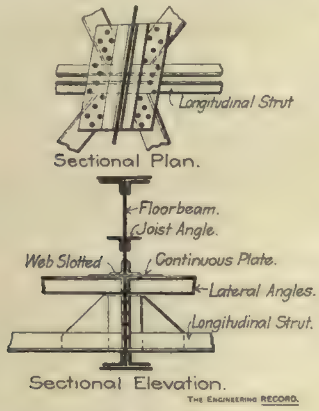
The Summer Street Bridge, Boston.

Summer Street, Boston, is carried over the South Boston freight yards of the eastern district of the New York, New Haven & Hartford Railroad on a paved bridge 100 feet wide and about 710 feet long between centers of end piers. The substructure consists of two masonry end piers and three steel intermediate piers 18 feet high, all with offset masonry footings on pile foundations. The superstructure consists of four pin-connected, through Pratt truss spans, about 98, 188, 203 and 211 feet long, center to center of end pins. Each span has three trusses, 25 feet deep and 40 feet apart on centers. All of the trusses are of the same type, with panels from 23½ to 29¼ feet long, subdivided for the floor system by middle subvertical suspenders attached to the centers of the main diagonals where the latter are braced by inclined posts to the next lower-chord panel point. All of the spans are regular and have a skew of 91 degrees 29 minutes and 37 seconds with their piers, except the east span, which has a skew of 99 degrees 23 minutes and 54 seconds with its east pier, making the north truss 15 feet 4½ inches longer than the south truss. This difference is all made in the middle two panels of the trusses, which are each 29 feet 3¾ inches long in the north and 21 feet 7¾ inches long in the south truss, thus skewing those two panels and the three panels east of them.

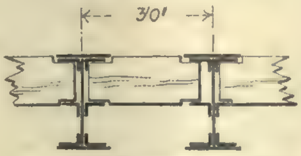
The lateral struts at top-chord panel points are lattice girders about 7 feet deep, with their top flanges riveted across the top chords and the ends of the bottom flanges clearing the vertical post webs and seated on the top flanges of solid-web knee-braces about 6 feet wide and deep. Each flange of the lattice girder is made with two 6 x 3½ x ⅝-inch angles and a 11 x ⅝-inch web plate, and they are latticed together with triple intersection 3 x 3 x ⅜-inch web angles. They are braced together on the center line by longitudinal struts of equal depth and materials. The portals are exactly similar, but deeper, so that their bottom flanges are in the same horizontal plane, and they are made with heavier materials. All top-chord panels are X-braced with 4 x 4 x ⅜-inch angles and ⅜-inch riveted connection plates. The bottom lateral system consists of 6 x 4 x ½-inch X-brace angles in every bottom-chord panel. All their horizontal connection plates are ½ inch thick and pass through slots in the floorbeam webs, so as to make the system continuous through the intermediate panel floorbeams.

In the center trusses the top chords and end posts have three webs; elsewhere they have only two. In the top chords of the long spans the webs are made of two or three plates riveted together, and the centers of the pin holes are 3 inches nearer the top than the bottom edge. The chord sections are made in two-panel lengths, with top and bottom flange and web cover splice plates about 3 feet beyond pin points. The hip joints have half holes and are not locked together by jaw plates. There are jaw plates with full holes locking the lower ends of the end posts to the end pins. All vertical and inclined posts are made with pairs of built channels, latticed on both sides. All floorbeams are suspended by double U-bolts from the lower-chord pins. The truss pins vary but slightly from 7 inches in diameter.

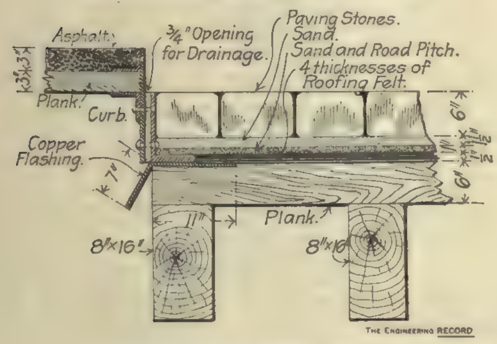
In the 203-foot span the maximum cross sections are made as follows: Top chord; one 24 x ½-inch cover plate, four 4 x 4 x ½-inch and four 6 x 4 x ½-inch flange angles, one 30 x ⅝-inch, two 30 x ⅜-inch and four 20 x ½-inch web plates. Main diagonals; four 8 x 1 9/16-inch eyebars. Vertical posts; two 18 x ½-inch plates and four 4 x 4 x 7/16-inch angles. Bottom chord; two 8 x 1⅜-inch, two 8 x 1½-inch, two 8 x 1⅞-inch and two 8 x 2-inch eyebars. Sub-panel vertical suspenders; two 5 x ¾-inch eyebars.



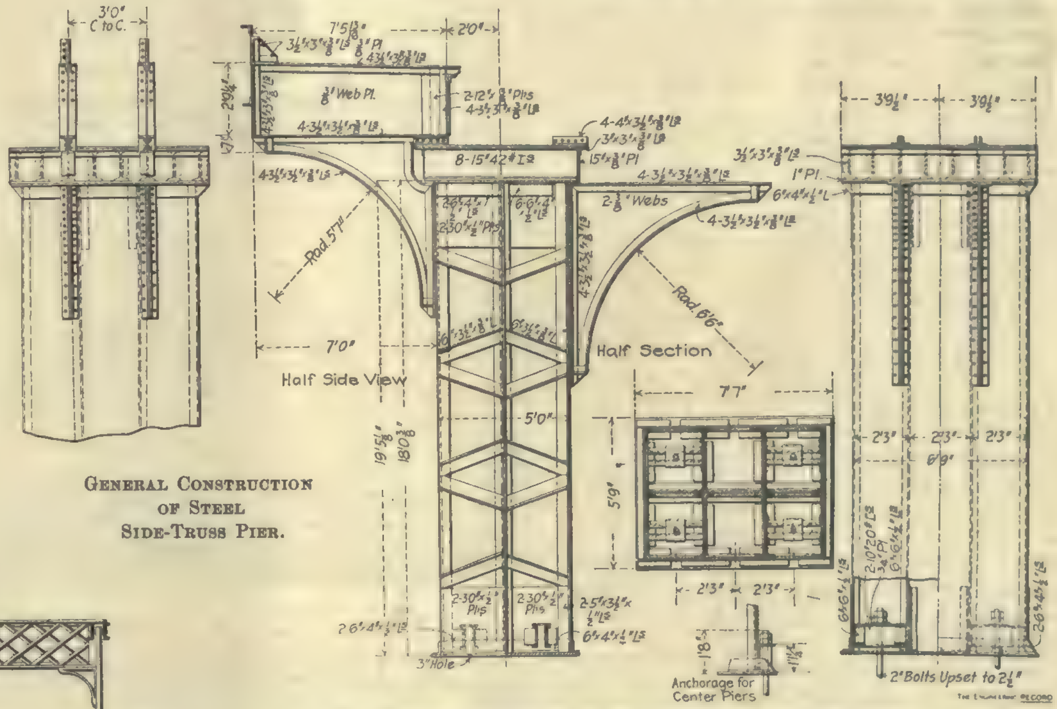
LONGITUDINAL STRUT CONNECTIONS.



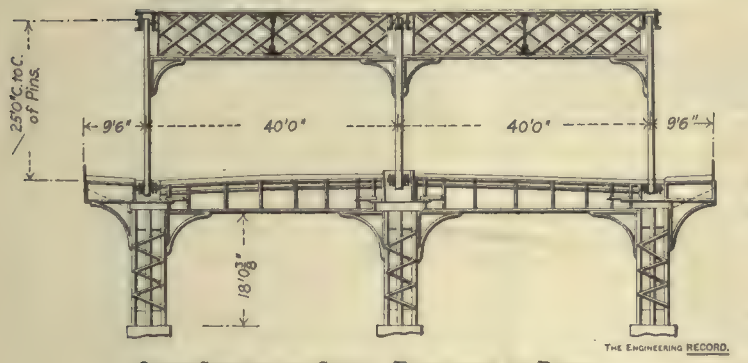
JOISTS AT EXPANSION JOINT.



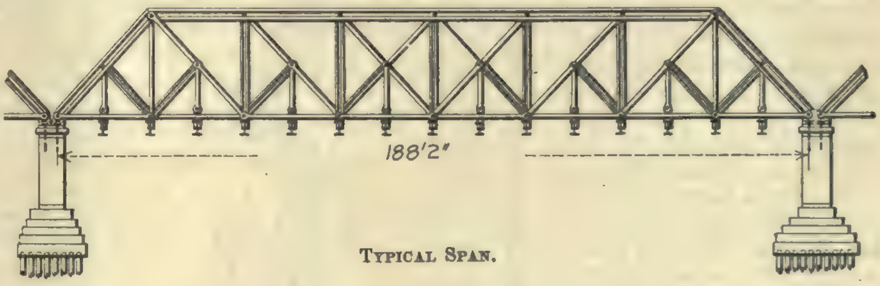
ROADWAY AND CURB DETAILS.



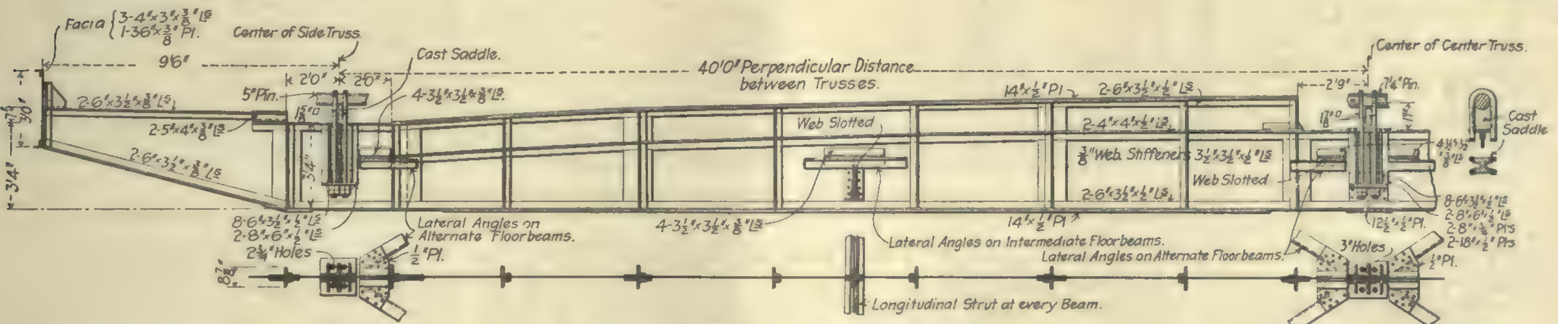
GENERAL CONSTRUCTION OF STEEL SIDE-TRUSS PIER.



CROSS-SECTION OF SPAN; ELEVATION OF PIERS.



TYPICAL SPAN.


Facia {3-4"x3½"x⅜" L's 1-36"x⅜" Pl.
Center of Side Truss.
Cast Saddle.
9'6"
2'0"
2'6"
5" Pin.
40'0" Perpendicular Distance between Trusses.
Center of Center Truss.
Cast Saddle
Web Slotted
Web Slotted
⅜" Web Stiffeners
Lateral Angles on Alternate Floorbeams.
Lateral Angles on Intermediate Floorbeams.
Lateral Angles on Alternate Floorbeams.
2¾" Holes
3" Holes
Longitudinal Strut at every Beam.
3'4"
THE ENGINEERING RECORD

HALF-ELEVATION OF FLOOR-BEAM AND HORIZONTAL SECTION OF WEB.

SUMMER STREET BRIDGE, BOSTON, ON NEW YORK, NEW HAVEN & HARTFORD R. R.

C. M. INGERSOLL, JR., CHIEF ENGINEER; WM. H. MOORE, BRIDGE ENGINEER; AMERICAN BRIDGE CO., CONTRACTORS.

The floorbeams are continuous plate girders 99 feet long and 4 1/3 feet deep in the middle, supported at three points 40 feet apart and having two 9½-foot cantilever ends carrying the sidewalks. The webs are ⅜-inch plates and the flanges are pairs of 6 x 3½-inch angles with 14 x ½-inch cover plates 80 feet long. The top flange is bent to a parabolic curve, crowning 1 foot in the center to give the transverse pitch to the road surface. Fifteen inches below the top flange there are two 4 x 4-inch shelf angles parallel to the top flange to support the dapped ends of the 8 x 16-inch yellow pine longitudinal joists 26 inches apart on centers. These shelf angles are made continuous and the vertical web-stiffener angles are made in two pieces each, and are fitted to the upper and lower sides of their horizontal flanges. The vertical ends of the U-bolt suspenders pass through notches in the top flanges of the floorbeams and between vertical web-stiffener angles which reinforce the horizontal flanges of 6 x 8-inch horizontal shelf angles on which the double nuts of the U-bolts take bearing. Cast-iron spacers are set between the chord pins and the top flanges of the floorbeams and are engaged by the U-bolts so that they are locked in position and give solid bearings, against which the U-bolts are screwed up with initial tension to hold the beams firmly in place. Twenty feet on each side of the center truss the floorbeams are braced by a line of longitudinal struts, composed of two angles riveted together back to back and connected to the lower parts of the floorbeam webs with solid-web vertical knee-braces.

The ends of the floorbeams are connected by a continuous fascia girder with a 36 x ⅜-inch web, and one 3 x 4 x ⅜-inch angle in each flange. These girders are riveted to the end vertical web-stiffener angles in the floorbeams and are made in double panel lengths, spliced over the floorbeam centers with single outside web cover plates. They terminate at the ends of the spans and are spliced with short sections between the end floorbeams, over the pier centers. Where the fixed ends of the spans meet they are spliced with a 3-foot section and two joints like the regular splice at intermediate panel points. Where the expansion ends of the spans meet they are spliced, as shown in the accompanying detail, with a 36 x ½-inch web plate riveted to the ends of the floorbeams and projecting about 18 inches beyond each to receive the double splice plates between which the fascia web is engaged with bolts through slotted expansion holes.

The roadway is covered with 6-inch transverse planks, the ends of which have a copper flashing and riveted steel curb bolted to them to receive the roadway and sidewalk pavements, as shown in the detail. The sidewalk planks are received between top and bottom flange angles riveted to the curb plate, which has fillers spacing it out ¾ inch from the curb angles to form drainage openings.

The hand rails, 3½ feet high, are made with cast-iron posts with continuous 2½-inch top and bottom pipes passing through them. To these horizontal rails are bolted grills made with vertical ½-inch gas pipes about 5 inches apart.

The rectangular steel piers are essentially triple-web columns, each supporting the adjacent ends of two trusses. They are latticed with heavy angles on the transverse faces and have thick base plates secured to the masonry with four 2-inch anchor bolts. To the 1-inch cap plate is riveted a grillage of eight 15-inch transverse I-beams, having a 1-inch cover plate on which the truss shoes are seated.

The side piers have cantilever brackets and platform girders supporting the sidewalks, and transverse kneebrace brackets, 7¾ feet long, which are riveted to the bottom flanges of the floorbeams. The center piers resemble the side piers, except that they have two floorbeam kneebraces and no sidewalk bracket, are 6 feet wide transversely, and have their anchor bolts connected outside the transverse faces. Each has three 81 x ⅝-inch web plates, eight 5 x 3½-inch and eight 3½ x 3½-inch angles.

The bridge was built by the Edge Moor branch of the American Bridge Company, in accordance with the requirements of the engineering department of the New York, New Haven & Hartford Railroad Company. Mr. C. M. Ingersoll, Jr., chief engineer; Mr. Wm. H. Moore, bridge engineer.

Moving a Long Tunnel Transversely.

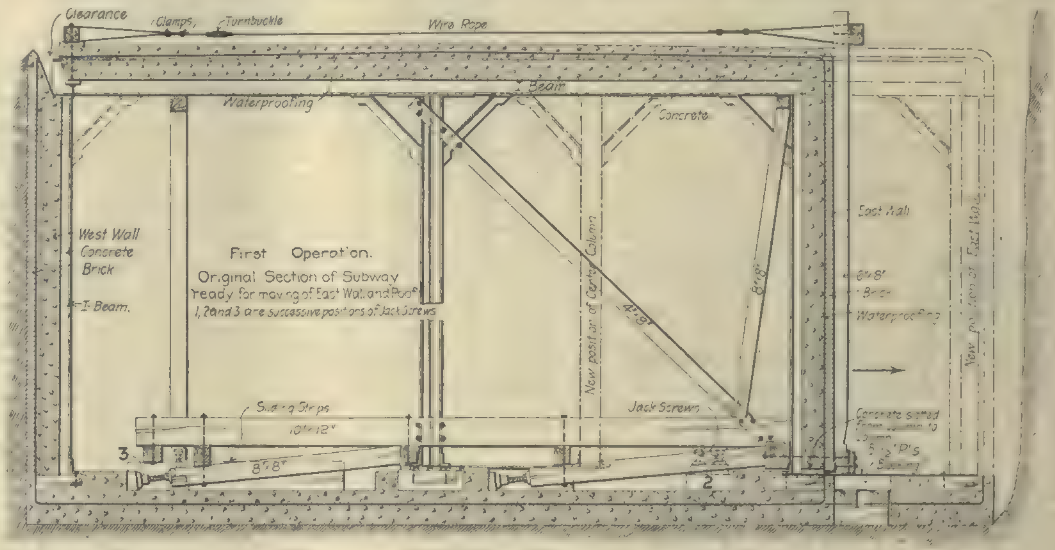
A portion of Section 13 of the New York Rapid Transit Railway, between West 136th and 138th Streets, was completed last year as a two-track subway with beam and concrete construction, substantially like the four-track standard which was illustrated in The Engineering Record of January 12, 1901. It was subsequently decided to enlarge it to accommodate three tracks, and it was estimated to be cheaper to modify the existing structure than to tear it out and entirely rebuild it, as was at first contemplated. This work involved moving transversely the long brick retaining walls of the south inclined approach, as described in The Engineering Record of October 26, and moving the steel and concrete roof and side walls of the finished subway section, nearly 300 feet long, 5½ feet transversely both ways from the center line. The heaviest part of this unusual work has been successfully completed, and involves some features of interest, which are here described from an examination of the work in progress and from the contractors' drawings.

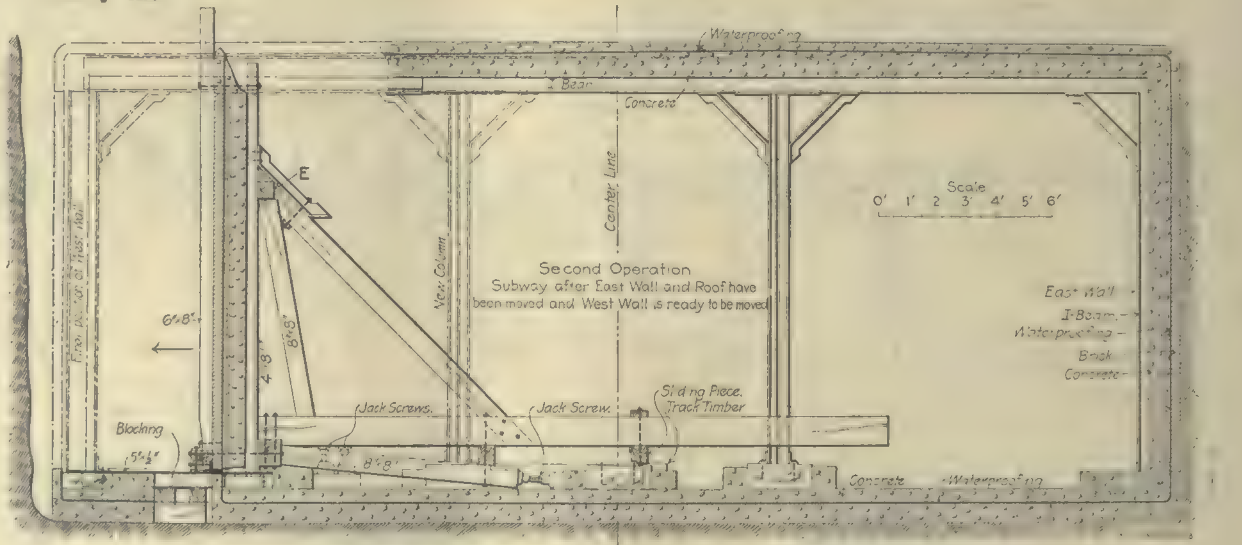
The two-track structure had a rectangular cross-section about 17 feet high and 28 feet wide over all, with transverse steel bents 5 feet apart on centers. Each bent consisted of three vertical posts supporting an I-beam roof girder, to which they were knee-braced. The center posts have an H-shaped cross-section, made of four bulb angles and a web plate; the side posts are single I-beams, between the webs of which are sprung concrete arches with vertical axes. The roof is made with transverse horizontal concrete arches sprung between the girder webs. The columns were seated on pedestal stones in the continuous concrete floor, under which and around the walls and roof arches was laid a continuous waterproofing course of tar paper and asphalt. This course was embedded in the top and bottom concrete and was outside of the side concrete, protected by an outer facing of single bricks, making a thin wall against which the back filling was rammed.

This section of the subway was built in open cut, and the sides of the trench had been backfilled against the brick outer facing of the structure, but its roof had not been covered. Excavations about 7 feet wide at the bottom were carried down to the bottom of the subway on each side, and in them continuous concrete footings were built for the side walls of the three-track structures. Arrangements were made for disconnecting the side walls and columns from the concrete floor and sliding them transversely into positions where they could serve the same functions in the three-track structure. The old floor was left in the original position and extensions and alterations were made as required to it and to the roof, which latter was moved, to adapt them to form portions of the new structure. This scheme was facilitated by the fact that the three-track structure is almost exactly like the two-track one, except that it is 11 feet wider from out to out, and that the two panels of the latter are increased to three in the former by the interpolation of a second intermediate vertical post and knee-braces, which are duplicates of the center post in the original construction.

The different operations required were to separate the west wall from the rest of the structure and to move it 5½ feet west, parallel to itself, to form the west wall of the new structure, and to move the east wall, center columns and the entire roof intact, 5½ feet east, to form the structure for the east track, insert the second row of intermediate columns, extend the roof and floor west to join the west wall and complete the structure. The east wall and roof had an estimated total weight of nearly 3,000,000 pounds, and the west wall, about 1½ feet thick and 15 feet high, weighed about 700,000 pounds and had very small stability on its narrow base. There was no longitudinal connection between the transverse bents of steel work, except by the concrete arches, which adhered so slightly to the beam webs that they afforded no tensile strength, and great care was necessary in moving the structure by jack screws to avoid cracking or injuring it.

The roof concrete was cut through at the top of the west wall from end to end of the fifty-seven bents of the tunnel which were to be modified; enough of the concrete was removed to permit the roof beams and wall columns there to be disconnected, and the knee-brace shown by dotted lines in the sectional elevation was removed. A slot about 6 inches high was cut through the bottoms of all the concrete arches in the east wall, where the cutting was so difficult that it often took two men three days to cut through the concrete between two vertical posts 5 feet apart.


Clearance
Clamps,
Turnbuckle
Wire Rope
Beam
Waterproofing
Concrete
West Wall
Concrete
Brick
I-Beam.
First Operation.
Original Section of Subway
ready for moving of East Wall and Roof
1, 2 and 3 are successive positions of Jack Screws
New position of Center Column
4"×8"
8"×8"
East Wall
8"×8"
Brace
Waterproofing
New position of East Wall
Sliding Strips
10"×12"
Jack Screws
Concrete slotted from column to column
3
8"×8"
2



Diagrams Showing Method of Widening Rapid Transit Railway Subway.

Continuous longitudinal horizontal timbers were set against opposite sides of the foot of the east wall and thoroughly bolted together through it. Both timbers were spliced together with butt joints and single side planks bolted on, and the outside timber had a continuous 4 x 4-inch angle bolted to one side, with the horizontal flange projecting into a slot in the 4-inch brick face-wall so as to support it. It also had angle clips on the upper side, to which were bolted vertical posts 10 feet apart, which extended a little above the top of the subway to give bearing to a continuous horizontal longitudinal timber. A corresponding timber was bolted to the top of the roof on the west side and they were tied together by ¾-inch wire ropes under considerable initial tension, which were spaced 10 feet apart to bind the structure firmly together and prevent injury from stress developed in moving it.

At every alternate bent a transverse horizontal timber was butted against the foot of the wall column and dapped over the top of the inside longitudinal sill. The bulbs of the angles in the center column were gained into its side about an inch, and it was clamped to the center column with four bolts and a cross-piece. A continuous longitudinal timber was bolted to the under side of these timbers and to the west side of each center column, and from the east end of each transverse timber a diagonal brace was bolted to the top of the center column, thus holding all the members of the transverse bent firmly in place and bracing them against distortion. The nuts were removed from the anchor bolts in the bases of the columns, and the ends of the bolts cut off flush with the tops of the base plates. A vertical shore was set on the west end of each transverse timber, bearing at the top against a longitudinal timber across the ends of the roof girders, and single and double jack screws under alternate shores were operated simultaneously to lift the ends of the roof girders about 3 inches above the tops of the west wall columns. This raised the center-column base plates high enough to clear the tops of the anchor bolts; they were shimmed up solid to keep them at this height and the jacks were released and shifted to the opposite ends of the transverse beams under the feet of slightly inclined shores, similar to those at the west ends. Operating the jacks in this position rocked the whole tunnel section over the base of the center column as a center of revolution, and as sufficient clearance between the roof girders and the tops of the west columns had been obtained by the first jacking, the west ends of the roof girders descended as the east ends were lifted, until the base plates of the east-wall columns were lifted clear of their anchor bolts and shimmed up in that position.

Blocking was built up from the subway floor to the tops of the column bases on the east sides of the east and center columns, and on it were laid flat steel track plates under the bases and reaching out to the new positions of the columns. Short longitudinal timbers were bolted under the west ends of the transverse beams to take bearing on timber skids, and slightly inclined transverse pushing braces were set against the longitudinal beams at the feet of the center columns. At the west end of each a 4-inch 5-ton jack-screw was set bearing against the concrete floor ledge; and by fifty of these screws, operated by twenty-five men, the wall and roof were moved 5½ feet east to its final position on the new footings in two days. The jacks were extended about 13 inches in 30 minutes and then released and 12-inch blocking packed behind them. The wall columns were left seated on the track plates and the latter were cut off at the inner edges of the base plates. It was at first intended to set a similar row of struts and jacks against the feet of the east wall columns, as shown in the sectional elevation, but they were finally omitted and the lateral stresses carried entirely through the transverse beams. The longitudinal timbers at the feet of the columns were assumed to carry all stress from the intermediate columns to the transverse timbers, and as their splices broke joints and they were connected by horizontal transverse struts between them at each joint, sufficient rigidity was secured. Each man attended to two jack screws, marked one and two, and at a given signal all the No. 1 jacks were turned 90 degrees, then No. 2 was called, and the others were turned the same amount, and so on. Before the moving was commenced a piano wire was stretched tightly from one end of the subway to the other, 1 inch from the faces of the wall columns, and each man was given a stick with a 1-inch mark at the end with which he tested the position of the wire every time the jacks had been turned out about 4 inches. By these precautions the wall was kept in excellent alignment, and at no time was as much as ⅛ inch out of line.

After the columns had been moved to the new positions indicated by dotted lines in the first figure, the second intermediate row of columns and knee-braces were set to support the ends of the roof girders and all the timber and blocking were removed. Vertical timbers were set against each side of the west wall in the center of every panel and bolted together top and bottom to stiffen the masonry. Horizontal longitudinal timbers, E, were bolted to these verticals and were spliced together continuously from end to end of the subway. A spare knee-brace was bolted in reverse position to the inside of each column and afforded a bearing for a triangular filler above the longitudinal timber, as well as a connection for an inclined strut. The latter reached out at 45 degrees to brace the wall from the transverse sill which had been removed from the east wall and turned end for end so as to dap over the wall sill as before. A nearly vertical shore was then driven in tight between each transverse timber and the upper longitudinal timber and keyed up the framework so as to make a very wide extended base for the wall. A short longitudinal sliding piece was bolted to the under side of each transverse timber near the middle, and a transverse track timber was set on the subway floor for it to rest on.

Slightly inclined jacking struts will be set against the lower longitudinal timbers and bolted to the transverse timbers, and, jack screws being set against them, between their east ends and the column footings, the west wall will be pushed over to the new position indicated by the dotted lines, in the same manner that the much heavier east side of the subway has been moved. The roof and floor will then be completed, any cuts in the masonry will be made good, and the subway will have been transformed from a two-track to a three-track structure without demolishing any of the original masonry, and at an estimated saving of about $6,000 over what it would have cost had the steel and concrete been torn out. About forty men and fifty jack screws have been employed on this work, and it was just four days after jacking up the west columns was commenced until the east wall was moved to its new position and seated on the new footings. In restoring the waterproofing layer at the bottom of the walls some of the lower part of the brick face walls will have to be removed to make the lap, and will be replaced with concrete.

The actual work is being done by the Terry & Tench Construction Company, who also made all the plans and did the engineering connected with this undertaking. Messrs. L. B. McCabe & Brother were the original sub-contractors for the subway at this point. Mr. S. L. F. Deyo, as chief engineer of the Rapid Transit Subway Company, approved of the methods employed.

Sulphuric Acid as a Typhoid Disinfectant is recommended by Dr. Samuel Rideal. In conjunction with Dr. Parkes he recently examined the action of various acids on water containing cultures of the typhoid bacillus, and, from the results then obtained, makes the above recommendation. About 4 grams of acid per imperial gallon of sewage is believed to be sufficient.

A Remarkable Core Wall for an Earth Dam.

Several articles have appeared in recent volumes of The Engineering Record concerning the new Burrator water-works of Plymouth, England, but none of them has brought out so prominently as is desirable the remarkable features of the Sheepstor earth dam, a structure only 470 feet long, yet needing a trench 680 feet long; 23 feet high, yet requiring a trench 105 feet deep. Fortunately, Mr. Edward Sandeman, M. Inst. C. E., the engineer of the new works, prepared a paper on them for the Institution of Civil Engineers, and from this it is now possible to obtain a reliable account of some hitherto unexplained features of the dam in question. The width of the bank on top, it may be premised, is 12 feet, and the inner and outer slopes are respectively 3:1 and 2:1. The depth of water against the inner slope is 17 feet and the top of the bank is 6 feet above the high-water level.

The water-tight core of the embankment is of clay 6 feet in thickness at the top, increasing to 8 feet at the base. Below ground the water-tight core is of concrete, forming a wall 5 feet in thickness, terminating at the top in a concrete shoe in which the clay rests. The cutting of the trench was commenced in August, 1894, and the embankment was completed in November, 1897.

Several trial pits were sunk in order to ascertain the most advantageous site for the trench, and eventually a line was decided upon. Two of the trial pits sunk on this line, which had exposed rock at a depth of about 14 feet, gave somewhat delusive results, since on the opening up of the trench they were found to be situated over pinnacles of rock which shelved away rapidly to considerable depths. At a few feet from the surface water was found, and pumps were required to keep the trench clear. The water increased in quantity with the depth, until the pumps were lifting 450,000 imperial gallons daily to a height of upward of 100 feet. The trench, which had a depth in the center of 105 feet, was a most interesting one. It was cut through an extensive layer of decomposed granite, and the sides of the trench exhibited a remarkable variety of colors. The decomposed granite had no distinctive color throughout, but varied every few yards. A vein of white china-clay crossed the trench near its deepest part, and at several different points veins of red elvan were cut into.

It is generally assumed, although it would appear difficult of proof, that the so-called decomposed granite was originally in a hard state, and that its present condition is due to the gradual disintegration of the constituents of the coarsely crystalline granite by the percolation of surface-water. A theory was advanced by an eminent geologist at the time when the construction of the reservoir was first contemplated, that possibly the change in the condition of the granite was caused by chemical action from below. This theory would seem to imply that the chemical action took place upward through rifts and cracks in the rock, and that therefore the decomposed material might be expected to extend downward. The solid rock was found beneath the layer of decomposed granite along the whole length of the trench, but at greatly differing depths, the deepest point being not far from the middle of the valley. It was observed that, as a rule, as greater depth was attained the decomposed granite became harder, until it gradually merged into the hard rock; but in some cases the transition from soft to hard rock was sudden. While cutting through the decomposed granite, rounded granite boulders were found with concentric rings of decomposed rock, the outer rings being soft, while the inner rings increased in hardness to a solid core. In other cases the concentric rings were found, but the core was soft. Mr. Ussher, of H. M. Geological Survey, assured Mr. Sandeman that the disintegration of the granite invariably proceeds from the surface downward, and that the boulder masses are simply harder patches which have remained in situ among the disintegrated materials.

Veins of rock, sometimes granite and sometimes quartz, intersected the trench, generally at an angle between 45 and 70 degrees. Usually these veins were practically parallel, although others of small size were found, which intersected the former. The veins ranged from 1 inch to 3 feet in thickness, and the larger had the appearance which would be exhibited by the section of a dry rubble wall of irregularly shaped stones fitting one into another. In other words, the veins consisted of vertical walls of broken rock with open joints. These veins were the main reason for so deep a trench being sunk. Had they been of solid rock, probably no difficulty would have arisen from them, but under the circumstances they simply formed deep land drains. That they did act in this capacity was shown by the fact that the upper stones of the veins were deeply stained with peat, carried down by the surface water, but the stains gradually disappeared and the stone became quite white as greater depths were reached.

In sinking the trench there was no certainty that solid rock would be found, nor was it known whether, supposing the solid rock were reached, the veins would terminate in it or would continue. At a depth of 70 feet there was no favorable change in the appearance of the two largest veins, their joints being still wide open and the blocks loose, and where they crossed the trench streams of water rose continually from them. About this time it was noted with satisfaction that one of the smaller veins, in a shallower part of the trench, had apparently terminated in a bed of solid rock, which gave rise to a hope that the others might run out in the same way. As the sinking proceeded it was seen that the water, which had formerly bubbled up like a strong spring in the bottom of the trench, was coming more and more from the sides of the trench, and at a still greater depth it was found to be entering the trench a few feet above the bottom and running down the sides, none coming in at the bottom of the trench. Deeper still the decomposed granite became harder, until—particularly where it adjoined the veins—it was very difficult to excavate. The joints between the stones in the veins became filled with an argillaceous deposit and decreased in number Then the narrow streaks of clay which had been observed vertically on either side of the veins, and which lay between them and the adjoining granite, disappeared, and the vein became one with the granite (so far as engineering purposes were concerned), although its course through the latter was plainly marked. In following down two other veins, water continued to flow upward from holes in the hard quartz rock of which they were formed, and in these cases pipes were placed over the springs, and were carried up above the water level of the reservoir.

The termination of the veins in the rock was not always as is described above. In several instances veins 6 to 12 inches wide in the decomposed granite appeared to terminate when the solid granite was bared, but on closer examination of the bared rock a black line about an inch wide could be observed, which continued downward through the rock, beneath the center of the vein. Near the east end of the trench there was quite a network of small veins, which crossed one another in every direction, necessitating the trench being sunk to a depth of 60 to 70 feet before the rock was found. At the east end the depth was 40 feet, and here the concrete is tied into decomposed granite, the trench being bottomed in solid rock and carried some distance into the hillside.

It is very probable that, had not the veins just described existed, the trench would not have been carried so deep, but would have been bottomed in decomposed granite at a much less depth; but in that case risk of leakage would have been greater; in fact, it is almost certain that water would have slowly drained through the decomposed granite along the whole length of the trench. However, as the difference in level between the reservoir top water line and the level of the subsoil water behind the dam is only 13 feet, it is not likely that it would have done any damage, the pressure being so slight.

On the completion of the excavation of the central part of the trench, the surface of the rock was washed clean and covered with a layer of cement and sand, on which a layer of concrete was spread across the whole width of the trench. On this layer a concrete wall 5 feet thick was carried up. The water face of this wall was supported by a framing of 3-inch tongued and grooved planks, held in position by struts against the side of the trench. As every batch of concrete was put in, sand and cement gauged 3 to 1 was carefully worked down between the concrete and the planks, making a facing about 1 inch thick against the smooth surface of the plank. It was generally arranged, in order that the joints between the new and the old concrete might receive proper attention, that the portion of the wall on which work was being concentrated should be carried up in as thick a layer as possible at one time, but not exceeding 3 feet, the height of one plank framing. On the completion of a layer, V-shaped depressions were made in it longitudinally by pressing timbers 4 inches by 4 inches, cut across the angles, into the soft concrete, in order to break the joint between the layers. Concrete which had already set was always prepared by being roughened with a pick; it was then washed clean and covered with a layer of cement and sand, before any newly mixed concrete was laid on. The considerable quantity of water flowing into the trench even in the driest weather was the cause of much trouble, and every attention had to be paid to it in order to prevent damage to new concrete. In cases where it was necessary to allow the incoming water to rise over newly made concrete, small wooden troughs were used, and as a rule the water was kept moving so slowly as to prevent the cement from being washed away to any extent.

The Engineer.

An "appreciation" in an address by Prof. J. B. Johnson on "Two Kinds of Education for Engineers."

In the foregoing description of the technical education and work of the engineer, the engineer himself has been considered as a kind of human tool to be used in the interest of society. His service to society alone has been in contemplation. But as the engineer has also a personality which is capable of appreciation and enjoyment of the best this world has produced in the way of literature and art; as he is to be a citizen and a man of family; and moreover, since he has a conscious self with which he must always commune and from which he cannot escape, it is well worth his while to see to it that this self, this husband and father, this citizen and neighbor, is something more than a tool to be worked in other men's interests, and that his mind shall contain a library, a parlor and a drawing room, as well as a workshop. And yet how many engineers' minds are all shop and out of which only shop-talk can be drawn. Such men are little more than animated tools, worked in the interest of society. They are liable to be something of a bore to their families and friends, almost a cipher in the social and religious life of the community, and a weariness to the flesh to their more liberal-minded professional brethren. Their lives are one continuous grind, which has for them doubtless a certain grim satisfaction, but which is monotonous and tedious in comparison with what they might have been. Even when valued by the low standard of money-making, they are not nearly so likely to secure lucrative incomes as they would be with a greater breadth of information and worldly interest. They are likely to stop in snug professional berths which they find ready-made for them, under some sort of fixed administration, and maintain through life a subordinate relation to directing heads who, with a tithe of their technical ability are yet able, with their worldly knowledge, their breadth of interests, and their fellowship with men, to dictate to these narrower technical subordinates, and to fix for them their fields of operation.

In order, therefore, that the technical man, who in material things knows what to do and how to do it, may be able to get the thing done and to direct the doing of it, he must be an engineer of men and of capital as well as of the materials and forces of nature. In other words, he must cultivate human interests, human learning, human associations, and avail himself of every opportunity to further these personal and business relations. If he can make of himself a good business man, or as good a manager of men, as he usually makes of himself in the field of engineering he has chosen, there is no place too great, and no salary too high, for him to aspire to. Of such men are our greatest railroad presidents and general managers, and the directors of our largest industrial establishments. While most of this kind of knowledge must also be acquired in actual practice, yet some of it can best be obtained in college. The one crying weakness of our engineering graduates is ignorance of the business, the social and the political world, and of human interests in general. They have little knowledge in common with the graduates of our literary colleges, and hence often find little pleasure in such associations. They become clannish, run mostly with men of their class, take little interest in the commercial or business departments of the establishments with which they are connected, and so become more and more fixed in their inanimate worlds of matter and force.

A Rotary Steam Engine employing single-acting cylinders arranged in a plane perpendicular to the engine shaft has been patented recently by Mr. Henry T. Vaders. Steam is admitted to the outer end of the cylinders, which thus act inwardly, the steam supply being controlled by a small valve concentric with and driven by the shaft, the valve uncovering the steam passage to each cylinder in turn. The length of valve opening is made to give a desired cut-off, the steam is allowed to work expansively during the remainder of the stroke, and the valve then opens the steam passage to the exhaust on the return stroke. Mr. Joseph T. Fenton, 2544 Turner Street, Philadelphia, who is representing the patent owners, is exhibiting a 4-horse-power engine which has four cylinders 2½ inches in diameter and 3-inch stroke. It stands 16 inches high, on a base 5 x 12 inches in size, and weighs 65 pounds; its shaft is 1¼ inches in diameter.

Recent Operating Experience in the Detroit Water Department.

For many years the Water Department of Detroit furnished data concerning consumption and waste, the use of meters and similar subjects of interest, which were as widely quoted as those of any American city. Within a few years, however, the acts of the Department became of less general interest, for the members of the commission seemed more intent on politics than the good of the city. Moreover, some of the early figures of consumption and waste have been declared to be misleading by Prof. Gardner S. Williams, who was the civil engineer of the commission for some years, and as his remarks refer directly to the data regarding the prevention of waste by the use of meters, so often quoted, it is appropriate to repeat them here, as given in the "Proceedings" of the American Society of Civil Engineers for August, 1901.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLVII, MONTPELIER THE AQUEDUCT.

"The statement is frequently made in the official publications that the reduction of consumption from the maximum in 1888 to the minimum of 1892 was due to the saving of water caused by metering. The quantity of water paid for by meter in 1889 was only about twice that similarly paid for in 1888, and yet the saving is nearly twice as great during the following year, when four times as much water was sold by meter, and beyond 1890 the increase in metered water has very little bearing upon the variation of consumption. These facts are sufficient to arouse suspicions as to the remarkable efficacy claimed for the meters; and when it was found by a computation of the discharging capacity of the connections metered in 1889, that if they had all been running wide open twenty-four hours in the day in 1888 and until metered in 1889, and had been closed completely during the portion of 1889 after the meters were set, the amount they would have reduced the consumption would not begin to account for the saving claimed, it became evident that some other cause of reduced consumption was to be looked for. Upon investigation it was found that the bulk of the saving between 1888 and 1892 was due to the restriction of waste at the engines themselves, and had no connection with the meters further than that it was instituted at the same time and for the same purpose that the meters were introduced.

"Previous to 1888 it was customary to open the waste-gate at the pumping engines and pump back into the river rather than lay off an engine at night, when the consumption fell below a certain point. The engineer in charge of the station was very severe with his subordinates when an engine stopped, and beam engines, fly-wheel engines, are likely to stop if they run below a certain rate of speed. So when the engines were slowed down to nearly their minimum capacity the attendants opened the waste-gates, discharging back into the pump-well, to keep them pumping during the night, thus avoiding danger of trouble from having to get the chief up early in the morning to start the engines again.

"It is interesting to note the decided jump in consumption from 1886 to 1887. By tracing this increase back it was found that the jump began at the time the reservoir was cut off from the system. Up to October, 1886, the Detroit system was a combination of reservoir and direct pressure, the water being pumped directly into the mains, but the reservoir being so connected that a surplus accumulated there, so that then it was not necessary to waste much water, because generally there was a chance to pump 8 or 9 feet depth of water into the reservoir at the times when the consumption was low. But the reservoir was disconnected from the system in 1886 because it was felt that it did not afford opportunity for sufficiently high pressures, and an increased waste at the engines commenced immediately, the jump being noticeable the very first day after the reservoir was abandoned, and the waste continued to increase until, in 1888, it had become so great that the Board of Water Commissioners were appalled at the quantity of water which they were pumping, a large portion of which was never getting to the city at all. They feared they would have to reconstruct their entire system at that rate inside of five years; and the only alternative appeared to be to introduce meters, which they began to do at once.

"There were some notable cases of reduction of consumption when those first meters were put in, but nothing that would account for anywhere near the drop which actually took place. Simultaneously with the introduction of the meters the waste at the engines was curtailed, and as little water was wasted there as could be with the devices that existed for controlling the machinery, for there were times when it was necessary to waste some water. In 1893, when the speaker's connection with the works began, he had a record kept of the opening of the waste-gates, the time during which they were open, the number of turns, etc., and began estimating the quantity of water wasted in that way; and although at that time it was supposed that there was no waste, or at least that no more water was wasted than was absolutely necessary, it was found that the waste-gates sometimes discharged anywhere from 500,000 to 2,000,000 gallons a day. When this waste was so great under those conditions, it can readily be imagined that considerably more had been wasted when there was no attempt to restrict the quantity so lost. Comparisons between Sunday and weekday consumptions in 1888 showed that from 7,000,000 to 10,000,000 gallons had been wasted daily on some occasions. In 1894 the engines were remodeled, and by 1895 they were so arranged that it was unnecessary to waste. Since early in 1895 there has been no loss of water pumped at the engines in the Detroit works."

In 1897 the policy of the commission in the matter of water waste was abandoned and private houses were no longer metered. The result is stated in the report for 1900-01 of Mr. H. S. Starkey, general manager of the works, substantially as follows:

The per capita daily consumption for 1900 was 153 gallons, an increase of six gallons over 1899. The per capita for 1897 was 125 gallons, for 1898 was 135 gallons, 147 for 1899, 153 for 1900, and 163 for the first six months of 1901. Since 1898 comparatively few meters have been placed, and Mr. Starkey believes the increase per capita each year is largely due to this fact. The enormous waste in Detroit is apparent by comparison with the quantity of water consumed in the city of Milwaukee, the population of that city, as shown by the census of last year, being but 200 less than this city. Presumably the uses for water are the same in each city. Milwaukee has 68 per cent. of taps metered; Detroit has 10 per cent. In 1900 the per capita in Milwaukee was 88 gallons; in Detroit it was 153 gallons; a difference of 42½ per cent.

In the report of Mr. T. R. Putnam, superintendent of meters and inspection for the same time, there are some additional statements concerning the subject, indicating that Detroit is returning to its former policy of metering, perhaps not so much to prevent waste as to make wasteful users pay for their carelessness. According to his figures, in the eighteen months following January 1, 1900, he placed 366 meters and removed 286, making a net increase of 80, which, added to the number in service previous to that date, makes a total of 5,635 in service on July 1, 1901. There were then 807 meters on premises that paid by the assessed rates, as against 1,113 eighteen months before. One hundred and thirty meters were removed from such premises and placed on such business places as required metering, and 176 consumers who changed from meter to assessed rates, where the meters were allowed to remain on the premises, were transferred back to the meter roll on account of their large consumption. A case in point is that of a private family where the consumption was 435,000 gallons in three months, which, by meter rates, would amount to $10.83, while the assessed rate for same length of time was only $1.78. After placing premises on meter roll the consumption was reduced to 9,000 gallons for three months, instead of 435,000 gallons as formerly. This is not an uncommon occurrence on metered premises, and it seems to be the experience of nearly all cities throughout the country, and is causing many of them to adopt the meter system, that being the only practicable way of stopping the enormous waste that is continually taking place.

When meters were first being introduced in Detroit the idea was that their life would be about ten years, but after the lapse of that time those that have been in service that number of years are still as good as ever, to all appearances. The Department deducted 10 per cent. each year for several years for depreciation in value, and later reduced it to 5 per cent., which amount is now regarded as too high. A 4-inch meter was recently removed from an abandoned service; it had been in constant operation for over ten years and had registered over 78,000,000 gallons. It had been repaired but once, the disk having been adjusted and train gear repaired, all of which was done in less than a day. It was tested with a new 1½-inch meter, and on 750 gallons it was only one-half of one per cent. slow, and that before anything had been done to it in the way of cleaning or repairs. On a ⅝-inch stream it was about 4 per cent. slow, but after it had been cleaned and adjusted it registered within 2 per cent. on ½-inch flow.

"In considering the subject of waste, the matter of house to house inspection deserves consideration," Mr. Starkey states in his report. "During the last three years, on account of the inspectors' time being taken up with other work, it has been impossible to give proper attention to house inspections for leaks. While inspection of private premises causes annoyance and irritation to our citizens, it seems, at present, a necessity. Great objection is made to admitting strangers into premises, and although the inspectors are provided with proper credentials showing their authority, many complaints have been received that men, claiming to belong to the water department, have gained admission to premises only to attempt to sell filters, attachments, etc. It is not advisable here to enter more fully into the many objections of this system. This condition has a bearing on the meter question, as it could be remedied by the placing of meters on all premises supplied with fixtures. Leaky fixtures will soon be repaired when payment for the waste is required."

In the report of the Board itself for the same period the gradual adoption of the meter system is recommended, and the following plain statement is made of the position of this commission: "There is no desire on the part of this Board to restrict in any way the most liberal use of water for all legitimate purposes, but there is no necessity that the people should be compelled to pay for waste that is a benefit to no one."

It is interesting to notice, also, that the Board has attempted to introduce two more desirable reforms in the financial management of the Department. The first of these was the laying of water mains at the expense of the property benefited, so that the out-of-town lot owner whose plot was enhanced in value by the main laid alongside it would have to contribute an equitable proportion of the expense of the construction. This act was declared unconstitutional by the Supreme Court, as too often happens. The second reform was the charging for water used for public purposes, thus laying the expense on the general tax levy, where it belongs, rather than on the water consumers. In this case the Supreme Court ruled that the charges against other city bureaus could not be collected unless a suitable provision for the payment was made by the Board of Estimates; on the other hand, it was held that the Water Department was not compelled to furnish water for municipal purposes unless it was paid for the service.

The Present State of Cement Testing in Germany.—II.

Extracts from a paper by Max Gary before the Budapest Congress of the International Association for Testing Materials.

IV. Fineness.—The Prussian Standards contain the following regulation: "Portland cement shall be ground so fine that if tested with a sieve containing 900 meshes to the square centimeter there shall remain at the most a residue of 10 per cent. The sieve shall be such that the thickness of a wire shall be equal to half the space between two consecutive wires.

"Explanations.—For every separate test with the sieve 100 grammes of cement are to be employed. As cement is used almost wholly with sand, and in many cases with a very considerable addition of sand, and the strength of a mortar increases in proportion to the degree of fineness to which the cement employed is ground (since then more parts of the cement come into effective working), the value of grinding the cement fine cannot be overestimated. It seems, therefore, advisable to test the fineness of the grain uniformly by a fine sieve with the above-mentioned size of mesh. It would, however, be an error to conclude that the good quality of the cement depends only on the fineness of the grinding, as it very often happens that inferior soft cements are ground finer than good clear-burnt cements. The latter, however, will, even when coarse ground, prove, as a rule, to possess a higher binding force than the former. If the cement is to be used mixed with lime, hard-burnt cements very fine ground are to be recommended, as the increased cost of production will be amply compensated for by the improvement in the mortar."

The degree of fineness required by this regulation, namely, so that a residue of at most 10 per cent. should remain on a sieve of 900 meshes to the square centimeter, is much too small for the present state of manufacture. A glance at the results of the numerous experiments with cement carried out at the Charlottenburg Institute shows that most cements in the German trade leave a very small percentage of residue on the sieve of 900 meshes, and that even cements which leave more than 20 per cent. residue on a sieve of 5,000 meshes to the square centimeter are very rare. With such fine-ground cement, also, the sieve of 5,000 meshes to the square centimeter, already long introduced regardless of the standards, is no more sufficient. Moreover, these sieves cannot be produced in the trade of uniform structure, and hence arise great deficiencies in testing with woven sieves, to which may be added the circumstance that the manner of handling the sieve or the sieving apparatus influences the result to a considerable extent.

The finer the sieves are made, the more difficult it is to obtain them of uniform construction, and it is plain that, for cements 80 per cent. of which pass through the sieve of 5,000 meshes, the sieve no longer gives a suitable standard for the actual degree of fineness to which the cement is ground. In addition, it appears from recent researches that the finest ground cements, if kept lying in stock, undergo a further fining to an extent altogether indeterminable by means of sieves, but which is apparent, for example, from the change in the weight of powder in a loose condition required to occupy a unit of space. For these reasons it will be necessary to give up the sieve method in testing the fineness of Portland cement and have recourse to the wet method, or to sifting with air blast. For the moment, uniform decisions on this point do not exist.

V. Strength.—1. Combination of the Bodies. (a) Mixing of cement and sand. For the testing of the strength of cement, a test applied to a mortar consisting of three parts by weight of a normal sand and one part by weight of cement, has been adopted as decisive in Germany and most other countries, with the exception of the United States, Great Britain and the British colonies. For this the Prussian standards regulate as follows:

"The binding force of Portland cement shall be determined by testing a mixture of cement and sand. The test shall be carried out according to a uniform method by applying tensile and compressive forces with the same apparatus to bodies having a similar shape and the same sectional area.

"As it has been observed by experience that the binding capacity to sand cannot be uniformly concluded from the results with regard to strength obtained by testing cement without an addition of sand, especially when a comparison of Portland cement from different factories is to be made, it is advisable to investigate the binding power of Portland cement by testing it with an addition of sand."

The self-evident condition for carrying out these tests is the employment of a sand which remains always uniform, and which has been introduced into practice under the name of normal sand. On the mixing of one part of cement with three parts of normal sand are based all the tests employed at present in Germany for determining the strength of Portland cement. The standards of June, 1887, expressly direct attention to the importance of employing a high addition of sand in the following terms: "As different cements, with respect to their binding force to sand, with which they are principally employed, conduct themselves very differently, a test with a high proportion of sand added is absolutely necessary, especially in comparing a number of cements. As a suitable proportion is accepted: Three by weight of sand and one by weight of cements, as with three parts of sand the degree of binding force in different cements appears with sufficient distinctness."

Although the degree of binding power of cements with fewer parts of sand is shown with sufficient distinctness, still, in view of the enormous development which the manufacture of Portland cement has made in Germany during the last decades, it seems desirable to obtain methods of tests for finer distinctions.

I have therefore already raised the question in the Association of German Portland Cement Manufacturers, whether it would not be advisable on the occasion of the revision of the standards about to be made to entirely discard the minimums of strength hitherto accepted, or to furnish them still with a new mark by which they can be distinguished. For instance, a figure which would express the cementing limit between cement and sand in such a manner that it could be seen which cement attains a certain strength with the highest addition of sand. Such a test appears, especially from a practical point of view, urgently to be wished for. It would afford a much better method of utilizing cements with a high limit of binding power which, as a matter of fact, are the most valuable of those employed in practice.

In any case, such a test assures the employment of a sand which comes nearer in size of grain to practical building sands than the normal sand of coarse grain hitherto used in Germany. This condition would be easily fulfilled by introducing a normal sand of mixed grain.

(b) Normal sand.—With regard to normal sand the Prussian Standards regulate as follows: "In order to obtain uniform results, sand of like grain, and of like condition, must everywhere be used. This normal sand is procured by taking the purest quartz sand obtainable, washing, drying, and passing it through a sieve of 60 meshes to the square centimeter to separate the coarsest particles, and then, by means of a sieve of 120 meshes per square centimeter, removing the finest particles from the sand thus obtained. The thickness of the wire in the sieves shall, for the first, be 0.38 millimeter, and for the second 0.32 millimeter.

"Since not all quartz sands show the same strength under similar conditions of treatment, it is necessary to determine if the normal sand at our disposal gives results as to strength agreeing with those obtained with the normal sand tested and supplied by the Council of the German Portland Cement Manufacturers' Association, which is also used by the Royal Testing Institute in Charlottenburg Berlin."

The Prussian normal sand was, before the Standards were introduced, procured in Freienwald a/O. The resolutions of the International Conferences at Munich, Dresden, Berlin and Vienna have recognized the normal sand of Freienwald as that with which all others shall be compared. They prescribe as follows: "The sand employed shall be normal sand produced from the purest possible quartz sand. Normal sand in the narrower sense; that is, a sand to which all others must be referred, is the sand of Freienwald, which is prepared by means of the wire sieves of 60 and 120 meshes. It must be left to other lands outside Prussia to obtain their own normal sand and, if possible, it should be of such a kind that it shall have the same effect as the normal sand of Freienwald with regard to the results of strength aimed at. If this is not possible, suitable coefficients of comparison should be sought for."

Some years ago I already had occasion to compare the normal sands employed in neighboring countries. From these comparisons it appeared that these sands, as regards their effect on the strength, differ to an extrordinary extent, although with regard to their size of grain they are not essentially different. In part these sands give lower degrees of strength, in part higher degrees, than the German normal sand. The individual sands behave in quite a different manner when subjected to tensile and compressive forces, and in addition to this, such deviations appear even in testing with one cement, that the determination of fixed coefficients for making ready comparisons between cements when employed with the sands of different countries will be accompanied with very great difficulties. This is not surprising after the experience in Germany with the normal sand of Freienwald. By a long series of tests it has been proved that even insignificant deviations in the stratifications of these very similar quartz formations can considerably influence the strength of mortars. It has further been shown that relatively small deviations in the size of the grain can affect the strength of mortars.

Although it has been attempted both in the Prussian Standards, as well as in the resolutions of the conferences, to fix accurately the size of the grains in the sand by regulating the width of the meshes in the wire sieves to be employed, it has been settled that perfectly similar and similar-remaining sieves are a practical impossibility, and that in the employment of woven-wire sieves in the preparation of normal sand certain deviations are always inevitable.

The sub-committee of the International Association has already in its proposals taken these experiences into account. It has pointed out that quartz sands of a certain size of grain can give very different strengths if these sands come from different places, even if in their surface condition and in their combination they show only small differences. It declares the desirability of agreeing as to a fixed international normal sand and of employing in sieving it tin sieves with circular holes. The Association of German Portland Cement Manufacturers is already joined with the Testing Institute in Charlottenburg for this purpose.

The properties of the Prussian normal sand (which is also used in the other States of the German Confederation) produced by this process and brought into commerce, are fixed by the following resolutions of this year: "Until some other sand shall be selected, the normal sand shall be obtained by washing and sifting tertiary quartz sand from a certain pit, Hammerthal, in Freienwald. The normal sand should contain at least 99 per cent. Si O$_2$ and not more than 1 per cent. of mud. The grains of sand should fall through circular holes of 1.35 millimeter, and remain on circular holes of 0.775 millimeter. The wires of the sieves should be 25 millimeters thick. [So printed in original paper, but probably wrong.] In controlling the sand with these sieves there should not be more than 2 per cent. too coarse and 10 per cent. too fine. The sand shall be controlled by the Royal Testing Institute at Charlottenburg and delivered in sacks closed with the Institute's lead."

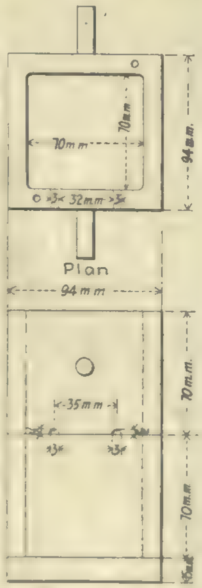
If, in accordance with this process, but with the application of three sieves somewhat similar or quite like those which are used in France (sieves with round holes of 2, 1.5 and 0.5 millimeter diameter) a normal sand consisting of mixed grains could be produced in Freienwald, the productiveness of the enormous sand formations in Freienwald would be considerably increased, and then such quantities of normal sand could be obtained that it would also be possible to supply the international market. That would signify an important step forward toward an international accord concerning the methods of testing cements.

(c) Mixing Methods.—According to the prescriptions of the Prussian Standards, the mixing of the cement and sand shall take place in a dish, at first dry, and then with an addition of 10 per cent. water. The whole mass shall be thoroughly stirred for five minutes. Experience has taught that, for fine cements, when ground so fine as is now usual in Germany, 10 per cent. water is almost always too much. The cement mortar stirred with too much water, after even a few blows gives off a considerable quantity of water and cement paste, and so becomes weak beyond control, and cannot thicken completely. We are therefore of necessity compelled to deviate from the Standard regulations, and to employ the amount of water required by the cement in any particular case. Since the quantity of water added essentially affects the strength in such a manner that cement mortars with a smaller addition of water usually afford higher degrees of strength, the want of a uniform method of determining the quantity of water to be added has led to great inconveniences, and frequently prevented the agreement of the results of testing the strength in the same cement at different places. In addition to this, in course of time, quite different methods of mixing had been adopted in the different testing places. While in the Testing Institute at Charlottenburg the wet mixing is carried on by means of a trowel, the material being on a stone slab, the Testing Institute at Stuttgart employs a peculiarly-formed pot with a heavy spade for the mixing, and at other places there is used a heavy iron spoon, a pestle and mortar.

Numerous experiments have demonstrated that the manner of preparing the mortar, and the duration of the mixing, influence very considerably the degree of strength. A suitable mechanical process of mixing was therefore sought for which should exclude the influence of handwork. For some years an apparatus devised by Director Steinbrück in Karlstadt a. M., and constructed in the machine factory of A. Schmelzer in Madgeburg, has been used for this purpose. The apparatus has been, in the course of time, rendered so complete that it can be recommended as a suitable mixing apparatus for normal mortars. The last series of experiments have proved that the probable error in the case of tests with material mixed mechanically is smaller than the probable error in the case of mixing by hand in different places. The Testing Institutes of Stuttgart and Charlottenburg therefore united in February, 1901, with the Association of German Portland Cement Manufacturers, in order to come to an agreement as to a new mixing process, and at the same time a new method for determining the quantity of water to be added, and to carry out these methods for the future with uniformity. For this purpose, after exhaustive testing, the following resolution has been adopted and sent to the Prussian ministers, with the request that it shall be recognized as an addition to the Prussian Standards:

Process of Mixing and Determination of the Quantity of Water to be used for Mortar in the Standard Tests.—"In the case of cube-shaped specimens containing cement and normal sand in the proportion of one to three (weight), of which it is desired to determine the resistance, the quantity of water to be added is determined as follows:

"1. Five hundred grams cement and 1,500 grams normal sand are mixed for one-half minute in a dry condition by means of a light spoon in a dish, and then again mixed for one-half minute with an addition of water. This is then uniformly distributed in Steinbrüch-Schmelzer's mixing apparatus and worked up during twenty revolutions of the basin.



"2. Eight hundred and sixty grams of this mortar are put into the molds. The cases for the cubes must be similar to those employed in the Charlottenburg Testing Institute. On the under side of the case are two grooves, as shown in the accompanying sketch.

"3. The mortar is then worked up with 160 grams (8 per cent.) and 200 grams (10 per cent.) of water. Which of these two quantities of water is nearer to the proper quantity to be employed can be ascertained from the behavior of the specimens when being beaten in, and the experiments continued with different quantities of water accordingly. The quantity of water has been properly chosen when between the ninetieth and the one hundredth blow, the cement paste begins to flow from one of the two grooves. The average of three specimens with the same addition of water is to be taken as the standard. The specimens to be submitted to the resistance test are prepared with the quantity of water thus ascertained."

2. Ram Method. (a) Normal mortars.—In the Prussian standards the ram method for preparing the specimens of cement to be tested is, in the first place, supposed to be carried out by beating with the hand, but the preparation may also be accomplished mechanically by means of the hammering apparatus of Dr. Böhme, which carries a hammer of 2 kilos, and applies 150 blows on each specimen. After describing these two processes, the Standards add the following:

"If the given prescriptions are accurately followed, handwork and mechanical preparation give results which are sufficiently in accord. In doubtful cases, however, the mechanical preparation is to be adopted as a standard."

Experience has shown that it is not easy to arrange that the time required for the work, if done by hand, shall coincide with the time required for the mechanical preparation, and as the mechanical preparation is to be the standard one, in cases of doubt it has been agreed to prefer the mechanical process, at least so far as the mortars tested are those of the 1:3 character. Although formerly in South Germany a different kind of ram apparatus was used for these purposes, Böhme's hammer apparatus, first used in the Prussian Testing Institute for Building Materials, has also come into general application there in recent times.

Messrs. von Tetmajer, of Zurich, and Greil, of Vienna, have recommended the employment of Tetmajer's ram, which, it is said, allows of the production of specimens of like thickness for tensile and compressive tests by applying two falling weights of different weight. With Böhme's apparatus, specimens intended for tensile and compressive tests are rammed uniformly with 150 blows of the 2-kilo hammer, and bodies containing different weights in the unity of volume are thus produced. The greater mass of the cube does not become compressed to such an extent by the same number of blows and the same falling weight as the smaller mass in the specimens to be subjected to tensile forces, but the differences are not considerable, and the opinion is held that they can be altogether neglected, as all specimens are prepared under the same conditions, and the difference in the weight per unit of volume between specimens used in tension experiments and those used in compressive tests will be in all cases almost exactly the same. The hammer apparatus has the advantage of being simpler and easier to handle.

(b) Neat cement.—The following are the regulations of the Prussian Standards with regard to the preparation of specimens to be tested made of neat cement: "At the same time it is advisable to determine the strength of the neat cement. The testing of cement without sand is to be recommended in cases where a comparison of Portland cements with mixed cements and other hydraulic mortars is to be made, because by testing the resistance of the cement itself the superior qualities wanting in the other hydraulic mortars become more easily apparent than in the case of the test with sand."

The testing of the strength of neat cement has, to a great extent, lost its value, because cements are continually being ground finer, but still for particular purposes it cannot well be dispensed with. In order to obtain reliable results, the rigid observance of the prescription for preparation of the specimens is an essential condition.

According to the prescriptions of the Prussian Standards, 1,000 grams of cement should be stirred for five minutes (best by means of a pestle) with 200 cubic centimeters of water, then put into the molds and beaten by means of an iron spade of a surface of 5 or 8 square centimeters, a length of 335 centimeters, and about 250 grams weight, at first gently, and from the sides, and then gradually more vigorously, until the cement becomes elastic and water is given off on its upper surface. The contents of the molds should not project above the edges, and the cement must be scraped and its surface smoothed. The cement should not be taken out of the mold before it has become completely hardened. It is then preserved, as in the case of the 1 : 3 specimens to be tested, in a cupboard containing moist air.

In the case of fine or rapidly-binding cements the choice of a considerable addition of water is assumed. In this again lies the difficulty of a uniform treatment in different places. Experience has taught that the quantity of water prescribed in the Standards is, in most cases, too great for tests with neat cement, so that with this addition of water the desired small degree of humidity (humidity of the earth) of the beaten-in mortar is not attained. But on the other hand, the addition of water must not be too small, because otherwise cements with a great hardening capacity become so strongly set that the resistance to tension after a certain time no longer increases, but diminishes. It is, therefore, also necessary in these tests to determine by preliminary experiments the quantity of water required for every cement before it is beaten into the molds. The discovery of a scientific and certain method for determining the amount of water to be employed in tests with neat cement is very desirable. The method employed in other countries of filling the molds with a cement paste in a mortar-like state suffers from still greater defects.

3. Injurious Influences on the Resistance of the Specimens to be Tested. (a) Testing Apparatus.—Under the supposition that the apparatus employed in the cement test are correct, that is to say, that their defects are known and taken into account, it is indifferent what apparatus are applied for testing the resistance of the specimens. But since particular defects which are not always taken into account are connected with every apparatus and machine, it is advisable that an agreement should be arrived at as to a particular type for carrying out work of the same nature.

The Prussian Standards contain in general the prescription that in the normal tests for cement the apparatus employed in the Royal Testing Institute for Building Materials (now Royal Mechanical and Technical Testing Institute at Charlottenburg) shall be used.

(b) Forms of Specimens Tested.—With regard to the form of the specimens, the Prussian Standards ordain: "The tension tests are to be conducted with specimens having a section of 3 square centimeters at the surface of rupture; the compression tests are to be conducted with cubes one side of which shall contain 50 square centimeters."

The form of the German specimens employed in tension, which approximates to the form of the figure 8, are supposed to be so well known that no more need be said about them. The same form is in use in France, in Austria-Hungary, in Russia and in Scandinavia. It is usual to leave the specimens for tension experiments in the molds for about half an hour, and the specimens for compression about twenty hours, and to keep them during this time, and until after the lapse of twenty-four hours, protected from drying in a covered tin cupboard.

(c) Estimation of the Results of Tension and

Compression Tests.—In the Standards special attention is directed to the following:

"Although the relation of the resistance to compressive and tensile forces in hydraulic mortars and cements is different, it is often the case that only the resistance to tension is taken as a standard of measurement for different hydraulic mortars. This leads, however, to an incorrect estimation of the latter. Since, moreover, mortars employed in practice are principally subjected to compressing forces, the standard test for resistance can be only the compression test.

"The standard test for strength is the compression test after twenty-eight days, because in a shorter period, if different cements are compared, the binding force is not sufficiently perceptible. For instance, the results with regard to the resistance of different cements in the case of a twenty-eight-day test can be uniform, whereas in a test after seven days essential differences can appear.

"As a test for goods delivered the tension test after twenty-eight days is employed. If it is desirable, however, to apply the test already after seven days, this can be done by a preliminary test, if the relation of the resistance to tension after seven days to that after twenty-eight days for the cement under consideration has already been determined. This preliminary test can also be carried out with neat cements if the relation of the resistance of the neat cement to that after twenty-eight days with three parts sand has been fixed.

"It is advisable, whenever this can possibly be done, to extend the test for strength on specimens prepared for this purpose over a longer period, in order to ascertain also the behavior of different cements when the process of hardening is of longer duration."

Although, according to this, the compression test is fixed as the standard test for strength, it has become customary in practice in the course of time to judge Portland cements almost exclusively by the tension test, which can be accomplished with less expensive apparatus and in shorter time, and with the employment of less material and space. This custom has produced the effect that the German cement factories, in offering their goods, have guaranteed for the most part a fixed degree of resistance to tension in the 1:3 mortar, and a further effect is that there has been a tendency to seek for a higher resistance to tension, a tendency which brings with it certain dangers for the durability of the cements.

In the course of this year's Proceedings of the Association of German Portland Cement Manufacturers it has, therefore, been rightly resolved to effect a change in this matter; it has been agreed to give again to the compression test the first place by introducing the mechanical process, and only afterward to take into consideration the tension test. This decision has, in addition to the practical consideration that in by far the majority of cases the mortar used in practice is subjected to compressive forces, another motive, viz., the circumstance that the carrying out of the compression tests affords more reliable results. The deviation of the individual values from the average values are, in tension tests, considerably greater than in compression tests.

Detailed information as to the degree of safety and the evaluation of experiments in accordance with the Standards relating to strength, is given in a work by Martens, in which he has, by means of a great number of experiments, carried out at different places, calculated the probable errors for tension and compression tests. (Minutes of the proceedings of the Association of German Portland Cement Manufacturers, 1900, p. 49.) According to his experiments, the probable error varies in tension experiments on an average between ± 3 per cent. and ± 5 per cent. (probable errors below ± 2 per cent. and above ± 7 per cent. are rare) and in compression experiments the error, on the other hand, varies only from ± 1 per cent. to ± 3 per cent.

Although the Standards recognize as decisive only the 28-day test, it has become usual in a complete test also to carry out the test for resistance to tension and compression after 7 days.

(d) Testing of the Specimens.—The Standards prescribe as follows with regard to the treatment of the specimen during the process of testing:

"All specimens are tested immediately after being taken from the water. As the duration of the tearing operation influences the results in extension tests, the addition to the loading during the tearing shall amount to 100 grs. per second. The average of 10 tension experiments shall be regarded as a standard resistance to tension.

"In compression tests, in order to obtain uniform results the pressure shall always be applied to two lateral surfaces of the cube and not to the under surface and the prepared upper surface. The average result of 10 tests shall be taken as a standard resistance to compression."

During the hardening of the specimen different influences can come into operation, and these must be taken into consideration. They arise from a renewing of the water, from possible concussions, from possibility of the specimens becoming dry under the influence of heat or draft in the first 24 hours, and from the temperature of the air and water.

Perfectly uniform treatment of the specimens is therefore an essential condition if consistent results are to be obtained in testing.

With regard to the number of tests of each series, it has in Germany become a fixed general rule to test 10 specimens and to form the average from all these, without excluding the tests which show considerable discrepancies. In other places there is an inclination to exclude the extreme values in the calculation of the average value. In the Testing Institute at Charlottenburg, however, values which show a strong deviation are only excluded when a defect can be proved to exist in the specimen or in the manner of conducting the experiment. The employment of two lateral surfaces of the cube as surfaces to be subjected to compression is to be recommended on account of these surfaces being more parallel to each other and smoother than the upper and lower surfaces.

4. Figures relating to Portland Cement.—According to the Standards:

"Slow-setting Portland cement should in the specimen, with three parts, by weight, of normal sand to one part, by weight, of cement, after a hardening for 28 days—one day in the air and 27 days in the water—have a minimum resistance to tension of 16 kilos per square centimeter. The resistance to compression should amount to at least 160 kilos per square centimeter.

"In quick-setting Portland cements the strength after 28 days is in general smaller than that given above. Hence, in giving figures for strength, the time of setting should always be supplied."

Although the figures here given are higher than those of all other countries, some of which employ still more suitable normal sand, they are for the present state of German cement manufacturing still too low; however, a change in these figures has hitherto not been considered desirable because a complete revision of the Standards is projected and so possibly another normal sand of mixed grains will be introduced. In this case the limiting values for the required strength would be changed.

Ventilation of an Office Building in Hartford.

One of the few office buildings in which means have been taken to effect positive ventilation for the many rooms in it is being completed in Hartford, Conn., for the Connecticut Mutual Life Insurance Company. Every office, in general, is warmed by direct-indirect radiators, and ventilation is obtained by the supply of fresh air thus admitted, with the additional provision of paths of escape through ducts under the inducing action of exhaust fans. In the main rooms, however, the direct-indirect radiation is replaced by a plenum system with fresh-air fans, which, in one case, is an auxiliary to direct radiators, and in the other the entire source of heat as well as of ventilation. The building has its own mechanical plant, including three tubular boilers, four electric generating sets, a hydraulic elevator equipment and the ventilating apparatus, the last comprising an extensive system of flues and ducts, both for fresh air and for foul air, steam heating surface for tempering and for heating the air, and 5 fans and 2 blowers. Steam for supplying the heating surface is circulated under the vacuum return system. The interesting plumbing work in the building was described in The Engineering Record of October 5.

The building is an eight-story structure, consisting in plan of three parts, a main portion 140 feet long and 45 feet wide, and a wing from each end of the main portion, 53 feet wide and 59 feet long, giving the whole structure an extreme depth of 104 feet. The typical floor encloses a court at the rear, 59 x 28 feet in size, and has a corridor serving the rooms in the front of the building, running in either direction from the elevators to a central corridor in each wing. The third floor plan, which may be taken to show the typical arrangement, is given in an accompanying illustration. Three passenger elevators rise through the building. At one end of the row of elevators is located a public toilet room, alongside which rise two vent flues; and at the other end, on opposite sides of the wing corridor, are two other vent flues besides the smoke flue; all the vent shafts are connected independently in the attic to four fans by which the air is exhausted into the atmosphere. A basement plan, herewith, shows the general arrangement of the mechanical plant; it was impossible to indicate the many ducts of the ventilating system also, but separate drawings serve to give the points of chief interest in that connection.

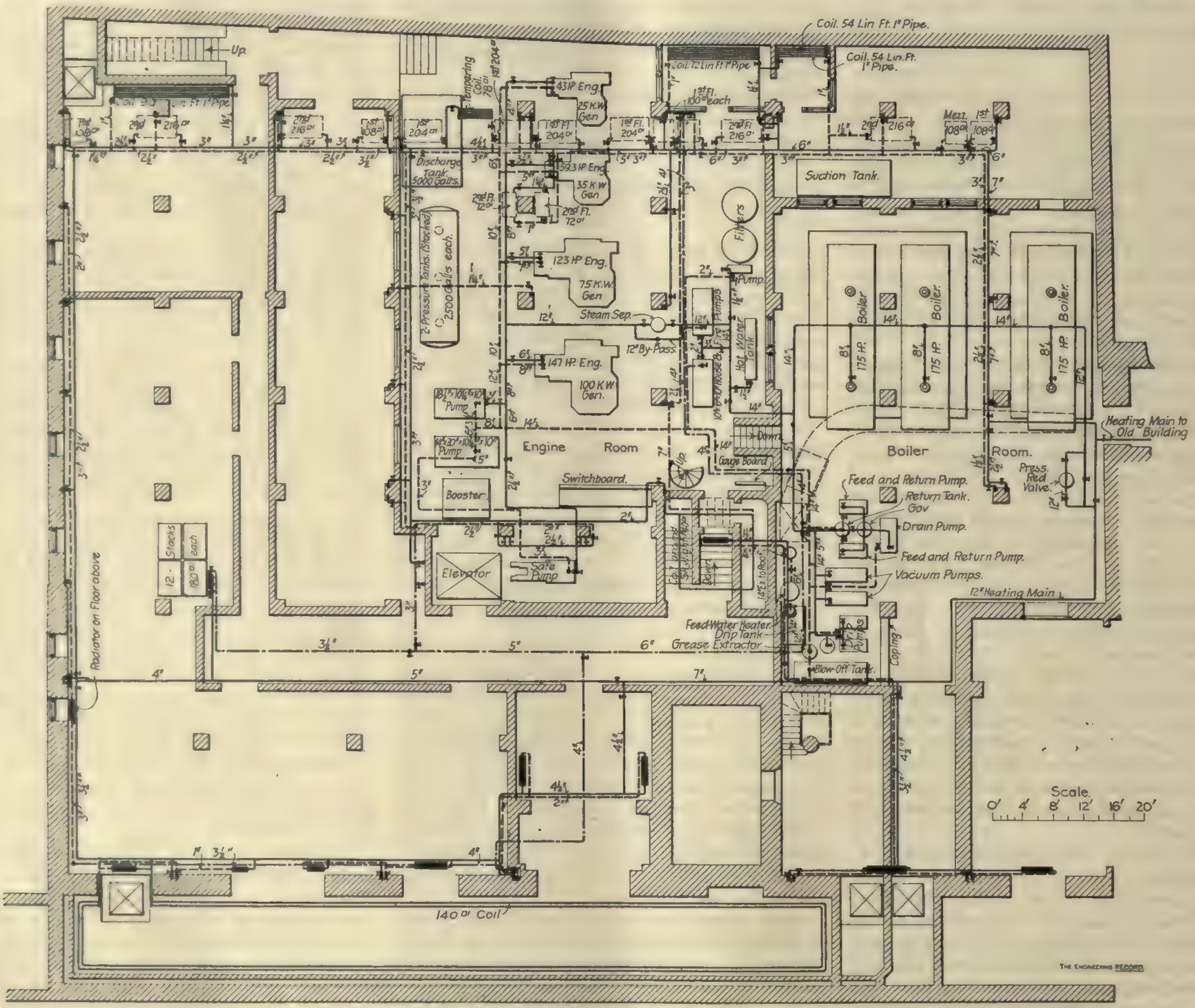
The warming of the building is accomplished by practically four independent systems. For the greater part, direct-indirect radiators are used, as stated, each radiator directly opposite an air inlet and each room provided with an exhaust air register. The main floors of the building, however, the first and second, are warmed in connection with fresh-air fans as well as exhaust fans and are served by two systems. The front parts of these two floors are heated by direct radiation and ventilated separately by a tempered supply of fresh air blown in from a blower-heater unit in the basement; the back parts of these two floors, together with rooms for directors of the company in a mezzanine floor interposed between first and second floors, are warmed and ventilated entirely by a supply of fresh air which is delivered from an independent fan in the basement. In connection with this fan is a tempering coil, and in addition, at the foot of the various flues by which the air is carried to the different rooms included in this system, are auxiliary or supplementary heating stacks, by means of which the temperature of the delivered air may be controlled independently to suit the local conditions. In the fourth system may be classed all rooms provided with direct radiation only, as, for example, the various toilet rooms, which, however, have exhaust registers. Besides these four systems a ventilating plant has been installed in the basement to maintain as low a temperature there as possible. This apparatus comprises a blower which delivers the air without warming, by means of ducts which discharge into the engine and boiler rooms.

The air supply apparatus for the front parts of the main floors mentioned is not shown on the basement plan, but in a smaller drawing is given the arrangement of air inlet, air filter, blower and tempering surface, from which it will be easy to follow the scheme adopted. As shown in this drawing, the blower-tempering unit, as it may conveniently be called, occupies a remarkably small amount of floor space. Two adjacent windows are utilized to admit the fresh air; the air is passed to the fan through a filter or screen of an unusual type in a galvanized-iron enclosure, and is then discharged into a galvanized-iron chamber in which are located indirect radiator stacks. The blower is of the centrifugal type, of the Sturtevant make, as are the other blowers and fans in the building. It was furnished under a specification that it would have a capacity of 16,850 cubic feet per minute against a pressure of 1 ounce and at a speed of 470 revolutions per minute. It is driven from a motor of about 6.6 horse-power capacity.

The area of each duct connecting inlet to screen chamber is 4 square feet, which makes the maximum velocity through them about 2,100 feet per minute. An unusual feature in this connection is a clean-out door in the bottom of each duct, made of wired glass, so that light may be admitted into the basement through the inlet openings. The screen, to filter out dust from the air, depends for its operation on the greater inertia of the dust particles over that of the air, similar to the operation of many steam separators. The inflowing air is given a zig-zag path to the blower without greater friction than that offered by passage along the surfaces of the screen, which is, therefore, calculated to require less power in blower propulsion than the type of screen in which the air is drawn directly through the screening material. The present filter is designed to arrest the dust particles, which either stick to the surfaces or fall to the bottom, while the air takes the zig-zag course. The screen consists of 18 panels of muslin stretched on wooden frames, each panel set in grooves formed by means of cleats fastened on floor and ceiling of air chamber.

The heating stacks for tempering the air are arranged in four groups, each in three banks, making 12 stacks altogether, each group presenting 612 square feet of heating surface, 2,448 square feet of heating surface all told. The position of these stacks, which will serve to indicate the location of the fan apparatus, is shown in the basement plan, being in line with the elevator wells and near the left side of the drawing. A detail drawing of the steam connections to these stacks is given in a separate drawing. A 4-inch low-pressure pipe feeds them, this branching into two 3-inch supplies, each of which is subdivided into two 2½-inch pipes. Each 2½-inch pipe feeds a tier of three stacks and is fitted with a valve, so that the tempering surface is thus divisible into four equal parts, one occupying each quarter of the tempering chamber. Each stack is separately drained to a thermostatic valve of the Webster vacuum system, which has been installed; and the greater condensation that occurs in the bottom stacks, which are first encountered by the inblown cold air, is indicated in the drawing by the larger valves provided. The whole tempering surface is mounted on a framework composed of piping.

The blower discharges into the space underneath the stacks and the air may pass into the ducts beyond the chamber through the usually provided by-pass around the heating surface. Four ducts, all of equivalent cross-section, are carried from the chamber, aggregating in total area 10 square feet. This is 25 per cent. greater than the area of the cold-air ducts, so that allowing for a 10 per cent. increase in volume due to warming, the velocity through the tempered air ducts is 0.88 that through the cold-air ducts Two of the ducts lead to two flues rising nearby as shown in the cut of the apparatus, and the other pair run at a corresponding location on the other side of the building. One in each case terminates at the first-story ceiling and the other at the second-story ceiling; they deliver into ducts carried over a suspended ceiling in each of these stories in the front part of the



Plan of Basement, Ducts at Ceiling not shown.

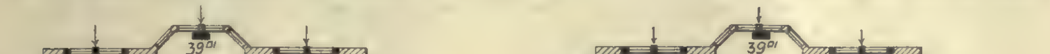
PLANT OF THE CONNECTICUT MUTUAL LIFE INSURANCE BUILDING, HARTFORD.

ERNEST FLAGG AND GEORGE M. BARTLETT, ARCHITECTS; O. F. SEMSCH, ENGINEER; CLEGHORN CO., HEATING CONTRACTOR.

building. This arrangement is indicated in an accompanying drawing of the ducts in the suspended ceiling of the front part of the first story. Each of the two flues, which is 2.5 square feet in cross-section, is joined into a duct of 3 square feet cross-section. These two supply seven registers in the suspended ceiling of the first story, the registers aggregating in gross area 17.5 square feet, or a net area of about 12.5 square feet, which, compared with 5 square feet area of main supply flues, makes the velocity issuing through the registers 5 ÷ 12.5 = 0.4 the velocity through the flues, which is 0.4 × 0.88 = 0.35, the velocity through the cold-air ducts. The registers are located in elaborate mouldings which drop about 2 feet below the ceiling line, marking panels in the ceiling.

The vent registers for these stories are located in the floors and the ducts taking air from the second story rooms of the front part of the building occupy the space above the suspended ceiling of the first story. The ducts connect with two vent flues alongside the fresh-air flues. The space provided by the suspended ceiling is about 12 inches deep, and the fresh air and vent ducts, where they cross one another, are 6 inches in height, the fresh air above the exhaust ducts.

The warming system for the two main floors in the rear of the building is indicated, so far as the auxiliary heating surface is concerned, on the basement plan. The apparatus consists of a fan and tempering unit supported overhead in the rear of the engine room, and two main ducts passing in opposite directions from the fan to the various auxiliary heating stacks. There are altogether in the auxiliary stacks 2,328 square feet of heating surface in 14 groups, all placed in a line extending across the rear of the basement.

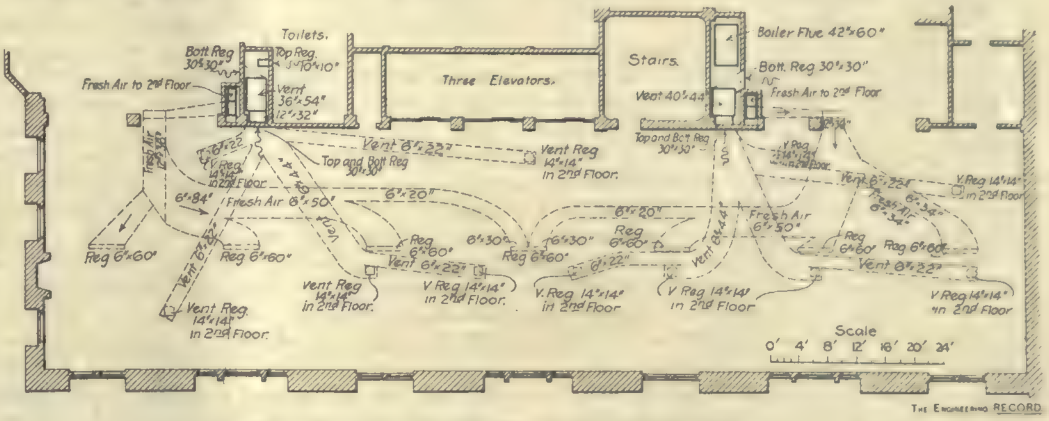


Plan of Third Floor, Ducts over Corridor Ceilings not shown.

The design of the blast portion of this system is quite interesting, and a separate drawing of it is given in the accompanying cuts. Air is received through a copper inlet tower, as shown, the top of which is 15 feet above the ground-floor level. Each air inlet has a 2 x 2.5-foot opening, making the gross area of opening for the three inlets 15 square feet. The tower carries the air to a propeller fan, mounted horizontally. The desirability of obtaining as much head as possible in the engine room made it necessary to crowd the duct rather close to the fan in the vertical direction. As it may be desired to utilize the whole system on a natural circulation and provide a path for the air around the fan, when not in operation, to reduce the friction otherwise offered if the air were drawn through it, a by-pass was built around the fan. This was obtained by expansion in the horizontal direction, as indicated in the drawing, which, however, shows the by-pass open with the fan; this, of course, is not the case, the fan having an enclosed discharge to the tempering coil and the by-pass to be opened up when the fan is out of use. The fan is 42 inches in diameter and is driven by a 3-horse-power motor to be run at speeds of 300, 400, 450 and 500 revolutions per minute, under which conditions it is designed to deliver from 16,300 to 27,200 cubic feet per minute under free circulation, according to the speed, and at least one-half these amounts when connected to the ducts.

Immediately beyond the fan is located a tempering coil of 78 square feet of heating surface, placed high enough in the duct to allow for a by-pass underneath it. The rooms supplied by this fan, as well as those of the system connected on the system previously described, are controlled by thermostats, the thermostats in the present instance operating dampers to allow the proper proportion of air to pass through and around the stacks at the bases of the various flues, and those on the system for the main front rooms controlling the steam valves of the direct radiators.

The direct-indirect radiators throughout the building are of the box-base pattern. Fresh air is conveyed to them through 2 x 4-inch ducts, made of No. 20 galvanized iron. Each opening on the outside has a solid bronze register, 4 x 6.5 inches in size, with 8 square inches of free opening. In some cases, particularly in bay windows where a large size of direct-indirect radiator was required, a direct radiator was installed. The base-board was extended outward a short distance behind it, and the space between base-board and wall line utilized to contain a long galvanized-iron box into which the fresh-air inlet was connected. The air leaves this box through a series of ⅝-inch holes spaced on 1¼-inch centers in the top of the box, the outflow of the air being spread across the entire rear of the radiator.



Suspended Ceiling over Front Part of First Story.

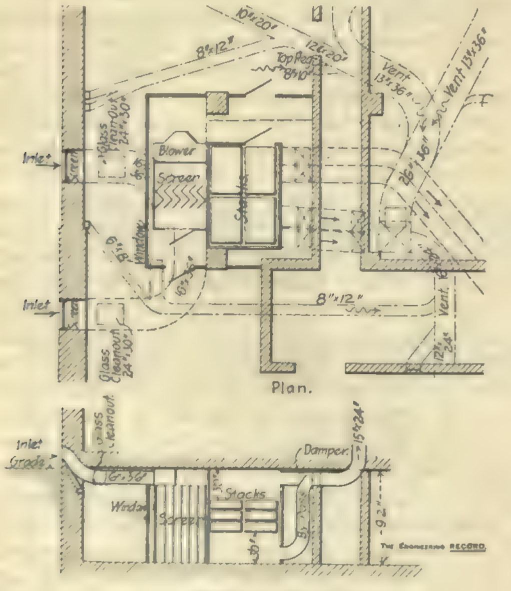
The radiation is connected on a two-pipe system supplied from heating mains shown in the plan of the basement, the bottoms of the supply risers being drained into the return mains through a thermostatic valve, the returns being under a vacuum of the Webster system, likewise the return risers, to which the radiators are connected through thermostatic valves on the radiators. All told there are 22 supply risers, with the return pipes in most cases dropping alongside the supply risers, but a sufficient number carried separately to require 34 pipe chases.

The boiler and engine-room ventilating apparatus, of which mention was made, consists of a blower, which receives air down an inlet tower similar to the one described, and discharges through a circular duct bifurcating into two smaller ones, one to the boiler room and the other to the engine room. The blower is located in the vault in the rear of the boilers, close to the air inlet. It is a centrifugal blower of the full housing type, driven by an electric motor capable of developing 6.6 horse-power, and calculated to give a discharge of 16,850 cubic feet of air against 1 ounce pressure when running 470 turns per minute. The air is discharged through a 38-inch duct delivering to a 24-inch duct for the boilers and a 26-inch duct for the engine room. The former carries air to four 12-inch outlets, which are short branches pointed in the direction desired, and discharging directly into the room, and the latter carries air to five 12-inch outlets. The two main ducts near their point of separation have each a damper to regulate the flow of air through them, and each outlet is also provided with a damper. These ducts are suspended from the ceiling so as to leave 1 foot between them and the ceiling, to allow for the passage of pipes.

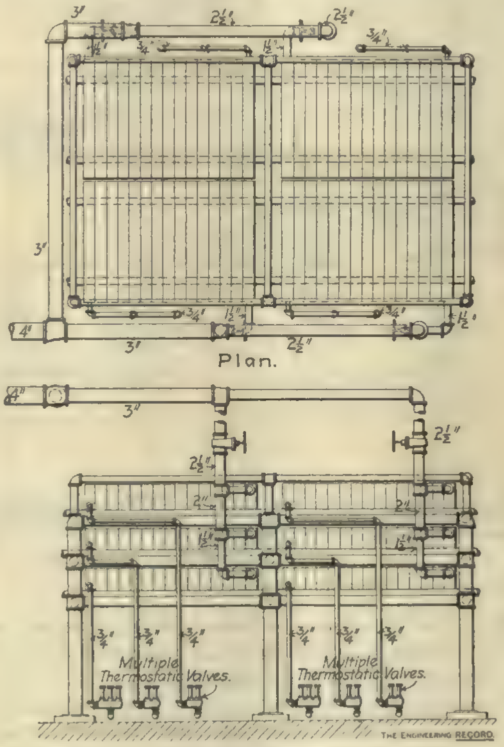
The mechanical system of exhausting the more or less vitiated air comprises four fans in the attic of the building drawing air up independent flues, the location of which has been indicated on the third-floor plan. Two of the fans are 60 inches in diameter, the third, 42 inches, and the fourth, 24 inches in diameter. The two largest take the air from the offices by means of ducts above suspended ceilings of the corridors, the offices having exhaust registers in the inside walls opening into flues which drop to the duct above the corridor ceiling of the story below, the ducts emptying into the vertical main flue. The fans are driven from 7-horse-power motors to run at speeds of 200 to 350 revolutions per minute and discharge into the atmosphere from 31,750 to 55,560 cubic feet of air per minute, according to the speed. The 42-inch fan is driven by a 3-horse-power motor to run at 300 to 500 turns per minute and deliver 16,335 to 27,225 cubic feet per minute. The 24-inch fan is run from a ½-horse-power motor; its speed limits are 400 to 700 turns per minute; its delivery, 4,060 to 7,100 cubic feet per minute. The discharge outlets of the fans are copper elbows of the full diameter of the fan, capped with ventilator hoods.

Three boilers of the horizontal return-tubular type, manufactured by the Bigelow Company, of New Haven, from the designs of the Hartford Steam Boiler Inspection & Insurance Company, furnish the steam. Each consists of a 72-inch shell, 21 feet 6 inches long, with 18 inches overhang in front and 92 3½-inch tubes 20 feet long. Each boiler has a capacity of 175 horse-power, and they are connected to a 42 x 60-inch smoke stack 129 feet high. Two boilers are in one setting, as indicated in the basement plan, while the third is independent, as required to escape columns. They feed a 14-inch steam main extending across the boilers. This at one end feeds the various pumps and the steam engines, passing into the engine room through a 12-inch Stratton steam separator, and at the other end feeds into the heating system, this connection being made in the usual way through a pressure-reducing valve provided with by-pass.

For the electric generating equipment four units, of 30, 35, 75 and 100 kilowatts capacity, respectively, have been installed, the smallest having been in service a short time in the old building. These being of different capacities, it is thus possible to make fifteen different combinations, giving 15 different outputs at the economical ratings of the machines. This series extends from 30 kilowatts to 240 kilowatts, a total range of 210 kilowatts, allowing for a new combination for about every 14 kilowatts change in load. Provided such changes were made on every such change of load, it will thus be seen that the generating plant can be worked constantly at practically the rated loads of the various machines in use, except, of course, for much of an overload over the full capacity of the four units, that is, 240 kilowatts.



GENERAL ARRANGEMENT.



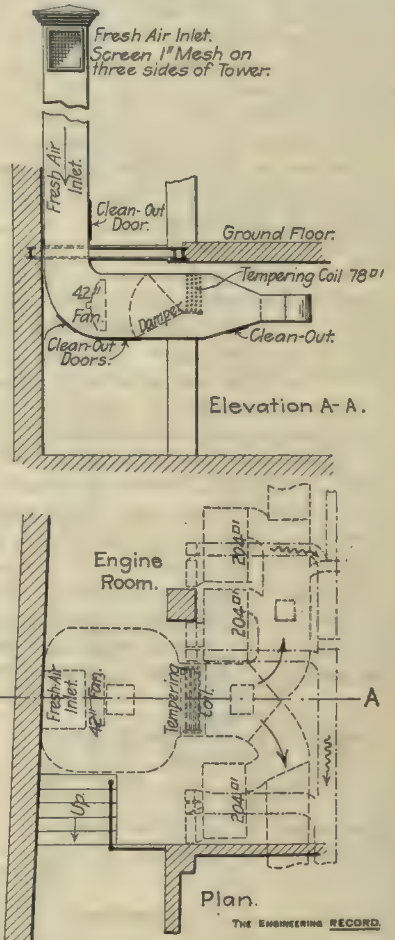
THE TEMPERING STACKS.

Air Tempering Apparatus for the Main Floors Front.

Three of the units are operated by Ames engines, 16 x 4, 14 x 14 and 11 x 10 inches in cylinder dimensions, and one Watertown engine, 10 x 10 inches; the dynamos are all of the General Electric manufacture. Besides the four engines there is in the engine room two pumps for the elevator system, which is of the Otis hydraulic type, and a high-pressure pump for safe lifting, located underneath the elevator wells. The branch steam supply pipe from the steam main to each machine has two valves in it, one near the main and the other near the engine.

The pumping plant, in addition to the three elevator pumps and two pumps for house and fire purposes, includes the following pumps in the boiler room: two feed pumps, 6 x 4 x 6 inches in cylinder dimensions, cross-connected and controlled by a pump governor to handle the returns from the heating system and feed the boilers; two vacuum pumps used in connection with the vacuum return system of circulating the steam through the heating apparatus; two pumps of the same size as the feed pumps, likewise cross-connected and controlled by a pump governor, one to drain the blow-off tank and the other to drain the drip tank, the contents of both of which are discharged into the sewer after cooling; and one 7½ x 5 x 6-inch duplex pump, also operated under the control of a pump governor, to drain low portions of the basement. The required cooling of the blow-off and drip tanks is effected, as explained in the article on the plumbing in the building, already referred to, by passing such additional fresh cold water as may be required for the boilers through the cooling coils submerged in the tanks. The two tanks are 36 inches in diameter, constructed of ⅜ and ½-inch iron, and the blow-off tank is 10 feet long and the drip tank 5 feet. As a relay to the drain pumps, Nathan No. 4 ejectors were installed.

The exhaust steam from the engines and pumps is collected into a 14-inch main which passes to a point near the vacuum return pumps, where it connects with a 14-inch exhaust riser extending through the building alongside the smoke flue. Connected into the bottom of the riser is a 525-horse-power feed-water heater of the water-tube type, the bottom part of the riser acting as the by-pass around the heater, both connections to which are taken from the riser. Above these connections, near the ceiling of the basement, is located a back-pressure valve in the exhaust riser, to allow in the usual way for the use of exhaust steam in the heating system without causing too great back-pressure on the engines when the supply of exhaust is comparatively great. At the base of the riser, the exhaust main continues 12 inches in size to a point near the blow-off tank, where it rises from the trench and connects into the heating main at the ceiling, a grease extractor being placed in the vertical section of the exhaust pipe.



Apparatus for Main Floors Rear.

The heating main passes in opposite directions from this point, one main 7 inches in size serving the building described, and the other 12 inches in size running to the low-pressure live-steam connection near the boilers, beyond which it subdivides into a 7-inch main for the old building adjacent, which is supplied from the mechanical plant in the new building, and a 7-inch main for the new building. The two 7-inch heating mains are thus started from opposite ends of a 12-inch section of low-pressure piping extending from the exhaust connection to the live-steam connection, and they pass in opposite directions around the basement, joining at their extreme ends and forming a complete loop or ring around the basement. The smallest size of main is 2½ inches. The returns are carried in trenches where the basement is crossed to reach the vacuum pumps. These pumps discharge into a vertical receiving tank 18 inches in diameter and 4 feet high, of ⅜-inch iron shell and ½-inch iron heads. This is provided with a 1½-inch vent to the atmosphere, and the governor controlling the feed pumps is located to maintain the water level at about its middle, which is about 5 feet above the level of the pump base.

Messrs. Ernest Flagg and George M. Bartlett, of New York, were the architects for the building, and the work described was designed by Mr. O. F. Semsch, their engineer. Mr. W. A. Payne was the architects' superintendent. The engines, fans and all electrical work were furnished by Mr. Charles N. Knox, of Hartford, and the Cleghorn Company, of Boston, were the contractors for the heating work.

Trade Publications.

The calendar season has opened with some excellent examples of engraving and color printing. The Continental Fire Insurance Co. has issued a wall calendar having a color reproduction of F. C. Yohn's picture of the battle of Bennington. The wall calendar of the Charles Millar & Son Co., Utica, has a large engraving of "black diamonds," in the form of four negro pit boys on a mule. The Ashton Valve Co., 271 Franklin Street, Boston, has always had one of the most attractive calendars of the season, and that for 1902 is no exception to the past record. Incidentally the company will please accept The Engineering Record's compliments on its high-grade goods always selected to decorate these calendars.

The electric hoists and automatic railways in a coal depot on the water front of New York are described in a new circular issued by the C. W. Hunt Co., Allen Street, West New Brighton, N. Y. Another circular just issued by the same company illustrates its various types of electric locomotives for industrial plants. These receive current from a storage battery carried on the body of the car, and the motors are similarly placed, out of the way of dust and mud, rather than on the trucks in the usual position. The standard-size locomotive weighs 5 tons, is 13 feet long and 52 inches wide, and runs freely on curves of 10-foot radius.

The Federal water filter is described briefly in a folder issued by W. M. Deutsch, 141 Broadway, New York. Both vertical and horizontal types of pressure filters, with capacities up to 500,000 gallons a day are listed, and gravity types from 500,000 to 1,500,000 gallons. The smaller pressure filters are designed particularly for use in office buildings, laundries and private houses.

A catalogue of steam specialties, including several types of float and expansion steam traps, strainers, exhaust heads, relief pipes for water and gas pipes as well as steam lines, reducing valves, special fittings to prevent noise in pipes, steam separators, blow-off valves and the like, has been issued by Watson & McDaniel, 146 North 7th St., Philadelphia. The devices are fully illustrated and listed, but their detailed description is reserved for a series of special circulars.

New bulletins issued by the General Electric Co., Schenectady, cover the following apparatus: No. 4267, low energy arc lamps; No. 4268, Brush arc generators; No. 4269, direct-driven revolving-field alternators for electric lighting; No. 4270, type CR feeder regulators. Recent flyers are: No. 2088, enclosing globe breakage; No. 2089, flexible insulating couplings; No. 2087, double push-button flush-pocket switch. All these publications are well illustrated.

The Victor Cooling Tower Co., St. Louis, Mo., makers of different types of cooling tower, has issued a well-illustrated pamphlet on the principles of the various towers it builds. One type allows the hot water to fall through a series of wire screens, causing it to be broken up into spray. By an up-coming blast of air, part is evaporated, thus cooling the remaining portion. Fans are used to produce this draught. Another fan type is described in which the water slowly descends from a given height in thin sheets upon a corrugated metal surface, a passing up-blast evaporating a small quantity, and cooling the rest, as before. Natural draught towers are also referred to.

In the Sprague Electric Company's bulletin for last month, are given concise descriptions and copious illustrations of its direct-current split-pole type of generator. By a special design of the pole pieces the distorting effect of the field by the armature current is overcome, according to the bulletin, thus avoiding shifting the brushes and securing a fixed point of commutation. The general design of the various machines, as well as the details of construction, are mentioned in this pamphlet.

The B. F. Sturtevant Co., Boston, has issued an attractively printed booklet describing the various patterns of forges it makes. These small catalogues are very useful for filing and answer so well most purposes of a trade publication that it is not surprising they are coming into general favor.

The steam turbine of the De Laval type has been the subject of various articles in The Engineering Record, yet its readers will find much interesting information in the handsomely illustrated book on these motors just issued by the De Laval Steam Turbine Co., 74 Cortlandt St., New York. It describes the principles governing their design and the details of their construction, gives illustrations of many types, and describes several tests.

The Exeter Machine Works, Pittston, Pa., has issued a well-illustrated catalogue describing conveying machinery for power stations and industrial establishments which it makes. Loaders, steam or motor drivers, crushing rolls, buckets and industrial railway plants are illustrated. Another new catalogue describes many types of hoisting engines, from very light plants on small contracts to the heavy machinery needed in mines. Even a list of the various varieties of engines is too long to print here.

The Mertes duplex gas engine, made by the National Gear Wheel & Foundry Co., is briefly described in a folder prepared by the general agents, J. D. Lyon & Co., 331 Fourth Ave., Pittsburg. It is a two-cylinder engine, at present made in 60, 100 and 150-horse-power sizes.

Locomotive coaling stations of a new design have lately been constructed by the Brown Hoisting Machinery Co., 26 Cortlandt St., New York, which has issued a well-printed book describing them. The stations have suspended coal pockets from which the coal is dumped by an automatic tub into the tender. Some of the large engravings illustrate an interesting station receiving coal via a cableway directly from the colliery.

Personal Notes.

City Engineer Bell, of Webb City, Mo., has resigned his position.

Mr. Clarence Parsons has been reappointed city engineer of Louisville, Ky., for a term of four years.

Mr. M. F. Bonzano, M. Am. Soc. C. E., has been appointed chief engineer of the Pittsburg, Shawmut & Northern Railroad to succeed Mr. William Barclay Parsons, who is to serve as consulting engineer.

Prof. E. G. Harris, for the past ten years professor of civil engineering in the Missouri School of Mines, at Rolla, Mo., has resigned to take the chair of civil engineering in the University of Pennsylvania.

Messrs. Henry F. Ballantyne and Myron Edward Evans have taken Mr. H. S. Burroughs into partnership and will continue their practice of architecture, civil, electrical and mechanical engineering under the firm name of Ballantyne & Evans, 20 Nassau Street, New York.

The following appointments for the incoming administration of the Board of Public Works, Buffalo, N. Y., have been announced: Deputy engineer commissioner, Charles M. Morse; deputy water commissioner, James Cairns; deputy building commissioner, Henry Rumrill; deputy street commissioner, Patrick J. Kennedy. Mr. Morse, who will succeed City Engineer Frank V. E. Bardol, is manager of the Buffalo Engineering Company. He has had a railroad experience extending over a period of about eight years, beginning in 1873, including surveying, machine work and shop equipment, and since 1882 has been engaged largely in private practice as a mechanical engineer. He is a member of the American Society of Civil Engineers and of the American Society of Mechanical Engineers. Mr. Cairns, who will succeed Mr. Frank J. Illig, is at present an inspector of motive power of the New York Central & Hudson River Railroad.

Mr. Gustav Lindenthal, M. Am. Soc. C. E., has been appointed commissioner of bridges of Greater New York by Mayor-elect Low. He will have much wider jurisdiction over the city's bridges than any of his predecessors, owing to the recent revision of the city charter, and will be the first official of that title really to possess full powers over the engineering and operating work of all municipal bridges. The new commissioner was born and educated in Austria, and engaged in engineering work in that country and Switzerland until, about 28 years ago, he came to the United States. The Centennial Exposition was then being planned, and Mr. Lindenthal joined its engineering force, which he left in about two years for work in Pittsburg. There he built up a large practice as a consulting bridge engineer, and it was while living in Pittsburg that he prepared his first plans for a suspension bridge across the North River at New York. He has given much of his time in the last ten years to this undertaking, which, in fact, led him to become a resident of this city.

The Piezometric Investigations of the flow of water in curved pipes made at Detroit some time ago and fully described by Messrs. Williams, Hubbell and Fenkell in a paper recently read before the American Society of Civil Engineers, had an immediate practical value mentioned in a recent official report by Mr. Hubbell, as civil engineer of the Detroit Water Department. These experiments showed that the curves offering the least resistance to the flow of water had radii of 2 to 3 diameters instead of 8 to 10 diameters, formerly considered good practice. As curved pipe costs about $63 a ton in that city and straight pipe only $22, the direct financial benefit to the board from these investigations was a saving of over $3,000 in the contract for specials for a 42-inch force main under construction at the date of the report.

The Great Luxemburg Masonry Arch of 275 feet span, described in The Engineering Record of October 12, is being carried along toward an early and satisfactory completion, according to information received by Mr. George H. Murphy, U. S. Vice-Consul-General at Frankfort. During its early stages, a Luxemburg official received an elaborate memorandum from a Swiss engineering professor, in which the writer demonstrated, to his own satisfaction if not to that of anyone else, that the actual unit working stresses in the arch were beyond the limits where it is not always safe to rely on the resistance of the stone to crushing. The Luxemburg engineers believe, however, that the length of the bridge could be made even greater than it is without danger. Nevertheless, the striking of the centers on October 25 must have been an interesting moment to them. The sinking of the crown after the removal of the falsework was about 0.22 inch. The bridge is being built, at a cost of about $300,000, across a valley which it is proposed to convert into a public park.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv aud xxiii.

WATER.

Sacramento, Cal.—The Board of Trustees on Dec. 9 adopted specifications for one 5,000,000-gal. and one 10,000,000-gal. vertical triple-expansion pumping engine for the water-works; bids to be received Jan. 13, and the Board will then decide whether to adopt the 5,000,000 or 10,000,000-gal. pump. C. M. Phinney, Deputy City Surveyor.

Sullivan's Island, S. C.—See "Government Work."

Gloster, Miss.—Bids are wanted Jan. 7 for constructing a water-works and electric light system. G. M. Causey, City Clk.

Roanoke, Ill.—The water-works question is said to be under consideration.

Doniphan, Mo.—It is stated that $15,000 bonds have been voted for water-works.

Cleveland, O.—Bids are wanted Jan. 13 for $600,000 water-works bonds. J. P. Madigan, City Aud.

Buffalo, Minn.—It is stated that plans are being prepared for the construction of a light and water plant.

Washington, N. C.—The Town Commissioners are stated to have granted a water-works franchise to S. S. Spruks.

Cheyenne, Wyo.—Press reports state that preliminary plans have been made for a reservoir to be located 25 miles from the city, to increase the water supply of Cheyenne. The estimated cost of constructing solid masonry dam is said to be $55,000 to $65,000.

Ann Arbor, Mich.—Engineers Riggs & Sherman, of Toledo, in the employ of the city, have placed the value of the plant and franchises of the Ann Arbor Water Co., at $291,205.

La Grange, Ill.—Village Pres. F. D. Cossitt writes that on Dec. 10 this village voted to lease the water-works for a period of 20 years and then purchase the same.

Riovista, Cal.—Town Clk. F. J. Kalber writes that on Dec. 7 it was voted to issue $20,000 bonds for the construction of water-works.

St. Louis, Mo.—A bill was introduced in the Council Dec. 14, appropriating $285,000 for water main extensions and $90,000 for valves, pipes and castings.

Llano, Tex.—Chas. Schuwirth, Mgr. Llano Water, Light & Power Co., writes that prices are now being obtained for materials required in proposed improvements. Said improvements include the enlarging and raising of company's dam to 15 ft., extension of water mains, the placing of fire hydrants for city use, and the putting in of new water power machinery and power pumps. Estimated cost, $20,000.

Ft. Washington, Md.—See "Government Work."

Atchison, Kan.—The City Council on Dec. 11 instructed the City Attorney to proceed at once with a suit in the courts for the condemnation and purchase of the plant of the Atchison Water Co.

Gloucester, Mass.—Water bonds to the amount of $730,000 were sold Dec. 13.

Meadville, Pa.—The contract for pumping machinery has been awarded to Henry R. Worthington, of New York City, for a triple expansion high duty pumping engine for $19,350.

Des Moines, Ia.—The City Council has provided for the loan of $50,000 to the Des Moines Water-Works Co. for the purpose of laying a 12-in. water main to the army post site. Capt. Turner, U. S. A., will let contracts for the work.

Lompoc, Cal.—Water bonds to the amount of $40,000 are reported to have been voted at the recent election.

Yazoo City, Miss.—The City Council's Special Committee, having the matter in charge, is said to have authority to employ an engineer to prepare plans and specification, and make surveys for the proposed water-works and electric light plants and sewerage system.

Miamisburg, O.—The Council has under consideration the question of constructing water-works.

Buffalo, N. Y.—Press reports state that the Board of Aldermen recomends the general use of water meters.

Cincinnati, O.—The Hygiene Committee of the Board of Education has recommended that filters be placed in the schools.

Harrisburg, Pa.—Local press reports state that the City Water Department proposes to construct a 12-in. main from the reservoir to Derry St., for an increased water supply for East Harrisburg.

East Providence, R. I.—Local press reports state that the East Providence Water Co. proposes to construct a stand-pipe.

Hackensack, N. J.—Press reports state that the Hackensack Water Co. is planning to build a storage reservoir near Oradell that will be 1½ miles long and 1,000 ft. wide.

Crosby, Tex.—It is stated that bids are wanted Jan. 2 for furnishing and erecting a power pumping plant for a rice irrigating system, about 7 miles from here. The pump is to lift 70,000 gals. of water per minute, through a lift of 65 ft., and through 2 lifts of 32 ft. 68 ins. each, for the Crosby Canal Co. John W. Maxcy, Consulting Engr., 205 Binz Bldg., Houston.

San Francisco, Cal.—City Engr. Grunsky has been requested to make a new estimate of the cost of a single pipe line from Tuolumne River having a capacity of 40,000,000 gals. daily; with the use of artesian wells at Dumbarton Point as an auxiliary or emergency supply.

Henry, Ill.—The question of water-works construction is said to be under consideration.

Escanaba, Mich.—Press reports state that the Escanaba Water-Works Co. proposes to expend about $60,000 in improvements.

Farmington, Me.—The Village Corporation has voted to purchase the works and rights of the Farmington Water Co. for $52,000.

Lynn, Mass.—The Aldermen have passed an order authorizing the Water Board to borrow $75,000 for the erection of a pumping station and other necessary works at Walden Pond.

Toronto, Ont.—A water main is to be laid on Dundas St. at a cost of $6,230.

Pueblo, Colo.—The Pueblo Water Supply & Power Co. has been incorporated, with a capital of $500,000. Incorporators: Jas. H. Brown, J. C. Craig and Moses Viancourt.

Pittsburg, Pa.—Local press reports state that bids will be opened about Jan. 31 for filtration contract No. 1, the ordinance providing for the expenditure of $1,500,000 for said work having been passed by the Councils.

East Orange, N. J.—City Clk. G. M. Long writes that on Dec. 17 it was voted to purchase the present water system or construct a new plant.

Pittsburg, Pa.—Bids are wanted Jan. 21 for furnishing and erecting, in the Brilliant Pumping Station, 2 compound condensing, high-duty pumping engines; also, in the Herron Hill Pumping Station, 1 triple compound condensing, high-duty pumping engine. J. Guy McCandless, Dir. Dept. of Pub. Wks.

Minneapolis, Minn.—The Council Committee on Water-Works has decided to recommend that the Council ask the Legislature for authority to issue $250,000 bonds for the improvement of the city water distribution system and the completion of the northeast station.

Sherman, S. D.—Bids are wanted Dec. 28 for drilling, piping, casing, etc., 2 artesian wells, not less than 2 ins. in diameter at any point. Chas. O'Neill, Town Clk.

New York, N. Y.—See "Miscellaneous."

Newark, N. J.—The Fire Commissioners have approved the suggestion of Engineer Sherrerd, of the Board of Works, for the laying of a 36-in. water main in Broad and Market Sts. Estimated cost, $35,000.

Collinsville, Ill.—Bids are wanted Dec. 28 for the extension and enlargement of the present water-works system. Probable cost, $30,000. Jas. N. Peers, City Clk.; Owen Ford, Consulting Engr., St. Louis, Mo.

Yardley, Pa.—Bids are wanted Jan. 14 for the supervision and construction of a water-works system. Plans and specifications to be furnished with bids. C. A. Clayton, Secy. Yardley Water & Power Co.

Kansas City, Mo.—Bids are wanted Dec. 27 for furnishing all labor and material necessary to lay 30-in. water main, weight 250 lbs. per lin. ft., from 12th and Bell Sts. to Kaw Point, a distance of about 5,420 ft. Harry B. Walker, Secy. Bd. Pub. Wks.

Temple, Tex.—Press reports state that the Santa Fe R. R. Co. is to increase the capacity of Lake Polk by raising the dam 2 ft. The present capacity of the lake, 67,000,000 gals., will be increased to 107,000,000 gals.

Jamestown, N. Y.—In a revised report on the subject of a municipal water-works J. F. Witmer, of Buffalo, estimated the cost of a system, including 64 miles of mains and 600 fire hydrants, at $600,000.

Dallas, Tex.—The Council has under consideration the proposition to issue $50,000 additional water-works improvement bonds.

Vinton, Ia.—City Clk. E. L. Stickney writes that two new 16-ft. x 60-in. steam boilers are to be installed for the water and light plant and the electric light plant is to be otherwise enlarged. I. M. Reeve, Engr.

Toledo, O.—The question of securing a system of adequate water supply for this city is under consideration.

Providence, R. I.—Bids were opened Dec. 13 by the Dept. of Pub. Wks. for furnishing the following sizes of cast-iron water pipe: 11.65 tons 4-in. B pipe, 538.39 tons 6-in. B pipe, 47.59 tons 8-in. A pipe, 79.02 tons 8-in. B pipe, 59.26 tons 12-in. A pipe, 158.75 tons 12-in. B pipe. Bids received were as follows: Warren Fdy. & Mch. Co., at $25.70 per ton; total, $22,993; 50 days. U. S. Cast Iron Pipe & Fdy. Co., at $27.95 per ton for 4-in., $26.95 for 6 and 8-in. and $26.45 for 12-in.; total, $24,013; 30 days. The Camden Iron Wks., at $27.75 per ton; total, $24,827.

Providence, R. I.—Bids will received by the Commissioner of Public Works until Dec. 23 for furnishing the following materials for water-works: 40,000 lbs. of ⅝, 5,000 lbs. of ¾ and 2,000 lbs. of 1-in. lead pipe; 26,000 lbs. of pig lead, 500 lbs. of pig tin; 500 ½, 10 ¾ and 10 1-in. taps; 5 1-in. taps, with waste; 550 ½, 20 ⅝, 10 ¾ and 35 1-in. stops, and 20 ½ and 15 ⅝-in. plugs. Robt. E. Smith, Commr.

Hattiesburg, Miss.—Consulting Engr. T. W. Nicol, of Mobile, Ala., writes that the following bids were opened Dec. 12 for constructing a system of water-works for Hattiesburg: M. T. Lewman & Co., Louisville, Ky., $20,980; W. C. Porter, Laurel, Miss., $20,889; Edward J. O'Beirne, Birmingham, Ala., $18,050. No bids were received on the sinking of the 6-in. well.

Ft. Wayne, Ind.—Local press reports state that the following bids were opened Dec. 12 for the installation of a new pump at No. 2 Pumping Station: R. D. Wood & Co. (not including foundation and not according to specifications), $10,975: Barr Pumping Engine Co., horizontal, 100,000,000 lbs. duty, $40,000; vertical, including boilers (not according to specifications), 145,000,000 lbs. duty, $39,400: Henry R. Worthington, horizontal, duty not named, $29,800: Holly Manufacturing Co., high duty, horizontal, complete, $27,400.

Philadelphia, Pa.—Bids for work on the filtration system were opened Dec. 18 by the Dept. of Public Works. Bidders all of Philadelphia. Bids received for the Torresdale plant, consisting of 55 filter beds, having a gross capacity of 115,500,000 gallons per 24 hours, and a basin to receive filtered water, were as follows: *a*, filter plant complete in all details; *b*, filtered water basin; *c*, total; *d*, time for completion: Daniel J. McNichol, *a* $3,734,000, *b* $1,146,000, *c* $4,880,000, *d* 780 working days; Ryan & Kelley, *a* $3,799,000, *b* $1,189,565, *c* $4,988,565, *d*, 36 months.

For the Oak Lane Reservoir the bids received were as follows: Daniel J. McNichol, $1,254,000, 325 working days; Ryan & Kelley, $1,289,000, 18 months; R. A. Malone & Co., $530,000, 15 months.

For materials and labor for lines of pipe varying in diameter from 6-in. to 48-in., and aggregating 7,396¾ tons, the bids were as follows: D. J. McNichol, $38 per ton; J. H. Wallace & Co., $35.57 to $35.77 per ton; Geo. A. Vare, $41.50 per ton.

New York, N. Y.—The following bids were opened Dec. 17 by the Aqueduct Commissioners for building the pumping plant in engine room and shaft No. 25 of the New Croton Aqueduct, near 179th St. and Amsterdam Ave.: A, Kilby Mfg. Co., Cleveland; B, R. G. Packard Co., 130 Pearl St., N. Y. City; C, Bacon Air Lift Co., 100 B'way, N. Y. City; D, Pneumatic Engineering Co., 128 B'way, N. Y. City; E, Henry R. Worthington, Brooklyn. Item *a* covers removal of the present hoisting engine, cables and all appurtenances of present bailing plant, except sheaves and boilers; Item *b* covers foundations; Item *c*, pumping to keep shaft dry; Item *d*, erection of the pumping plant with a capacity to lift 2,500,000 gals. of water 337 ft. in 12 hours. The contractor receiving award must agree to a forfeit, at the rate of $5,000 per hour, for additional time over 12 hours required to pump the specified 2,500,000 gals., and on the other hand is to receive a premium, at the same rate, for the time less than 12 hours to pump the specified quantity:

	A.	B.	C.	D.	E.
Item a	$1,000	$500	$1,500	$985	$3,000
Item b	4,000	1,000	4,500	4,880	8,000
Item c	10,000	1,500	3,000	3,728	4,000
Item d	110,000	52,000	142,500	56,234	85,000
Total	125,000	55,000	151,500	65,827	100,000

SEWERAGE AND SEWAGE DISPOSAL.

Charlotte, Mich.—Bids are wanted Jan. 29 for furnishing all material and labor for the construction of pipe sewers, also brick and concrete sewers, as advertised in The Engineering Record.

Oakland, Cal.—At a meeting of the City Council, Dec. 9, a special committee was appointed to review plans, etc., and report on reconstruction of 12th St. drain. Estimated cost approximately $60,000. Work to consist of raising, widening and paving the street and building concrete water-way.

St. Louis, Mo.—Bids will soon be received for the construction of 4-ft. brick sewer; plans to be on file at the office of Richard H. Phillips, Ch. Engr., Civil Engineering Division, Dept. of Wks., Louisiana Purchase Exposition Co., Forest Park. Isaac S. Taylor, Dir. of Works.

Randall's Island, N. Y.—Bids are wanted Dec. 27 for reconstructing the sewerage system and plumbing at the House of Refuge for Juvenile Delinquents, Randall's Island, as advertised in The Engineering Record.

Akron, O.—Bids are wanted Jan. 4 for constructing local sewers in 5 streets. J. V. Mahar, Clk. Bd. City Commrs.

Boston, Mass.—Bids are wanted Dec. 23 for sewerage works in Bowen St., South Boston Dist., in Wayland St., Dorchester Dist., and in Vinson St., Dorchester District. Guy C. Emerson, Acting Supt. of Streets.

Lorain, O.—Bids are wanted Jan. 3 for constructing sewers in portions of several streets. Address, City Clerk.

Murdock, Ill.—Bids will be received by the Commissioners of Drainage Dist. No. 2, town of Murdock, until Dec. 26, for constructing a tile drain known as the W. F. Murdock branch, consisting of 3,600 ft. of 20-in., 2,020 ft. of 15, 1,930 ft. of 14, 1,550 ft. of 10, and 375 ft. of 8-in. tile. O. E. Jones, Clk.

Sandusky, O.—The question of building a trunk sewer in Warren St. is said to be under consideration. Estimated cost, $21,000.

Anglesea, N. J.—The Boro. Council has accepted plans prepared by F. G. Rachor for a new sewer system.

Sullivan's Island, S. C.—See "Government Work."

Washington, Pa.—The Borough Council of East Washington is stated to have decided in favor of the construction of a system of sewerage and sewage disposal.

Utica, N. Y.—Plans are said to have been completed for sewers in Liberty St. Work to be done early in the spring.

New Philadelphia, O.—The following bids were opened Nov. 28 for the construction of 2,300 ft. of 12 to 24-in. pipe sewers, with 6 manholes and 4 catch-basins; the trench to average 7 ft. in depth and be excavated in gravel and sand: Paul R. Murray, Engr.: Adams Bros., Zanesville, O., $3,118; A. G. Pugh, Columbus, O., $2,893; Stoyle & Ralston, Mt. Vernon, O., $2,506; O. R. Hines, Scio, O., $2,475 (awarded).

Pasadena, Cal.—See "Miscellaneous."

Beloit, Wis.—Bids are wanted Dec. 23 for constructing a sewer in Sewer Dist. No. 8. Kate Holt, City Clk.

Syracuse, N. Y.—Bids are wanted Dec. 23 for constructing a 12-in. pipe sewer in Gere Ave. Jos. H. Saunders, City Clk.

Jackson, Mich.—Bids are wanted Jan. 13 for furnishing material and constructing intercepting sewers on each side of the Grand River. A. E. Vandercook, Supt. Pub. Wks.

Anderson, S. C.—J. L. Ludlow, of Winston, N. C., is stated to have been engaged to prepare plans and estimates for a sewerage system. Probable cost, about $40,000.

Terrell, Tex.—Press reports state that contracts will be let in January for the construction of a sewerage system, to cost about $9,000.

Sheffield, Mo.—Representatives from Sheffield have protested to the Kansas City, Mo., Board of Public Works against the plan to have the Gooseneck sewer empty into Blue River in the limits of Sheffield, and City Engineer Waddell, of Kansas City, has been instructed to devise some plan to abate the sewer nuisance in Sheffield.

Champaign, Ill.—Petitions are in circulation for the construction of a brick sewer, estimated to cost about $40,000.

Michigan City, Ind.—Plans have been prepared for 12-in. sewers in Boston and Michigan Sts.

Philadelphia, Pa.—A measure is before the Council authorizing the construction of Rock Run main sewer in proposed Ashdale St. and appropriating $50,000 therefor.

New Castle, Ind.—The contract for constructing about 7 miles of sewers is stated to have been awarded to M. A. Talbert & Co., of Logansport, for about $40,000.

Yazoo City, Miss.—See "Water."

Peoria, Ill.—The Board of Local Improvements has instructed City Surveyor Janessen to prepare plans for the proposed north side sewer system.

Indianapolis, Ind.—The Board of Public Works is being petitioned to construct the West Indianapolis and Pleasant Run sewer systems. Local press reports quote City Engineer Nelson as stating that work will probably be begun next summer.

Marion, Mass.—At a recent citizens' meeting a vote was taken in favor of constructing a sewerage system.

Cincinnati, O.—Bids are wanted Jan. 14 for constructing sewers in portions of 3 streets. Geo. F. Holmes, Clk. Bd. Pub. Service.

Davenport, Ia.—Press reports state that steps are being taken for the construction of sewers in several streets. Albert J. Smith, City Clk.

Buffalo, N. Y.—Bids are wanted Dec. 26 for constructing a 10 and 15-in. tile sewer in Barnard St. R. G. Parsons, Secy. Bd. Pub. Wks.

St. Paul, Minn.—Bids are wanted Dec. 26 for constructing a sewer in Fauquier St. and Armstrong Ave. C. H. Bronson, Clk. Bd. Pub. Wks.

Hanover, Pa.—A franchise has been granted a local company composed of H. E. Young, C. E. Moul, A. H. Melhorn, J. H. Schmuck and others, to construct and operate a sewerage system in this borough.

Northampton, Mass.—The State Board of Health in a recent communication to the Sewer Commissioners insists upon the establishment of a filtration plant for the disposal of sewage now emptying into Connecticut River. The Board advises the Sewer Commissioners to employ an expert engineer to assist in determining the feasibility of above plan.

Medina, N. Y.—Plans prepared by Engineer Holmes are stated to have been approved for a sewer to drain the eastern and southeastern portions of the village.

Ithaca, N. Y.—Bonds to the amount of $15,000 are about to be sold by the Sewer Commission, the proceeds to be used for extending and improving the sewer system.

BRIDGES.

Cincinnati, O.—Separate bids are wanted Dec. 30 for the superstructure of a plate girder bridge at Marshall Ave., and for the superstructure of St. Clair St. bridge, as advertised in The Engineering Record.

Henderson, Me.—It is reported that a steel bridge at Henderson, just finished, has been carried away by freshets.

Erwin, N. Y.—Permission has been granted to the town to construct a $5,000 bridge across Canisteo River.

Pipestone, Minn.—The construction of a viaduct across the Northern Pacific R. R. tracks, at Taylor St., is being considered.

New Cumberland, Pa.—Press reports state that the Steelton & New Cumberland Bridge Co. is about to be incorporated for the purpose of constructing a steel bridge connecting Cumberland and Steelton. Incorporators: Jacob H. Foreman, Arthur R. Rupley, Walter Stuart, Harry Hertzler and H. W. Smith, all of Carlisle.

Spokane, Wash.—Local press reports state that early in the spring the Northern Pacific Ry. Co. will construct a modern steel viaduct at Washington St., to replace present structure. E. H. McHenry, Ch. Engr., St. Paul, Minn.

Ft. Dodge, Ia.—It is stated that the King Bridge Co. has secured the contract for constructing the superstructure of the Chicago & Great Western R. R. bridge across Des Moines River at Ft. Dodge, for $500,000.

Memphis, Tenn.—Press reports state that the Missouri Pacific R. R. Co. is contemplating the construction of a $3,500,000 bridge across Mississippi River, at Memphis. J. W. Way, Ch. Engr., St. Louis, Mo.

New Castle, Pa.—The proposed viaduct to cross Shenango River at Mahoning Ave. extension is to be built by the city of New Castle, the Pittsburg & Lake Erie R. R., and the County of Lawrence. Probable cost, $75,000. J. A. Atwood, Ch. Engr. P. & L. E. R. R., Pittsburg.

Clinton, Mo.—Press reports state that during the recent freshets a steel trestle at Clinton was carried away.

Brooklyn, N. Y.—Bids are wanted Dec. 28 for constructing a rustic masonry arch in Highland Park. Geo. C. Clausen, Commr. of Parks, N. Y. City.

Troy, O.—The collapse of one span of the Big Four bridge across Miami River, near Troy, is reported.

New Brunswick, N. J.—H. S. Kerbaugh, Philadelphia, Pa., is reported to have secured the contract for constructing a 21-span stone arch bridge, 1,264 ft. long, to cross Raritan River, at New Brunswick, for $500,000.

Williamsport, Pa.—It is stated that the collapse of part of the four-span iron girder bridge on the Pennsylvania R. R. crossing, Lycoming Creek, between Williamsport and Newberry, has been caused by freshets.

London, Ont.—The residents of the north side are about to petition the City Council to construct a bridge at Wellington St. Probable cost, $35,000.

Cohoes, N. Y.—The City and the United Traction Co. are considering the repairing or rebuilding of bridge at Ontario St.

Pittsburg, Pa.—The Point bridge is reported to be in a dangerous condition.

Waco, Tex.—The Attorney-General has approved the issue of $50,000 bonds for the purpose of constructing a bridge across Brazos River.

Manasquan, N. J.—The Board of County Freeholders has recommended the construction of a bridge across Manasquan River, in Manasquan.

Changewater, N. J.—It is stated that the Delaware, Lackawanna & Western R. R. Co. will construct an iron bridge at Changewater.

Pueblo, Colo.—The Pueblo Bridge Co. has, according to reports, received the contract for the construction of a bridge at Mesa Ave. for $4,900.

New York, N. Y.—See "Miscellaneous."

Kane, Pa.—It is stated that bids are wanted Dec. 27 for constructing the approach to Poplar St. bridge. C. B. Gillis, Pres. Boro. Council.

Rutland, Vt.—See "Railroads."

Cleveland, O.—The Prospect Street Improvement Association has adopted a resolution to recommend to the Board of Control the construction of a viaduct from Huron to Lorain Sts.

Indianapolis, Ind.—Five supporting rods in the center of the W. Washington St. bridge have given way, and the bridge is said to be in a dangerous condition.

Buffalo, N. Y.—The Grade Crossing Commission has approved plans prepared by the engineer for a $120,000 viaduct at Perry St. The structure, including approaches, will be 1,200 ft. long, the main span to be about 120 ft., and 5 approach spans, each about 60 ft. long.

Kenosha, Wis.—City Clk. Gus. Jacob writes that the contract for constructing center pier and approach for Middle St. bridge has been awarded to Jas. Cape & Sons, 468 Water St., Racine, Wis., at a total of $6,900.

Greensboro, Ga.—Bids are wanted Feb. 6 for constructing an iron and steel bridge across Oconee River, to consist of 2 steel spans, 144 ft. and 80 ft. long, on steel cylinder piers, together with about 252 ft. of steel trestle approach. Jas. L. Crossley, Co. Clk.

El Paso, Tex.—See "Railroads."

Newton, Ia.—Bids are wanted by the County Board of Supervisors until Jan. 6 for building and repairing county bridges during the year 1902. J. Horn, Co. Aud.

Chattanooga, Tenn.—The construction of a viaduct at Market St. by the city and the Nashville, Chattanooga & St. Louis R. R. Co., is being considered.

Greenpoint, Pa.—The Grand Jury has recommended the construction of a bridge between Greenpoint and Lickdale.

Buffalo, N. Y.—Bids received Dec. 5 by John N. Partridge, Supt. of Pub. Wks., Albany, for constructing a bridge at Ferry St., Buffalo, have been rejected.

Rochester, N. Y.—The construction of a bridge at Caledonia Ave. is contemplated.

Herkimer, N. Y.—See "Miscellaneous."

Clay, W. Va.—Bids are wanted Jan. 20 for constructing a bridge across Elk River, near the mouth of Big Otter Creek. W. T. Hamrick, Clk. Co. Court.

Newark, N. J.—See "Railroads."

Bay City, Mich.—John H. Blomshield, Engr. for Bay County Bridge Commission, writes that the following bids were opened Dec. 14 for constructing a steel draw-bridge across the west channel of Saginaw River at Lafayette Ave.: H. N. Sand Sons Co., Ausable, Mich., with second-hand draw span (iron bridge, wooden joist, built in 1879 by King Bridge Co.), $3,100; King Bridge Co., Cleveland, O., $5,950, new, steel joist; American Bridge Co., of New York City, by Michigan Agent, $6,290, new, steel joist.

Des Moines, Ia.—The following bids were opened Dec. 14 for the construction of a steel highway bridge across Des Moines River, from the south end of East 6th St. to Main St., in Sevastopol: Magden & Sheeley, Des Moines, $39,975 (awarded); Fair-Williams Bridge & Mfg. Co., Ottumwa, Ia., $41,000; American Bridge Co., New York City, $45,300; Des Moines Bridge & Iron Wks., Des Moines, $46,860; The Marsh Bridge Co., Des Moines, $47,500; Geo. E. King Bridge Co., Des Moines, $52,900; N. M. Stark Co., Des Moines, $54,000.

Bids opened at the same time, for the construction of a Melan arch highway bridge over Des Moines River at North 6th Ave., were as follows: Capital City Brick & Pipe Co., Des Moines, $74,900 (awarded); Marsh Bridge Co., $75,900; Stamson & Blome Co., Chicago, Ill., $76,685; Geo. E. King Bridge Co., $78,000; J. H. Kellmar, Des Moines, $81,600.

Greenfield, Mass.—The citizens of Greenfield and Deerfield and the officers of the Greenfield & Deerfield Street Ry. Co. are contemplating the construction of an iron and steel bridge, on piers of the old bridge, across Deerfield River at Cheapside. Probable cost, $28,000.

PAVING AND ROADMAKING.

Washington, D. C.—Bids are wanted Dec. 28 for grading Connecticut and California Aves., as advertised in The Engineering Record.

Wellsville, O.—City Engr. H. H. Leith writes that 8 streets and 2 alleys are to be paved during the summer of 1902, vitrified brick to be used, with possibly some block asphalt. Cost, about $96,000. Bids will be received in January for paving 4 streets and 2 alleys.

Akron, O.—Bids are wanted Jan. 4 for grading, curbing and paving with brick a portion of Grant St. J. V. Mahar, Clk. Bd. City Commrs.

Ogden, Utah.—Bids are wanted Dec. 31 for furnishing material and labor necessary to pave Washington Ave.; work to include 8,440 cu. yds. excavation, 4,562 lin. ft. curbing, 10,780 sq. yds. sandstone block paving, and 13,872 sq. yds. asphaltum on a 6-in. concrete base. A. F. Parker, City Engr.

Kearney. N. J.—Town Clk. T. C. Wildman writes that bids will be received in a few weeks for paving a portion of Johnston Ave. with asphalt. Probable cost, $5,000. C. M. Borrie, 757 Broad St., Newark, Engr.

Cleveland, O.—Bids are wanted Jan. 8 for grading, curbing and paving with brick on portions of 10 streets. Chas. P. Salen, Dir. of Pub. Wks.

Brooklyn, N. Y.—Bids are wanted Dec. 28 for furnishing, delivering and laying with hexagonal asphalt paving tiles, 45,000 sq. ft. of walks on the Bayridge Parkway (Shore Drive). Geo. C. Clausen, Commr. of Parks, N. Y. City.

Boston, Mass.—Bids are wanted Dec. 24 for constructing a macadam roadway in Torrey and West Tremlett Sts., Dorchester District, also for a macadam road in Brookline Ave., Roxbury District. Guy C. Emerson, Acting Supt. of Streets.

Toledo, O.—Bids are wanted Jan. 13 (not Jan. 10, as previously stated) for block pavement on portions of Church and Ontario Sts. John E. Connell, City Clk.

Oakland, Cal.—See "Sewerage and Sewage Disposal."

Mankato, Minn.—The Council is taking steps toward paving certain streets with asphalt or macadam.

Toronto, Ont.—The City Engineer has reported in regard to the proposed driveway 100 ft. wide, extending 3½ miles along the lake front, that the cost of cribbing would be $225,000, and of a breakwater, $160,000.

Savannan, Ga.—This city contemplates doing considerable street pacing, with brick, early in the year 1902.

Cleveland, O.—Park Engineer Williams is said to be preparing plans and making estimates for the completion of the new west side boulevard. Probable cost of this improvement, over $500,000.

Poughkeepsie, N. Y.—Plans and specifications for building 3½ miles of highway, known as Violet Ave. or Creek Road, leading from this city, have been submitted to the State Engineer for approval. Total estimated cost, $32,450, of which $16,225 is to be paid by the county.

West Seneca, N. Y.—Plans prepared by Div. Engr. R. J. Rockwood, of Rochester, have been submitted to the Bd. of Supervisors, at Buffalo, for the improvement of the Aurora-Buffalo road in the town of West Seneca. Estimated cost, $56,000, one-half of this sum being the county's share. The same road is to be improved in the town of Tonawanda; total cost, $26,400.

Louisville, Ky.—The contract for paving a portion of Gray St. with asphalt has been awarded to the R. B. Park Asphalt Co., of Louisville, at $1.49 per sq. yd.; total, about $14,000.

Pasadena, Cal.—See "Miscellaneous."

Albany, N. Y.—The Board of Supervisors of Albany County has resolved to bond the county to the extent of $250,000 for the improvement of its roads. The county expects to obtain $250,000 additional from the State.

Joliet, Ill.—The lowest bids received for paving Collins and Benton Sts. with asphalt were from R. F. Conway & Co., of Chicago, Ill., at $14,830 and $4,380 respectively, the price per sq. yd. being $1.77 for both streets.

Elyria, O.—Resolutions have been passed and specifications adopted for the paving of West Broad and West Bridge Sts. with brick on a 5-in. concrete foundation.

Wabash, Ind.—It is stated that bids are wanted Jan. 27 for constructing 22,000 sq. yds. of asphalt paving in Main and Wabash Sts. John Hilty, City Engr.

Marion, O.—It is stated that bids are wanted Jan. 16 for $37,000 street improvement bonds. S. E. Barlow, Member of Finance Com.

Monticello, Ind.—It is stated that bids are wanted Jan. 7 for constructing about 12½ miles of macadam roads in Mono Township, at a cost of about $29,767. Jasper L. Ackerman, Co. Aud.

Morristown, Tenn.—Petitions will be presented to the County Court at its meeting in January, asking for authority to issue $50,000 bonds for the purpose of building pike roads.

Champaign, Ill.—Estimates are being prepared for 1½ miles of paving. Probable cost, $33,000.

Waukesha, Wis.—It is stated that the Council is preparing to issue bonds for street improvements.

Erie, Pa.—An ordinance is before the Council providing for the issue of $20,000 bonds for the purpose of repaving around Central Park.

Toledo, O.—Petitions have been approved for paving a portion of Michigan St. with either sheet asphalt or asphalt block, and for repaving a portion of Bancroft St. with asphalt block.

Nashville, Tenn.—A bill has passed first reading in the City Council providing for the appropriation of $10,000 to pave a portion of Market St. with granite.

Wallingford, Conn.—Bids are wanted Dec. 23 for constructing a macadam road in the town. W. Burr Hall, 1st Selectman.

Paterson, N. J.—Bids are wanted Dec. 30 for grading and macadamizing portions of several roads. Geo. W. Botbyl, Clk. Co. Bd. Chosen Freeholders.

East Orange, N. J.—Street improvement bonds amounting to $41,000 have been sold.

Seattle, Wash.—Street Superintendent Little, C. M. Anderson, Eugene Semple and Dr. J. R. Booth, have been appointed by the Broadway Street Improvement Club to secure estimates of the cost and other data necessary to pave Broadway.

Buffalo, N. Y.—The Board of Supervisors has adopted the recommendation of the Good Roads Committee, to purchase a steam road roller from the Buffalo Pitts Co., for $3,500.

Hammonton, N. J.—Bids are wanted by the Board of Chosen Freeholders, Atlantic City, until Jan. 8 for constructing a gravel road from Hammonton to Pleasant Mills, a distance of about 8 miles. John J. Albertson, Engr., Magnolia, N. J.

Chester, Pa.—W. H. Cullis, Chmn. Street Committee, writes that the following bids were opened Dec. 16 for paving a portion of Walnut St. (about 12,000 sq. yds.) with Trinidad Lake asphalt. The prices are per sq. yd., with 5 and 10-year guaranty, respectively: The Vulcanite Paving Co., Philadelphia, $2.12 and $2.23; The Penna Asphalt Paving Co., Philadelphia, $2.45 and $2.60.

POWER PLANTS, GAS AND ELECTRICITY.

Wrightsville, Pa.—Henry McElroy, Pres. Wrightsville Light & Power Co., writes that bids will be opened about April 7 for the construction of an electric light plant, estimated to cost $20,000.

Canton, O.—The City Council is reported to be in favor of granting the Central Heat & Power Co. a franchise for a heating plant.

Plattsmouth, Neb.—J. E. Riley, of Omaha, is interested in a project to construct a water power canal, 24 miles long, on Platte River, commencing at Ashland and running to near Plattsmouth. The fall is 63½ ft.; 15,000 H. P. to be developed. R. B. Howell, Engr. Probable cost, $1,750,000.

Frederick, Md.—Mayor Geo. Edw. Smith writes that the electric light plant is soon to be enlarged by the addition of 2 new dynamos, new engine of about 200 H.-P., new boilers, etc. Bids for above have not yet been asked.

Gloster, Miss.—See "Water."

Baltimore, Md.—The Consolidated Gas Co. is reported to be considering the construction of two gas holders, to cost about $100,000.

Solon, Me.—It is stated that arrangements are being made to establish a complete electric light plant.

Ouray, Colo.—See "Electric Railways."

Livingston, Mont.—The City Council is stated to have granted to A. O. Newton a franchise to erect poles and string wires to conduct electricity for lighting purposes.

Tiffin, O.—See "Electric Railways."

McKeesport, Pa.—The Monongahela Light & Power Co. is stated to have secured the contract for lighting the streets of the city for 3 years at $70 per light per year, or about $22,000 a year.

It is stated that at the Council meeting Dec. 9 the bond ordinance for a city light plant was declared dead by the City Solicitor.

Frankfort, Ind.—The Superintendent of the electric light plant is stated to have reported that a 350-H.-P. boiler is needed.

Marshall, Mo.—Plans for an electric plant for street lighting have been prepared by Richard H. Phillips, of St. Louis.

Spokane, Wash.—The Washington Water & Power Co. is reported to have started a survey for a line to carry electric power from this city to the Coeur d'Alene silver-lead mines in Northern Idaho. The power plant here will be doubled. Mr. Richards, Pres.

Buffalo, Minn.—See "Water."

La Salle, N. Y.—A press report states that the Niagara Falls Electric Lighting Co. will extend its line to La Salle. The village will have 60 lights.

San Francisco, Cal.—The California Gas & Electric Co. has been incorporated, with a capital of $30,000,000, to acquire gas plants and machinery for manufacturing gas for illuminating and heating purposes, and to distribute same in San Francisco, Sacramento, Stockton, San Jose, Bakersfield and other towns of California along that line. It is also reported that it will absorb the North Pacific Coast R. R. and convert it into an electric road. Incorporators: A. E. Childs, Boston, Mass.; R. R. Colgate, New York, N. Y.; Eugene J. De Sabla, Jr., San Francisco, and others.

Philadelphia, Pa.—The Council on Dec. 12 passed an ordinance providing for the introduction of 5,363 Welsbach incandescent gasoline lamps on the highways in the suburban wards, at the rate of $29.25 a year each, to take the place of plain gasoline lamps.

Llano, Tex.—See "Water."

Pierce, Neb.—A stock company is reported to have been formed here, with Benj. Lindsay as President, to construct an electric light plant, to cost $5,500.

Reynoldsville, Pa.—The Reynoldsville Light & Power Co. has been incorporated with a capital of $20,000.

Glendive, Mont.—The County Commissioners are stated to have granted Alex. Hughes a franchise for the construction of an electric light plant.

Oregon City, Ore.—The Oregon, General Electric Co. is reported incorporated with a capital of $2,000,000 to construct an electric plant on the Clackamas River. Fred'k S. Morris and Frank Watson are among the incorporators.

Yazoo City, Miss.—See "Water."

Assumption, Ill.—A. Shafer and Jas. H. Down are stated to have secured a franchise for an electric light and power plant.

Deadwood, S. D.—Colby & Tenny, representatives of the Practical Gas Co., of Chicago, Ill., are stated to have received a gas franchise.

Woodstown, N. J.—The Ice & Cold Storage Co. is stated to have secured the contract for lighting the streets with electricity. It is expected that the streets will be lighted by spring.

North Amherst, O.—The Village Council is reported to have under consideration the construction of an electric light plant.

Tampa, Fla.—See "Electric Railways."

Pontiac, Ill.—Jas. A. Carathers is stated to have secured a franchise for an electric light plant.

Albany, N. Y.—Mayor Blessing, in his recent message to the Common Council, recommends that, as far as practical, all telegraph and telephone wires be placed under ground.

Ft. Totten, N. D.—See "Government Work."

New Albany, Ind.—Wesley R. Perry is stated to have petitioned the Council for a franchise to construct gas, electric light and steam heating plants.

Wellington, Kan.—The Council is stated to have selected A. M. Patitz, of Milwaukee, Wis., to prepare plans for the proposed $15,000 electric light plant.

Charles City, Ia.—Frank K. Lane, of Lasalle, Ill., has received a franchise for a gas plant. Work will begin about Feb. 1. W. W. Dennis, City Clk.

Vinton, Ia.—See "Water."

Brooklyn, N. Y.—Bids are wanted Dec. 30 for installing electric light wiring and fixtures in School No. 26. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

ELECTRIC RAILWAYS.

Culpeper, Va.—The Secretary of the Eastern Virginia Construction Co., of Culpeper, writes that said company proposes to construct, next summer, an electric railway from the Tidewater section around Fredericksburg to Washington in Rappahannock County, through Culpeper County. Probable cost, $1,000,000. Surveys not yet completed. R. L. Marshall, Engr.

Aurora, Ill.—The Aurora, DeKalb & Rockford Electric Traction Co. has been incorporated, with a capital of $100,000, to construct a line from Aurora, Ill., to Rockford, Ill. Incorporators: R. W. Nichols, Jr., Chas. C. Davis and others, all of Chicago.

Long Beach, Cal.—The Council is stated to have granted a franchise to E. Randolph.

San Francisco, Cal.—See "Power Plants, Gas and Electricity."

Elizabeth, N. J.—A press report states that a company has been formed with a capital of $1,000,000 to construct an electric railway from Elizabeth to a point on Staten Island Sound, near Boynton Beach. Incorporators: Benj. A. Vail, Rahway; Hamilton F. Kean, Elizabeth, and others.

Greensburg, Ind.—The Council has granted a franchise to the Greensburg, Shelbyville & Batesville Traction Co.

Grand Rapids, Mich.—H. H. Patterson, of Grand Rapids, is reported to be Vice-Pres. of the Grand Rapids, Kalamazoo & St. Joseph Traction Co., which proposes constructing an electric railway from Allegan to Benton Harbor.

Little Falls, N. Y.—The Council is stated to have granted the Little Falls & Herkimer St. Ry. Co. permission to lay double tracks on W. Main St.

Akron, O.—Fredk. W. Green, of Cleveland, and Dan'l Gindelsperger, of Independence, are about to petition the County Commissioners for a franchise through Summit County.

Fairport, N. Y.—The Village Trustees are stated to have granted a franchise to the Fairport Electric Ry. Co.

Tiffin, O.—The Tiffin & Southern R. R. Co., of Toledo, O., has been incorporated to construct and operate an electric railroad from Tiffin to Kenton, O., also to erect and maintain telephone and telegraph lines, and lighting and power plants; capital, $500,000. Incorporators: Allen Smalley, Upper Sandusky; D. C. Donnovan, of Toledo, and others.

Hastings, Mich.—The Council is stated to have granted a franchise to Chas. Watkins, Trustee for the Michigan Traction Co., which proposes constructing an electric railway from Grand Rapids to Jackson.

Pecatonica, Ill.—The Rockford & Freeport Electric Ry. Co. is stated to have secured a right of way through this village.

Dayton, O.—The Dayton & Kenton Ry. Co. has been incorporated with a capital of $2,500,000 to construct an electric railway from Dayton to Kenton and also to Springfield and Troy. Incorporators: W. W. Steele, Detroit, Mich.; Chas. L. Hubbard and B. H. Rannells, both of Dayton, and others.

Oklahoma, Okla. Ter.—The Oklahoma City & Canadian Ry. Co. has been incorporated with a capital of $200,000 to construct and operate a street railway 5 miles in length in Oklahoma City and another line from Oklahoma City to El Reno, a distance of 27 miles. Directors: Geo. W. Baumhoff, St. Louis, Mo., and Edw. H. Cooke and C. W. Carrico, of Oklahoma City.

Covington, Ill.—The City Council is stated to have granted a franchise to the Danville & Covington Electric Ry. Co.

Georgetown, O.—The Ripley, Georgetown, Hillsboro & Columbus Ry. Co., of Georgetown, has been incorporated with a capital of $10,000 by M. McKeehan, G. Baumbach and others to construct and operate an electric railway from Ripley to Columbus and touching Georgetown, Sardinia and Hillsboro.

Covington, Ind.—The Council is stated to have granted a franchise to the Fountain & Warren Traction Co.

Sheboygan Falls, Wis.—The Wisconsin Ry. & Electric Co., of Sheboygan, has been incorporated with a capital of $100,000 to construct and operate a street and interurban railway through and between the village of Sheboygan Falls and the city of Plymouth and other points in Sheboygan County. Incorporators: Geo. B. Mattoon, J. Donahue and others.

Elgin, Ill.—The Council has granted a franchise to the Elgin, Aurora & Southern Traction Co.

New Castle, Ind.—E. T. Ice, of Muncie, is reported interested in the construction of an electric railway from New Castle to Muncie.

The County Commissioners are stated to have granted a franchise to the Central Traction Co. to construct an electric railway along the National road between Knightstown and the east line of the county.

Salamanca, N. Y.—A press report states that the Erie R. R. Co. is considering the question of changing the motive power to electricity on the line from Salamanca to Dunkirk, a distance of 47 miles. C. W. Buchholz, Ch. Engr., New York, N. Y.

Bowling Green, O.—The Middle States Ry. Co. of Toledo, has been incorporated with a capital of $10,000 by Harrison B. McGraw, Fred'k A. Henry and others, to construct and operate an electric line from Bowling Green to a point in Lucas County, where the Detroit & Toledo Shore Line R. R. ends, and also to purchase the latter line from Toledo to Monroe, Mich.

Knightstown, Ind.—A. D. Ogborn, of Newcastle, is stated to have secured a franchise from the County Commissioners for the use of the National road from the corporation line of this city to the east county line.

Matteawan, N. Y.—It is stated that the Citizens' St. Ry. Co., of Fishkill, has consolidated with the Carroll Electric Co., of Matteawan, and will expend about $20,000 for new machinery.

Cooperstown. N. Y.—The Village Trustees are stated to have granted a franchise to the Oneonta, Cooperstown & Richfield Springs Electric Ry. Co.

Bloomington, Ill.—H. W. Price is stated to have petitioned the City Council for a franchise to construct an electric railway through the city.

Ouray, Colo.—The citizens are stated to have voted to grant a franchise to the San Juan Electric Co. Under the contract the company is to build a $1,000,000 power plant and electric road from Ouray to the coal-fields 27 miles north of the city. The franchise includes privileges to furnish the city and mines of the district with light and power. G. A. Taft and W. R. Thurston, both of Colorado Springs, are among the incorporators.

Tampa, Fla.—John P. Martin, of Xenia, O., is General Manager of a company which proposes to construct an electric light plant and electric railway in Tampa and 83 miles of interurban railway in Hillsboro County. Estimated cost, $2,500,000. Contracts have been awarded for part of the work, balance to be let in January.

Jersey City, N. J.—Press reports state that the old Hudson River tunnel, to connect 15th St., Jersey City, with Morton St.. New York, will shortly be pushed to completion. A syndicate. of which F. B. Jennings, of New York, and Horace C. Golding, of London, are members, is reported interested. The North Jersey St. Ry. Co. (David Young, Gen. Mgr., Jersey City) is to connect its lines with the tunnel when finished.

Murphysboro, Ill.—The County Supervisors are stated to have granted a franchise to the Murphysboro & Carbondale Electric Ry. Co.

Leipsic, O.—Bids are wanted Dec. 23 for constructing and operating Street Railway Route No. 1. Andrew A. Kober, Village Clk.

Westminster, Md.—The Washington, Westminster & Gettysburg Ry. Co. is stated to have petitioned the Council for a right of way through the city.

Elizabeth City, N. C.—A charter is stated to have been granted to the Elizabeth City Electric Ry. Co., with a capital of $125,000, to construct and operate electric lines in Elizabeth City and in the counties of Pasquotank, Camden and Currituck. C. M. Ferebee, of Elizabeth City, is one of the incorporators.

Langhorne, Pa.—The Philadelphia & Langhorne Passenger Ry. Co. is reported to be applying for a right of way for a road from Langhorne to Trenton, via Morrisville.

Camden City, Colo.—The Council has granted Thos. Robinson a franchise for an electric railway.

Upper Marlboro, Md.—The Commissioners of Prince George County are stated to have granted the Washington & Annapolis Electric Ry. Co. right of way through the county.

Findlay, O.—Directors of the Toledo, Fostoria & Findlay Electric Ry. Co. are stated to have decided to at once construct the road from Fostoria to Toledo. The line is already in operation between this city and Fostoria. Theo. Wentz, Mgr., Fostoria.

Galesburg, Ill.—The Knox County Supervisors are stated to have granted a franchise to the Galesburg & Oneida St. Ry. Co.

Fond du Lac, Wis.—The Fond du Lac & Oshkosh Electric Ry. Co. has been incorporated with a capital of $100,000 to construct a line from Fond du Lac to Friendship, Eldorado, Black Wolf, Nekinn and Oshkosh. Incorporators: Carl F. Geilfuss, Geo. A. West and Geo. Lines.

Leavenworth, Kan.—The County Commissioners are stated to have granted the Kansas City, Lawrence & Topeka Ry. Co. a franchise for an electric line from Lansing south to a point near the Kaw River. H. G. Pert, Pres., Kansas City, Kan.

South McAlester, Ind. Ter.—A charter is stated to have been granted to the Indian Territory Traction Co., of South McAlester; capital, $200,000. Directors: L. W. Bryan, L. P. Boyle and others.

Greeley, Colo.—C. W. Beer is stated to have petitioned the City Council for a franchise.

Lima, O.—The County Commissioners are stated to have granted franchises to the Toledo & Lima Electric Ry. Co. and to the Lima & Ft. Wayne Electric Ry. Co.

Burlington, Ia.—The City Council is about to grant a franchise to the People's Electric Co. for the construction of 3 miles of street railway between Burlington and West Burlington.

Worthington, Ind.—H. B. Leavitt and associates are stated to have secured a franchise to construct an electric railway from Worthington to Jasonville.

Quincy, Ill.—The Adams County Supervisors are stated to have granted a franchise to the Quincy & Southeastern Electric R. R. Co. It will construct a line from Quincy to Nauvoo. Rushville and Hardin. Rob't W. Gardner and Geo. Wells, of Quincy, are reported interested.

RAILROADS.

Emporia, Kan.—The Omaha, Kansas & Gulf R. R. Co. is stated to have been incorporated with a capital of $25,000 to construct a railroad from Emporia to Omaha; headquarters to be at Topeka. Incorporators: Richard Nevins, Emporia; F. C. Willard, Topeka, and others.

El Paso, Tex.—A press report states that the Southern Pacific R. R. Co. will during the coming year expend $3,000,000 on the Atlantic system between El Paso and New Orleans, for reballasting, new 80-lb. steel rails, bridges, new equipment and building of branch lines.

Chicago, Ill.—The Illinois Valley R. R. Co., of Chicago, is reported incorporated; capital, $300,000. Incorporators: J. Cratty and Wm. H. Duval.

Zanesville, O.—The Zanesville, Marietta & Parkersburg R. R. Co. has been incorporated, to construct a railroad from Zanesville to Marietta and Parkersburg and to the West Virginia coal-fields. Directors: R. C. Burton, Zanesville; P. B. Crosby, Marietta; J. T. Blair, Greenville, Pa., and others.

Dodge, Tex.—The Trinity Valley Southern Ry. Co. has been incorporated with a capital of $20,000 to construct a railroad between Dodge and Cold Springs, a distance of 20 miles. Incorporators: E. J. Deupree, J. T. Pinkley and others, all of Oakhurst, Tex.

New York, N. Y.—See "Miscellaneous."

Rutland, Vt.—A press report states that the Rutland R. R. Co. will expend about $1,000,000 for reditching and reballasting of main line and Bennington branch, putting in steel bridges in place of wooden ones, erecting new stations, the relaying out of the yards at Rutland, North Bennington, Bellows Falls, Burlington and other junction points, the rebuilding and enlarging of the shops at different locations, with other necessary work. Wm. S. Jones, Gen. Supt.

Newark, N. J.—The Board of Works has passed on second reading the ordinance providing for the removal of all grade crossings of the Lackawanna R. R. in this city. Press reports state that the total expenditure is to be about $3,000,000, and includes a bridge across Passaic River, an ornamental bridge across Broad St. and a new railroad station. The city of Newark agrees to pay $600,000 as its share. W. K. McFarlin, Ch. Engr., Hoboken.

The city on Dec. 18 sold $500,000 track elevation bonds.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Randall's Island, N. Y.—See "Sewerage and Sewage Disposal."

Billings, Mont.—Bids are wanted Jan. 7 (readvertisement) for erecting a city hall and fire station. J. D. Matheson, City Clk.; Archts., Link & Carter, 9 Belknap Blk.

Brooklyn, N. Y.—Bids are wanted Dec. 30 for furnishing material and erecting the center pavilion of the Eastern Parkway front of the Brooklyn Institute of Arts and Sciences. Geo. C. Clausen, Commr. of Parks, N. Y. City.

Aiken, S. C.—Plans and specifications will be received by the Board of County Commissioners until Jan. 6 for a 2-story, 4-room fireproof building for the use of the Clerk of the Court and the Probate Judge and Master. John R. Eidson, Superv.

Montclair, N. J.—John C. Howard, of Montclair, is stated to have been selected to prepare plans for the $30,000 Carnegie Library, to be erected on Church St.

New York, N. Y.—Bids are wanted Dec. 26 for a laundry equipment at the Willard Parker Hospital. John B. Sexton, Pres. Bd. of Health.

Indianapolis, Ind.—Bids will be received by the Board of Trustees until Dec. 27 for erecting an ice and refrigerator plant for the Central Indiana Hospital for the Insane at Indianapolis. Adolf Scherrer, Archt., Indiana Trust Bldg.

Chicago, Ill.—Henry J. Schlacks, Schiller Bldg., is stated to be preparing plans for a $75,000 edifice for St. Boniface's German R. C. Church, to be erected on Cornelia and Noble Sts.

Watertown, N. Y.—The Supervisors are stated to have adopted a resolution providing for the erection of a $40,000 building for county officials.

Washington, D. C.—The plans of Paul J. Pelz, Washington, D. C., and A. A. Richter, of Lebanon, Pa., are stated to have been accepted for a $35,000 edifice for Grace Reformed Church. Rev. J. M. Schiek, Pastor.

Rockford, Ill.—Bradley & Carpenter, 226 S. Main St., are stated to have been selected by the Board of Supervisors to prepare plans for the Soldiers' Memorial Building, to be erected on N. Main St., to cost about $30,000.

Freeport, Ill.—The Board of Supervisors has passed resolutions to build a $30,000 addition to the County Court House.

New York, N. Y.—A permit has been issued for a brick and stone edifice to be erected on 138th St. and St. Anns Ave. for St. Luke's Church, to cost $85.000. Architect, M. J. Garvin, 3307 3d Ave.

Elk Point, S. D.—G. W. Burkhead, Sioux City, Ia., is stated to be preparing plans for an addition to the Union County court house, to cost about $20,000.

Spartanburg, S. C.—It is stated the First Baptist Church will erect a $25,000 edifice on Main St. Capt. John H. Montgomery, Chmn. Bldg. Com.

Findlay, O.—Kramer & Harpster are stated to have completed plans for a 3-story city hall.

Norristown, Pa.—A press report states that Schermerhorn & Reinhold, 430 Walnut St., Philadelphia, are revising the plans for the Montgomery County court house and will be ready for estimates in about 2 weeks; cost, about $250,000.

Pasadena, Cal.—See "Miscellaneous."

Detroit, Mich.—Malcomson & Higginbotham, Moffat Bldg., are stated to have prepared plans for a $20,000 edifice for St. Thomas' Episcopal Church, to be erected on Western Boulevard.

Guthrie, Okla. Ter.—D. R. Cotton is stated to have received the contract for erecting the city hall, for $19,700.

Houston, Tex.—The German Lutheran Society is stated to have accepted the plans of O. H. P. Rudesill & Sons, Moore Bennett Bldg., for a $20,000 church.

Newport, R. I.—It is stated that Mrs. Vanderbilt will have erected here for the Newport Hospital a $200,000 building, as a memorial to her husband, the late Cornelius Vanderbilt.

Navasota, Tex.—The citizens are stated to have voted to issue $15,000 bonds for the erection of a city hall.

Cleveland, O.—Local press reports state that architects will shortly be invited to submit competitive plans for the First Methodist Church, to be erected on Sterling Ave. and Prospect St., to cost about $150,000.

Red Wing, Minn.—Andrew Carnegie is stated to have offered this city $15,000 for a public library.

Livingston, Ala.—The Commissioners of Sumter County are stated to have decided to secure plans for a court house, to cost about $20,000.

Lancaster, Wis.—Plans and specifications will be received by the Grant County Court House Building Committee until Dec. 26 for a court house. O. W. Fessel, Secy., Muscoda.

Akron, O.—Bids are wanted Jan. 7 for the structural steel and iron work for the proposed new jail structure. F. O. Weary, Archt., Savings Bank Bldg.; L. E. Sisler, Co. Aud.

Galveston, Tex.—Local press reports state that bids will be received by the Building Committee of the First Baptist Church until Jan. 1, for erecting a church.

Olivia, Minn.—It is stated that bids are wanted Jan. 14 for erecting a court house at Olivia. J. T. Brooks, Co. Aud., Beaver Falls.

Racine, Wis.—Andrew Carnegie is stated to have offered this city $50,000 for a public library.

Decatur, Ill.—It is stated that bids are wanted Jan. 30 for erecting a public library. Wm. J. Quinlan, Pres. Library Bd.

New York, N. Y.—See "Miscellaneous."

Riverside, Cal.—Plans will be received by the Library Board for the Carnegie Library. Probable cost, $20,000. Geo. H. Dole, Secy.

Newark, N. J.—The city on Dec. 18 sold $300,000 bonds for the new city hospital.

BUSINESS BUILDINGS.

Oskaloosa, Ia.—Frank E. Wetheral, of Oskaloosa, has prepared plans for the proposed $40,000 Y. M. C. A. building. W. S. Lacey, Sec'y.

Livingston, Mont.—Reed & Stem, Endicott Bldgs., St. Paul, Minn., are stated to have been selected to prepare plans for a depot to be erected here by the Northern Pacific R. R. Co., to cost about $75,000. W. L. Darling, Ch. Engr., St. Paul, Minn.

Chicago, Ill.—S. K. Colton, 95 Clark St., is stated to be preparing plans for a 2-story store and office building to be erected on 63d St. and Greenwood Ave. for Knight & Marshall, to cost $30,000.

The Chicago Picture Frame Works, at 20th St. and Western Ave., will be enlarged by a 2-story warehouse, 100 x 125 ft., from plans by Thos. McCall, 167 Dearborn St., to cost $25,000.

Brooklyn, N. Y.—George L. Morse & Son, 303 Washington St., are preparing plans for a 9-story addition to the Eagle Building, to cost $500,000.

The Standard-Union has purchased the property formerly known as the Arlington Hotel and will remodel same.

A permit has been issued for a $50,000 theater to be erected on Willoughby and Pearl Sts. for Mrs. H. Levy. W. E. Mowbray, Archt., 1300 B'way, N. Y. City.

Mobile, Ala.—The contract for erecting a $40,000 store building for L. Hammel has been awarded to Cook & Lary, of Montgomery, Ala.

Cavanah, Barney & Co. are to erect a $25,000 building on Water St.

Johnstown, N. Y.—A press report states that it is proposed to erect a $40,000 Y. M. C. A. building at this place.

Council Bluffs, Ia.—Schoentgen & Cox, of Council Bluffs, have prepared plans for a 4-story brick warehouse, 132 x 170, to be built at a cost of $50,000.

Milwaukee, Wis.—It is stated that the Milwaukee Electric Ry. & Light Co. will erect a fireproof car house on Fond du Lac Ave. and Locust St. John I. Beggs, Gen. Mgr., Milwaukee.

Flint, Mich.—The Elks of this city are reported to be organizing a stock company to erect a temple here, to cost $35,000.

Waukesha, Wis.—Dr. B. M. Caples, Sec'y of the Waukesha Sanitarium, recently burned, is stated to have employed Carl Barkhausen, 501 Iron Blk., Milwaukee, to prepare plans for rebuilding the sanitarium.

Birmingham, Ala.—It is stated that the Birmingham Ry., Light & Power Co. will erect a car barn at 3d Ave. and 10th St., to cost about $100,000. J. B. McClary, Mgr., Birmingham.

Pittsburg, Pa.—J. E. Obitz, McCance Blk., is reported to be preparing plans of a 3-story brick business block to be erected at Frankstown and Linden Aves., at a cost of $30,000.

Pueblo, Colo.—It is stated that Guggenheim Bros. will remodel the building at 4th and Main Sts. Two stories will be added. The improvements will cost about $70,000, and will include a complete heating and electric plant, electric elevators, etc.

San Francisco, Cal.—Fred H. Meyer is stated to have prepared plans for the 8-story Rialto office building, to be erected on New Montgomery and Mission Sts., for Herbert E. Law.

Topeka, Kan.—C. J. Devlin is stated to have purchased a site south of the Central Nat'l Bank, and will erect a 4-story building, 25 x 150 ft., to cost about $30,000.

Hancock, Mich.—Oscar Cobb & Son, 85 Dearborn St., Chicago, Ill., are stated to have been selected to prepare plans for a theater to be erected here for Wm. Kerredge.

Los Angeles, Cal.—Plans are being prepared by John Parkinson, Laughlin Bldg., for a 7-story office building, to be erected at 4th St. and B'way. Owner, O. T. Johnson, of Los Angeles.

Atlanta, Ga.—F. W. Denny, Prudential Bldg., is stated to have prepared plans for a theater to be erected on N. Pryor St. and Auburn Ave., for the Bijou Amusement Co., to cost about $35,000.

Homestead, Pa.—Plans are being prepared for the erection of a 4-story bank, 40 x 110 ft., for the Monongahela Trust Co. Cost, $35,000.

Denver, Colo.—W. E. Fisher, Ferguson Bldg., has prepared plans for a 3-story brick and stone building, 50 x 125 ft., to be erected at 1465 Court Pl. Cost, $23,000.

South Framingham, Mass.—The theater nearing completion here is stated to have been destroyed by fire on Dec. 16.

Los Angeles, Cal.—Andrew Beyrle is stated to have secured the contract for erecting a 40-stall roundhouse in this city for the San Pedro, Los Angeles & Salt Lake R. R., for about $25,000.

Dallas, Tex.—It is stated that the Henry Pollack Trunk Co. will erect a 3-story business building 50 x 200 ft., to cost $40,000.

Seattle, Wash.—It is stated that M. Gottstein, of Seattle, and D. M. Hoffman, of Tacoma, will erect a 7-story brick building on 1st Ave. and Madison St., to cost about $100,000.

Youngstown, O.—J. R. Thomas' Sons, wholesale produce merchants, are stated to have decided to erect a 2-story brick and steel warehouse on Holmes and Commerce Sts.

Selma, Ala.—It is stated that the Louisville & Nashville R. R. Co. will erect a 2-story brick depot at Selma, to cost about $30,000. Geo. E. Evans, Gen. Mgr., Louisville, Ky.

Boston, Mass.—Chas. F. Park, Studio Bldg., is stated to have prepared plans for a 6-story stone business building to be erected on Atlantic Ave. and India St. for the Atlantic Ave. Building Trust. Wm. E. Lincoln and John L. Behneke, Trustees. Cost, about $150,000.

Sharon, Pa.—The contract for the building of the new chemical works near this city is stated to have been awarded to Wallis & Carley, of Sharon. The plant will cost about $100,000.

Chicago, Ill.—The car barns of the Chicago Union Traction Co., on Lincoln and Wrightwood Aves., are stated to have been destroyed by fire Dec. 15. J. M. Roach, Gen. Mgr., Chicago.

Rutland, Vt.—See "Railroads."

Anderson, Ind.—Chas. L. Henry and Thos. J. McMahan, of this city, are reported interested in the erection of a 6-story business and office building, to cost about $250,000.

Nashville, Tenn.—B. J. Hodge, Cole Bldg., has prepared plans for a $20,000 bank, to be erected for the Nashville Trust Co., at North College St., near Union St.

Newark, N. J.—See "Railroads."

San Francisco, Cal.—It is stated that the Market St. Ry. Co. will construct a new car house on 23d and Utah Sts., to cost about $80,000. E. P. Vining, Gen. Mgr., San Francisco.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

14 to 18 Hancock St, br stores & flats; c, $55,000; o, Israel Lippman; a, M Bernstein.

288 Delancey St, br lofts & stores; c, $25,000; o, Gold & Lippman; a, Horenburger & Straub.

312 to 316 E 23d St, br & stone factory; c, $100,000; o, Eliphalet W Bliss; a, Rudolph L Daus.

1st Ave, 44th to 45th St, br & stone abbatoir and packing house; c, $200,000; o, Swift & Co; a, J G Glover.

47 E 19th St, br storage bldg; c, $45,000; o, Inga M Olsen; a, C Abbott French.

364 & 366 5th Ave, br & stone stores & offices; c, $325,000; a, A D Shepard, Jr.

29th St & 11th Ave, br factory; c, $35,000; o, estate of Richard Ray & Nathalie E Baylies; a, Chas F Rose; b, Rich'd Deeves & Son.

Madison Ave & 26th St, br & stone hotel; c, $600,000; o, Olivia E and Caroline Phelps Stokes; a, Howell & Stokes.

William St & Exchange Place, raise bldg 4 stories; c, $152,000; o, John T. Williams; a, J T Williams, Jr.

360 & 362 Washington St, br warehouse; c, $65,000; o & br, Thos Scott Van Nest; a, Louis Falk.

Gramercy Park, 19th & 20th Sts, br & stone hotel; c, $225,000; o, Rob't J Blake Bldg & Realty Co; a, Gilbert & F S Robinson.

B'way & 18th St, alterations; c, $20,000; o, B F Hawes; a, Fred'k Jacobsen.

1674 to 1688 Madison Ave, alterations; c, $24,000; o, Max Weinstein; a, Sass & Smallheiser.

ALTERATIONS.

5th Ave & 58th St, raise bldg; c, $25,000; o, Elbridge T Gerry; a, Alfred Zucker.

6th Ave & 31st St, 4-story extension; c, $30,000; o, Powell & Mahler; a, Le Lemos & Cordes.

4 & 6 E 42d St, 4-story & basement extension; c, $20,000; o, B Farquhar Curtis; a, York & Sawyer.

35 to 51 E 23d St, 11-story extension; c, $1,500,000; o, Metropolitan Life Ins Co; a, M LeBrun & Sons; b, V J Hedder & Sons.

DWELLINGS.

Chicago, Ill.—L. M. Mitchell, 145 La Salle St., is stated to have prepared plans for a 3-story apartment house to be erected on 57th St. and Drexel Ave., to cost $30,000.

Detroit, Mich.—Frank G. Baxter is stated to be preparing plans for an apartment house for Matthew H. and Joseph Finn, to be erected on Hancock and 2d Aves., to cost about $35,000.

Atlanta, Ga.—It is stated that Mrs. R. Ridley will erect an 8-story apartment house on Peachtree and Pine Sts.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

138 to 142 E 17th St, br flat; c, $100,000; o, Feller & Sherufsky; a, Sass & Smallheiser.

144 to 148 E 22d St, br flat; c, $75,000; o, Levin & Packtman; a, Sass & Smallheiser.

141 E 71st St, 4-story & basement extension; c, $20,000; o, Mary Lyons; a, Rob't T Lyons.

SCHOOLS.

Allegheny, Pa.—Bids will be received by W. G. Weitershausen, Sec'y Reserve Township School Bd., 717 E. Ohio St., Allegheny, until Jan. 3, for erecting a school at Mt. Troy, Reserve Township.

Corsicana, Tex.—Plans and specifications will be received by Chas. H. Allyn, Chmn. Com., for a high school.

Alameda, Cal.—City Clk. J. W. Gillogly writes that on Dec. 7 it was voted to issue $100,000 bonds for a high school.

Elmira, N. Y.—Contracts for work on addition to School No. 4 have been awarded as follows: Building to Swan & Murray, 613 Baldwin St., for $16,537; heating to LeValley, McLeod & Co., 169 Lake St., for $2,375; plumbing to J. A. Walker, 334 E. Water St., for $2,175.

Schenectady, N. Y.—Carpenter & Williams, of Norwich, Conn., are stated to have secured the contract for erecting the high school, at $82,420.

St. Louis, Mo.—Two new high school buildings have been ordered. Cost, $200,000 each.

Boston, Mass.—The Allston School on Boardman and Harvard Sts., Cambridgeport, is reported to have been destroyed by fire Dec. 12.

Shawano, Wis.—Competitive sketch plans and outline specifications will be received by the School Board until Jan. 3 for a high school, including a ventilating and steam heating system; total cost, including architect's and inspector's fees, not to exceed $11,500. M. Wescott, Chmn.

Brooklyn, N. Y.—Bids are wanted Dec. 30 for installing electric light wiring and fixtures in School No. 26 and for sanitary work in School No. 132. Rich'd H. Adams, Chmn. Com. on Bldgs., Bd. Educ., N. Y. City.

Iowa City, Ia.—Bids are wanted Jan. 5 for furnishing material and erecting a 2-story brick and stone High School for the Independent School District. Bids will also be received at the same time for erecting a one-story heating station, together with coal and ash vaults and brick smokestack; a brick steam tunnel, connecting new and old High and Grammar schools; a hot-blast steam heating apparatus, required to heat and ventilate proposed new High School, including the installation of 3 new steam boilers, and all steam pipe work and connections required to connect with the old apparatus in present High and Grammar schools; also for sewer and plumbing work. A. J. Hertz, Secy., School Bd.; Liebbe, Nourse & Rasmussen, Archts., Des Moines.

Springfield, Mass.—The National Steam Economizer Co., of Springfield, is stated to have secured the contract for heating the N. Chestnut St. school, for $8,293.

Baltimore, Md.—The Board of Public Improvements is stated to have approved the ordinance appropriating $50,000 for the erection of a school on Mount and Saratoga Sts.

Buffalo, N. Y.—Timothy McEvoy & Son are stated to have secured the contract for ventilating and heating District 24 school, for $10,098.

New York, N. Y.—See "Miscellaneous."

Austin, Tex.—The general contract for constructing the school for the State Deaf and Dumb Institute has been awarded to Fischer & Ramsey, of Austin, for $35,270, and the heating contract to H. A. Kennison, of Dallas, for $2,900. O. J. Lorehn, Archt., Houston.

McKeesport, Pa.—W. F. Wilson, of McKeesport, is stated to have prepared plans for a $50,000 school, to be erected in the 10th Ward.

Marquette, Mich.—Watterworth & Fee, of Duluth, Minn., are stated to have secured the contract for erecting a high and manual training school, for about $56,000.

Kern, Cal.—Bonds to the amount of $15,000 have been voted for a new school.

College Station, Tex.—It is stated that competitive plans will be received by the Chairman of the Building Committee until Jan. 24 for a Chemical and Veterinary Laboratory Building at the Agricultural and Mechanical College, to cost about $20,000.

Redding, Cal.—It is stated that bids are wanted Jan. 8 for erecting a brick high school, cost not to exceed $35,000. W. O. Blodgett, Clk.

Wellesley, Mass.—J. D. Rockefeller has offered $150,000 to Wellesley College for a dormitory and a central heating plant, provided an equal amount be added to the college endowment fund from other sources before commencement day, 1902.

Alexandria, La.—It is stated that bids will be received early in January for erecting a brick and stone high school, 260 x 520 ft., to cost about $35,000. It is to be equipped with a water heating system, electric lighting and elevators. F. M. Welch, Mayor.

New York, N. Y.—The following bids were opened Dec. 16 by the Committee on Buildings, Bd. of Educ., for installing heating and ventilating apparatus of addition to and alteration in School 22, Boro. of Manhattan: John Neal's Sons, $21,750; Blake & Williams, 362 W. B'way, $20,270 (awarded); E. Rutzler, $22,800; Frank Dobson, $20,900; Williams & Gerstle, $20,982.

Bids opened at the same time, for installing electric light wiring fixtures and electric bell system of above school, were as follows: Fre'k Pearce, $7,360; Commercial Construction Co., 1 Madison Ave., $6,500 (awarded).

Bids opened at the same time, for installing heating and ventilating apparatus, electric bell system and gas fixtures of addition to and alterations in School 164, Boro. of Bronx, were as follows: Williams & Gerstle, $8,585; Jas. Curran Mfg. Co., $9,930; John Neal's Sons, $9,000; E. Rutzler, 178 Centre St., $8,350 (awarded); Frank Dobson, $8,625.

STREET CLEANING AND GARBAGE DISPOSAL.

Philadelphia, Pa.—Contracts for cleaning the city streets are stated to have been awarded by Director of Public Works Haddock as follows: First District, to E. H. Vare, at $125,000. Second District, to E. H. Vare, at $180,000, Third District, to Daniel Dooley, at $65,000. Fourth District, to James Curran, at $184,000. Fifth District, to David McMahon, at $138,000. Sixth District, to Richard P. Bennes, at $28,890. The contract for the collection and disposal of the garbage was awarded to the American Product Co., at $489,900.

Rochester, N. Y.—Local press reports state that the contract for the collection, removal and disposal of garbage for 1902 has been awarded to C. Henry Perry, at $24,900.

Newport News, Va.—City Clk. W. L. Cooke writes that the contract for erecting a building for the garbage crematory has been recommended for award to B. T. Pillow, of Newport News, at his bid of $1,197.

Buffalo, N. Y.—R. G. Parsons, Secy. Bd. of Pub. Wks., writes that the following bids were opened Dec. 17 for the collection and removal of dirt, ashes, garbage and general refuse from Jan. 19, 1902, to June 19, 1903: A, Dwyer & Huntington; B, J. J. Fitzpatrick; C, Mosier & Summers:

Ashes and garbage—	A.	B.	C.
Total per mo.	$7,382.00	$7,275.00	$8,285.00
1st dist., per mo.	1,038.00	1,037.00	1,372.78
2d dist., per mo.	1,359.00	1,240.00	1,597.62
3d dist., per mo.	1,139.00	1,119.00	1,480.72
4th dist., per mo.	1,638.00	1,500.00	1,765.54
5th dist., per mo.	1,134.00	1,215.00	1,340.72
6th dist., per mo.	1,074.00	1,170.00	1,482.39
Garbage, per ton, total.	1.49	1.45	1.60
1st dist	1.53	1.50	1.70
2d dist	1.35	1.50	1.60
3d dist	1.65	1.55	2.15
4th dist	1.50	1.47	1.65
5th dist	1.25	1.50	1.80
6th dist	1.25	1.50	1.65
Ashes, per c. yd., total.	.245	.25	.275
1st dist	.30	.25	.35
2d dist	.24	.26	.32
3d dist	.20	.23	.32
4th dist	.30	.27	.32
5th dist	.24	.27	.34
6th dist	.24	.27	.33

Other bids received were as follows: Gottfried Offerman, Buffalo, ashes and garbage from all districts, total per month, $6,666. All districts taken as a whole, per ton for garbage, $1.80; all districts taken as a whole per cu. yd., for ashes, 22 cents; McDonough & Karnes, lump sum per month per district for ashes and garbage, 1st, $1,624; 2d, $1,894; 3d, $1,504; 4th, $2,050; 5th, $1,300; 6th, $1,392.

Cincinnati, O.—Local press reports state that the following bids were opened Dec. 11 for the collection, removal and disposal of garbage for a period of 5 years: M. H. Chamberlain and John B. Corliss, of Detroit, bidding jointly, $392,000, or an average of $78,400 per annum; Henry Rauh, of Indianapolis, $421,300; Jones Fertilizing Co., of Cincinnati, $408,000.

Ottawa, Ont.—It is stated that bids are wanted by the City Engineer until Jan. 31 for an incinerating plant for the garbage, waste, etc. Alderman Bayly, Chmn. Com.

Albany, N. Y.—In his recent message to the Common Council, Mayor Blessing recommended that a plan be devised for the removal of garbage and ashes.

Montreal, Que.—Local press reports state that there is a proposition under consideration for the construction of a new incinerator in the eastern section of the city. Cost, $25,000 to $35,000.

Seattle, Wash.—The Board of Health is urging the necessity of the construction of a public crematory for the disposal of city garbage and waste.

GOVERNMENT WORK.

Salem, Ore.—Bids are wanted at the Treasury Dept., Washington, D. C., until Jan. 30, for furnishing the hot water heating apparatus, etc., for the U. S. Post Office at Salem, as advertised in The Engineering Record.

Blair, Neb.—Bids are wanted at the Treasury Dept., Washington, D. C., until Jan. 20, for heating apparatus, and until Jan. 21 for the installation of a conduit and electric wiring system for the U. S. Post Office at Blair, as advertised in The Engineering Record.

Savannah, Ga.—Bids are wanted at the U. S. Engineer Office, until Jan. 16, for dredging in the Harbor of Savannah, as advertised in The Engineering Record.

Sullivan's Island, S. C.—Bids are wanted Jan. 15 for constructing water and sewer systems at this post, as advertised in The Engineering Record.

Cincinnati, O.—The following bids were opened Dec. 16 by Major E. H. Ruffner, Corps of Engrs., U. S. A., for one set of steel lock gates for Lock No. 9, Muskingum River: The periods of time in various bids are for time of delivery after notification of approval of contract: Chas. Hegewald Co., New Albany, Ind., $2,818, 3 months; $2,583, 4 months; $2,465, 5 months, $2,348, 6 months. John P. McGuire, Cleveland, O., $2,750, 6 months. New Jersey Foundry & Machine Co., New York, N. Y., $2,946, 5 months.

Albuquerque, N. Mex.—Bids will be received by Ralph P. Collins, Supt. of Indian School, Albuquerque, until Jan. 9, for furnishing material and labor for the construction and completion of a boiler house, with boiler, pump and engine, at the Albuquerque School. W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C.

Astoria, Ore.—Bids are wanted Jan. 4 for constructing, plumbing and electric wiring a mess hall and kitchen for 2 companies, at Ft. Stevens, Ore. Address Captain Goodale, Q. M.

Washington, D. C.—Bids are wanted Jan. 15 for erecting buildings for the Weather Bureau at North Head, Port Crescent and Tatoosh Island, Wash. Jas. Wilson, Sec'y, Dept. of Agriculture.

Creston, Ia.—The following bids were opened Dec. 17 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Post-Office at Creston: Angus & Gindele, Chicago, Ill., $109,700; C. W. Gindele & Co., Chicago, Ill., $91,000.

Ft. Totten, N. D.—Bids are wanted Jan. 24 for furnishing material and constructing steam heating and electric lighting plants at the Ft. Totten School. Address Chas. L. Davis, Supt. Indian School, Ft. Totten; W. A. Jones, Commr. of Indian Affairs, Dept. of the Interior, Washington, D. C.

Ft. Washington, Md.—Capt. Abe S. Bickham, Constructing Q. M., Alexandria, Va., opened the following bids on Dec. 9 for the construction of a permanent pumping station at Ft. Washington, including a 140.000-gal. reservoir and a 60,000-gal. steel tank: Rosser & Costoe, Belaire, O., entire work, $15,800; Lewis Hatton, Ft. Washington, Md., pump house, $2,462; Shreve & Co., Baltimore. Md., entire work, $17,450; Cranford Paving Co., Washington, D. C., reservoirs, "Ransome System," $3,650; brick and cement, $3,935; W. H. McCray, Washington, D. C., pump house, $2,700; reservoir, $4,100; H. E. Horton, Chicago, Ill., tank and trestle, as specified, $5,800; his plan, $5,200; New Jersey Foundry & Machine Co., New York, machinery, $4,237; tank and trestle, $6,787.

Buffalo, N. Y.—Maj. Thos. W. Symons is reported to have received word from the Lighthouse Board that it has decided to expend $13,000 in placing range lights along the channel at Strawberry Island, in Niagara River.

Annapolis, Md.—The contract for constructing building for cadets' quarters has been awarded to Noel & Thomas, of Baltimore, for $2,448,000.

MISCELLANEOUS.

St. Louis, Mo.—Bids are wanted Dec. 23 for excavating a new channel way for River des Peres and te boxing in of same. Address Isaac S. Taylor, Dir. of Works, Louisiana Purchase Exposition Co.; Rich'd H. Phillips, Engr. in Charge, Forest Park.

Stapleton (S. I.), N. Y.—Bids are wanted Dec. 28 for furnishing labor and material required for drain pipe, water pipe and appurtenances, constructing asphalt walks, setting curbstones, building walk and surface drains, etc., all in Washington Sq., Stapleton. Geo. C. Clausen, Commr. of Parks, N. Y. City.

Brooklyn. N. Y.—The Board of Estimate & Apportionment has authorized the Corporation Counsel to begin proceedings to acquire title to lands for a park in the Eastern District of Brooklyn.

Minneapolis. Minn.—The Park Board has passed a resolution requesting the City Council for permission to issue $70,000 bonds for park improvements.

Montreal, Que.—M. S. Lonergan, of Montreal, is said to be solicitor for the capitalists seeking incorporation with a view to constructing the Lake Huron & Lake Erie Canal; total length of proposed canal, 45 miles. Estimated cost, $40,000,000. Preliminary surveys are stated to have been made.

Pasadena, Cal.—City Auditor Geo. F. Kernaghan writes that on Dec. 9 it was voted to issue $30,000 bonds to be expended as follows: $167,000 for public parks, $49,500 for city hall and jail; fire department improvements, $20,000; street improvements, $17,500; experimental well, $6,000; outfall sewer, $35,000; improvements to sewer farm, $5,000.

Crosby, Tex.—It is stated that bids are wanted Jan. 2 for constructing about 250,000 cu. yds. of canal levees about 7 miles north of Crosby; also for the construction of pile foundations, flumes, bulkhead, bridges, concrete and brick masonry for one or more power houses at the same place. John W. Maxcy, Consulting Engr., Crosby Canal Co., 204 Binz Bldg., Houston.

Martinez, Cal.—It is stated that bids are wanted Jan. 6 for a franchise to construct a wharf on the southern shore of the Strait of Carquinez. J. D. Wrightman, Chmn. Bd. Supervisors.

Boston, Mass.—The Common Council has passed a loan order of $25,000 for park purposes in Brighton.

Seattle, Wash.—Local press reports state that the Northern Pacific Railway Co. has awarded to the Seattle Bridge Co. a contract for the building of Yesler pier No. 2, for about $50,000; also a contract for the construction of a warehouse on the new White Star dock for about $40,000.

New York, N. Y.—Bonds to the amount of $7,891,000 were sold Dec. 12, the proceeds of the sale to be applied as follows: $2,500,000 for the rapid transit railroad; $2,100,000 for new schools; $1,900,000 for new bridges; $650,000 for the use of the Dock Department; $241,000 for the Fire Department, and $500,000 for the new aqueduct.

Webb, N. Y.—The contract for constructing a concrete dam across Beaver River near Stillwater, in the town of Webb, has been awarded to Stroble & Moynehan, of Herkimer, N. Y., for $75,045.

Sullivan, Ind.—Press reports state that the Commissioners of Sullivan and Knox counties have decided to straighten Bussum Creek. Estimated cost, $80,000.

Philadelphia, Pa.—Robert Higgins, 4655 Lancaster Ave., bid as follows for the extension of Merion Creek (bids opened Dec. 16): 4 ft. 3-in. in diameter, vitrified shale brick bottom, at $4.86; 3 ft. 6-in. in diameter, stone block bottom also at $4.86.

Sterling, Ill.—Press reports state that plans have been prepared by L. L. Wheeler, U. S. Asst. Engr., Sterling, and approved by the War Department, for a movable dam to be built across Rock River, near Sterling. Estimated cost, $88,000. Length of dam, 1,350 ft.

Herkimer, N. Y.—A press report states that the dam at Hinkley Lake, on East Canada Creek, 23 miles north of Herkimer, has given way, the flood wrecking an iron bridge and a sawmill.

NEW INDUSTRIAL PLANTS.

Chas. Titche, Rayville, La., contemplates erecting a 20-ton ice plant.

L. Florman, 317 to 321 Santa Fe Ave., Pueblo, Colo., will, in six months or a year, erect a 4-story and basement, 162½ x 165-ft. paint factory and warehouse.

The Lumiere North American Co., Ltd., Burlington, Vt., will erect buildings to cover upwards of 2 or 3 acres and to be run by electrical power. The company would like to receive catalogues of electrical, refrigerating and paper-box machinery.

The Consolidated Ice Co., Monroe, La., will, in a few months, erect a cold-storage building.

J. C. Beam, Shelby, N. C., expects to erect a roller flour mill, corn mill and cotton gin, to be run by water power.

The Wm. J. Lemp Brewing Co., St. Louis, Mo., is erecting a 2-story, 50 x 150-ft. addition to its refrigerating department, the lower and mezzanine floors to be used for cold storage and the second floor to contain two 75-ton freezing tanks.

The Rettew Mfg. Co., Harrisburg, Pa., is erecting a 75 x 28-ft. factory, and contemplates intalling a 10 to 16-H. P. engine, 16 to 20-H.-P. boiler and a generator of about 5 K.-W.

The High Point, N. C., Buggy Co. will erect two 2-story 50 x 100-ft. buildings, and expects to install an electric motor of not more than 30 H.-P., and will be in the market for various machines, forge blowers, etc.

The Kenmare, N. D., Milling Co. contemplates erecting a flour mill having a capacity of at least 75 bbls., and installing steam plant for 100 bbls.

The Bagby Furniture Co., Biddle and Chester Sts., Baltimore, Md., is having plans prepared for a 3-story, 192 x 162-ft. factory, warehouses, boiler and engine house, dry kilns, etc., and is in the market for shafting, engine, boiler, elevators, etc.

Young Bros., 320-326 Atwater St., Detroit, Mich., will erect a 2-story, 95 x 100-ft. factory, the power to be a gas engine.

W. M. Chelf, Phillipsburg, Kan., will erect a 32 x 68-ft. mill and a 22 x 32-ft. engine room, using a 75-H.-P. Corliss engine.

Picard & Geismar, Dutchtown, La., propose erecting a cotton gin and installing a 60 to 75-H.-P. engine.

J. R. Burchell, Manchester, Ky., will install flour mill machinery, using water power of 40 H.-P.

PROPOSALS OPEN.

WATER-WORKS.

Bids Close		See Eng. Record.
Dec. 23.	Providence, R. I	Dec. 21
Dec. 24.	Tunnel, etc., Cincinnati, O Adv., Eng. Record, Nov. 23 to Dec. 21.	Nov. 23
Dec. 26.	Richmond N. Y	Dec. 14
Dec. 26.	San Jose, Cal	Dec. 7
Dec. 27.	Wilmont Minn	Dec. 14
Dec. 27.	Kansas City, Mo	Dec. 21
Dec. 28.	Collinsville, Ill	Dec. 21
Dec. 28.	Well, Sherman, S. D	Dec. 21
Dec. 31.	Chicago, Ill	Dec. 14
Dec. —	Caldwell, Idaho	Nov. 9
Jan. 1.	Osborn, O	Nov. 2
Jan. 2.	Crosby, Tex	Dec. 21
Jan. 7.	Gloster, Miss	Dec. 21
Jan. 13.	Pump, Sacramento, Cal	Dec. 21
Jan. 14	Yardley Pa	Dec. 21
Jan. 15.	Sullivan's Island, S C Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 21.	Pittsburg, Pa	Dec. 21
Jan. 31.	Pittsburg, Pa	Dec. 21
Jan. 31.	Minneapolis, Minn	Dec. 7
Jan. —	Columbus Grove, O	Dec. 14
Jan. —	Walhalla, S. C	Oct. 26
Apr. 1.	Centennial Heights, Mich	Nov. 2

SEWERAGE AND SEWAGE DISPOSAL.

Dec. 23.	Beloit, Wis	Dec. 21
Dec. 23.	Boston, Mass	Dec. 21
Dec. 23.	Syracuse, N. Y	Dec. 21
Dec. 24.	New York N Y	Dec. 14
Dec. 24.	Brooklyn, N. Y	Dec. 14
Dec. 26.	Omaha, Neb	Dec. 7
Dec. 28.	Murdock Ill	Dec. 21
Dec. 26.	St. Paul, Minn	Dec. 21
Dec. 26.	Buffalo, N. Y	Dec. 21
Dec. 27.	Randall's Island, N. Y Adv., Eng. Record, Dec. 21.	Dec 21
Jan. 1.	Brownwood, Tex	Dec 14
Jan. 3.	Marion, Ind	Dec. 14
Jan. 3.	Lorain, O	Dec 21
Jan. 4.	Akron, O	Dec. 21
Jan. 13.	Jackson, Mich	Dec. 21
Jan. 14.	Cincinnati, O	Dec. 21
Jan. 15	Sullivan's Island, S C Adv., Eng. Record, Dec 21.	Dec. 21
Jan. 16.	Newark, N. J Adv. Eng. Record, Dec. 14, 21.	Dec. 14
Jan. 20.	Charlotte, Mich Adv., Eng. Record, Dec. 21.	Dec. 21
——	St. Louis, Mo	Dec. 21

BRIDGES.

Dec. 24.	Buffalo, N. Y	Dec. 14
Dec. 27.	Harrisburg, Pa	Nov. 30
Dec. 27.	Kane, Pa	Dec. 21
Dec. 28.	Brooklyn, N. Y	Dec. 21
Dec. 30.	Cincinnati, O Adv., Eng. Record, Dec. 21.	Dec. 7
Dec. 30.	Cincinnati, O Adv., Eng. Record, Dec. 21.	Dec. 14
Jan. 6.	Beattyville, Ky	Dec. 14
Jan. 6.	Newton, Ia	Dec. 21
Jan. 8.	Victoria, B. C Adv., Eng. Record, Nov. 16 to Dec. 7.	Nov. 16
Jan. 9.	Sioux Falls, S. D	Dec. 14
Jan. 20.	Clay, W. Va	Dec. 21
Feb. 6.	Greensboro, Ga	Dec. 21
Feb 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

Dec. 23.	Wallingford, Conn	Dec. 21
Dec. 24.	Boston, Mass.	Dec. 21
Dec. 27.	Pittsburg, Pa	Dec. 7
Dec. 28.	Cincinnati, O	Dec. 14
Dec. 28.	Brooklyn, N. Y.	Dec. 21
Dec. 28.	Washington, D. C Adv., Eng. Record, Dec 21.	Dec. 21
Dec. 30.	Paterson, N. J	Dec. 21
Dec. 31.	Ogden, Utah	Dec. 21
Dec. 31.	National Military Home, O	Dec. 7
Jan. 4.	Akron, O	Dec. 21
Jan. 7.	Monticello, Ind	Dec. 21
Jan. 8.	Cleveland, O	Dec. 21
Jan. 8.	Hammonton, N. J	Dec. 21
Jan. 13.	Toledo, O	Dec. 21
Jan. 27.	Wabash, Ind	Dec. 21
Jan. —	Wellsville, O	Dec. 21
——	Kearney, N. J	Dec. 21

POWER, GAS AND ELECTRICITY.

Dec. 30.	Brooklyn, N. Y	Dec. 21
Dec. 30.	Yosemite Valley, Cal	Dec. 14
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
Jan. 2.	New Ulm, Minn	Dec. 7
Jan. 7.	Gloster, Miss	Dec. 21
Jan. 22.	New Orleans, La Adv., Eng. Record, Nov. 30 to Dec. 21.	Nov. 30
Jan. 24.	Ft. Totten N. D	Dec. 21
Apr. 7.	Wrightsville, Pa	Dec. 21

GOVERNMENT WORK.

Dec. 26.	Mobile, Ala	Dec. 14
Dec. 28.	Ft. Morgan, Ala	Dec. 7
Dec. 27.	Hardwood floors, Washington, D. C Adv., Eng. Record, Nov. 30 to Dec. 21.	Nov. 30
Dec. 27.	Elevator enclosures, Washington, D. C. Adv., Eng. Record, Nov. 30 to Dec. 21.	Nov. 30
Dec. 28.	Bremerton, Wash	Nov. 30
Dec. 28.	Repairing light station, Mobile, Ala	Dec. 7
Dec. 30.	Depot, Mobile, Ala	Dec. 7
Jan. 4.	Astoria, Ore	Dec. 21
Jan. 4.	Bremerton, Wash	Nov. 30
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23 to 30.	Nov. 23
Jan. 6.	Cable, Washington, D. C	Dec. 14
Jan. 7.	Ft. Meade, S. D.	Dec. 14
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 8.	Baltimore, Md Adv., Eng. Record, Nov. 30, Dec. 7.	Nov. 30
Jan. 8.	Bldg. Ft. Banks, Winthrop, Mass	Dec. 14
Jan. 9.	Albuquerque, N. Mex	Dec. 21
Jan. 14.	Portland, Ore	Nov. 23
Jan. 14.	West Point, N. Y Adv., Eng. Record, Dec, 14, 21.	Dec. 14
Jan. 15.	Washington, D. C	Dec. 21
Jan. 15.	Sullivan's Island, S C Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 16.	Savannah, Ga Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 18.	Cable Ry., San Juan, Porto Rico	Dec. 14
Jan. 18.	Coal towers, etc., San Juan Porto Rico	Dec. 14
Jan. 20.	Htg. Apparatus, Bliar, Neb Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 21.	Electric wiring, Blair, Neb Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 24.	Ft. Totten, N. D	Dec. 21
Jan. 30.	Salem, Ore Adv., Eng. Record, Dec. 21.	Dec. 21

BUILDINGS.

Dec. 26.	Court house plans, Lancaster, Wis	Dec. 21
Dec. 26.	Hospital laundry, New York, N. Y	Dec. 21
Dec. 26.	School, Jersey City, N. J	Dec. 14
Dec. 27.	Pub. bldg., Indianapolis, Ind	Dec. 21
Dec. 27.	Plumbing, Randalls Island, N. Y Adv., Eng. Record, Dec. 21.	Dec. 21
Dec. 30.	Institute bldg., Brooklyn, N. Y	Dec. 21
Dec. 30.	Wiring, etc., in school, Brooklyn, N. Y.	Dec. 21
Dec. 31.	Fire station, South Bend, Ind	Nov. 16
Jan. 1.	School, Flint, Mich	Nov. 2
Jan. 1.	School, Hamilton, O	Dec. 7
Jan. 1.	Church, Galveston, Tex	Dec. 21
Jan. 2.	Library, Washington, Ind	Dec. 14
Jan. 3.	School plans, Shawano, Wis	Dec. 21
Jan. 3.	School, Allegheny, Pa	Dec. 21
Jan. 5.	School, Iowa City, Ia	Dec. 21
Jan. 6.	Plans for Pub. Bldg., Aiken, S. C	Dec. 21
Jan. 7.	City Hall, Billings, Mont	Dec. 21
Jan. 7.	Jail improv., Akron, O	Dec. 21
Jan. 8.	School, Reading, Cal	Dec. 21
Jan. 10.	Court house, Jacksonville, Fla	Dec. 14
Jan. 10.	Court house, New Roads La	Dec. 14
Jan. 10.	City hall plans, Bradford, Pa Adv., Eng. Record, Dec. 14, 21.	Dec. 14
Jan. 13.	Jail, McRae, Ga	Dec. 7
Jan. 14.	Court house, Olivia, Minn	Dec. 21
Jan. 15.	Church, Pensacola Fla.	Nov. 30
Jan. 15.	Court house, Reidsville, Ga	Dec. 7
Jan. 24.	College bldg. plans, College Station Tex.	Dec. 21
Jan. 30.	Library, Decatur, Ill	Dec. 21
Jan. 31.	Bus. bldg., Toronto, Ont.	Dec. 14
Jan. 31.	School plans, Milwaukee, Wis	Dec. 14
Jan. —.	School, Alexandria, La	Dec. 21
Feb. 1.	Library, Muncie, Ind	Nov. 23
Feb. 1.	University bldg., Stanford University, Cal	Dec. 7
Feb. 8.	Hospital plans, Washington, D C	Dec. 7
Mar. 8.	Plans I. O. O. F. bldg., San Jose, Cal	Dec. 14
——	School plans, Corsicana, Tex	Dec. 21
——	Library plans, Riverside, Cal	Dec. 21

MISCELLANEOUS.

Dec. 23.	El. Ry., Leipsic, O	Dec. 21
Dec. 23.	St. Louis, Mo	Dec. 21
Dec. 28.	Park work, Stapleton, S. I., N. Y	Dec. 21
Dec. 31.	Incinerators, Calcutta, India	Aug. 3
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Jan. 2.	Levee work, etc., Crosby, Tex	Dec. 21
Jan. 6.	Wharf, Martinez, Cal	Dec. 21
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Jan. 7.	Drainage ditches, Bloomfield, Mo	Dec. 7
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THE ENGINEERING RECORD.

Volume XLIV., Number 26.

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The Engineering Record, conducted by Henry C. Meyer, is published every Saturday at 100 William Street, New York. Its opinions on technical subjects are either prepared or revised by specialists.

Subscriptions are received and single copies supplied by the International News Company, Breams Building, Chancery Lane, London.

The subscription rate is $5 a year for the United States, Canada and Mexico, and $6 for other countries in the Postal Union. Remittances should be made by check, New York draft or money order in favor of The Engineering Record. No responsibility is assumed for payments made otherwise, except those for subscriptions to the International News Company.

Subscribers are asked to notify the publication office immediately if their papers are mutilated in transmission; all delays in transmission should be reported to the post office from which delivery is made and not to the publication office.

The Engineering Record is obliged to ask its readers to excuse any shortcomings in this issue and any delay in its receipt. The complete destruction by fire early in the week of its customary facilities for type-setting renders this request necessary.

Sewerage of the Passaic River Valley.

The Passaic River has long been noted in the vicinity of New York for the same characteristics which made the Chicago River famous, or infamous, in the country about lower Lake Michigan. A number of commissions have reported upon methods of preventing its pollution, the courts of New Jersey have rendered several decisions of much importance in suits brought to prevent the contamination of the river, and the engineers charged with devising systems of sewage disposal for the communities in the valley have been forced to struggle against many problems of unusual complexity, caused mainly, perhaps, by political rather than engineering reasons. Most of the pollution arises between Paterson and Newark Bay, and an elaborate report on the method of final disposal of the domestic and manufacturing sewage of the communities of this district was submitted on Tuesday of this week to the State Sewerage Commission by Messrs. Rudolph Hering, J. J. R. Croes and William M. Brown. On account of the past history of the subject, the great extent of the works involved for a complete sewerage of the valley, and the many earlier recommendations to use in this district some of the new methods of bacterial sewage disposal, this report possesses more than usual interest.

The territory contributing sewage to the Passaic River embraces an area of about 53,200 acres in four counties. In this territory are located the cities of Paterson, Passaic, Newark, Orange and East Orange, four towns, the whole or parts of four townships, and eight boroughs. The present population is about 520,000. There are five combined systems of sewerage and seven separate systems in use in these municipalities.

The project recommended by the consulting engineers is the construction of a single trunk sewer from Paterson to the southern boundary of Newark, rather than independent systems of sewers and disposal works by the separate communities or by combinations of a few of them. Such a sewer for domestic and manufacturing sewage, and a limited amount of rain water, can be laid on a grade ensuring a satisfactory discharge by gravity to a point on the shore of Newark Bay. It will be 7 feet in diameter at Paterson and 11½ feet at Newark Bay; the distance between these two points is 15.7 miles. The head of the trunk sewer is 14 feet above high tide at its upper end and 14 feet below high tide at its lower end, making constant pumping necessary to keep the sewage in motion. The adoption of such a project of course presupposes the construction of sewerage systems in the several tributary communities by which the river and all its branches will be kept free from pollution. It will be low enough to receive by gravity the sewage of the valley, except for a district of about 1,500 acres in Passaic and the adjoining townships, where pumping must be resorted to; if any other gradient is adopted, the cost of the undertaking as a whole is enhanced to a degree exceeding the benefits derived from the change.

The trunk sewer must be designed, according to the report, for a capacity of 270,000,000 gallons daily at its lower end. This will provide for 150 gallons per capita from a population of 1,500,000, which will be living in the valley 30 years hence if the present rate of increase is maintained, and also have room for a little storm water. Fortunately the length of the sewer is such that the maximum volume of the daily flow from Newark will have been discharged from this trunk sewer before the maximum daily volume from Paterson arrives at the lower end of the conduit. Such a trunk sewer will cost $4,500,000, inclusive of necessary pumping plant.

The disposal of this great quantity of sewage is the feature of the problem which will most interest the engineer. Two methods only are available, its discharge into tidal waters in a raw condition, or after more or less purification. To discharge the sewage of 1,500,000 people into Newark Bay without any purification is out of the question, as it would take fifteen days of tidal oscillation for this foul liquid to reach a point in New York Bay from which it would not be taken back into Newark Bay by the tide. The bay would be filled with a mixture of one part of sewage to five parts of clean water, which would doubtless become offensive at times. The report states that it would be hazardous to discharge the sewage of a population of even 800,000 into the bay; were the sewage allowed to settle before its discharge, the permissible amount to enter the bay might be increased 20 to 30 per cent., and if the sewage is treated chemically or by the septic process, the amount might be doubled. It is evident, therefore, that the sewage must be really purified before it is discharged into the bay, or it must be carried through an outfall sewer to deep water in New York Harbor.

To carry out the latter project it will be necessary to construct a pumping station discharging the sewage collected by the trunk sewer into a pair of cast-iron force mains 60 inches in diameter. These will cross under Newark Bay to a sewer 11½ feet in diameter, beginning in Bayonne at a sufficiently high elevation to allow a free gravity discharge through a single outfall pipe 13,000 feet long. This outfall is to end in 70 feet of water in the center of New York Bay, north of Robbin's Reef ledge.

The only alternative to this deep-sea method of disposal is the purification of the sewage by works on the Newark Meadows. The consulting engineers state that a sufficient purification can be attained by septic-tank treatment, followed by the use of contact beds, provided a sufficiently large plant be installed. Its cost of construction is regarded as problematical, however, as the following extract from the report shows: "The cost of this method, particularly when applied to large quantities of sewage, is still a matter of doubt, arising from a lack of sufficient experience with operations on a large scale. We are somewhat uncertain as to the quantity of sludge which will be deposited in the present case and require mechanical removal. There is also still some doubt as to the best preparation of the tank effluent for the contact beds, the life of the latter, and the best details of operation." In view of this uncertainty, the report states that it will be necessary to construct for the first works, capable of purifying 100,000,000 gallons a day, settling tanks for the deposit of the grosser mineral impurities held in suspension, from which the effluent will flow into septic tanks of at least 50,000,000 gallons capacity and 8 feet depth, arranged to empty upon contact beds of broken stone of about 167 acres area, underdrained at the level of the highest tide. In the studies leading to this conclusion the consulting engineers visited a number of American cities affording information bearing on the subject, and secured the assistance of Mr. H. W. Clark, who has been in charge of the Lawrence Experiment Station of the Massachusetts Board of Health for a number of years, and their recommendations regarding the size of the works were not made without a careful consideration of the available information on the subject. The first cost of a disposal plant of the size mentioned is figured at $4,500,000, while the cost of an outfall sewer of like capacity, discharging into deep water, is estimated at but $2,500,000. In addition to the advantages in low first cost of the latter project there is to be considered its freedom from any operating charges, which makes it, in the language of the report, "not only the least expensive of the possible solutions of the problem, but also a final solution."

It has been proposed to separate the sewage of Paterson and Passaic from that of the other communities and treat it by some method of disposal on the so-called Hackensack Meadows, on tide water, a considerable distance from the terminus of the trunk sewer. The least cost of such a disposal plant for 50,000,000 gallons per day is estimated at about $2,500,000. The sewer leading to it will cost $829,000 more, and the operating expenses, capitalized at the rate of 4 per cent., will be $1,975,500, making a total of $5,304,000. If the two cities, Paterson and Passaic, were assessed for half the cost of the entire trunk sewer project, they would have to pay but $3,500,000, and in later years, when the disposal works needed enlargement, the difference would become still greater in favor of the deep-sea outfall system. Indeed the nuisance caused by handling such large quantities of sewage might make it imperative to adopt some trunk line sewer scheme before the time for enlarging the disposal works was reached.

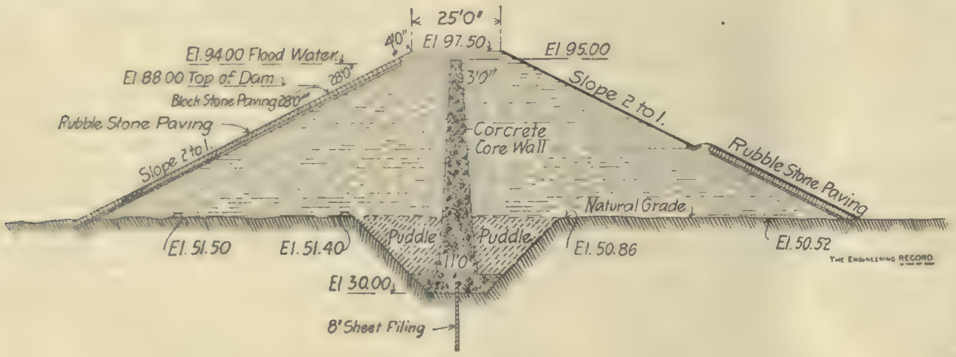
The Red Bridge Power Station of the Ludlow Manufacturing Company.

The Ludlow Manufacturing Company, Ludlow, Mass., has recently built works for developing about 5,000 horse-power at Red Bridge, on the Chicopee River, about four miles from the mills. The power will be transmitted electrically to the company's hemp and jute factories, eight in number, with nearly 620,000 square feet of floor space, where it will supplement the 5,000 horse-power derived from the water privileges previously utilized.

The Red Bridge station is so located that at the site of the dam steep banks run along both sides of the river, that on the north side rising 68 feet above the water-level, and that on the other side still higher.

The Athol branch of the Boston & Albany Railroad formerly followed the course of the river on its north bank, at an elevation varying from 11 to 23 feet above the surface of the water in the river in a distance of about one and one-half miles. The natural fall in the river for this distance was about 44 feet, which it was desired to utilize, and which necessitated relocating about two miles of the railroad on higher ground back from the river, the new location being 42 feet above the elevation of the old road at the site of the dam.

In determining the location of the stone dam, numerous borings were made in the banks and bed of the river, ledge being found on the north bank and in the bed of the river to within a few feet of the south bank, where it disappeared very abruptly at a slope of about one to one. The ledge was composed of quartz, hornblende, mica, and a small quantity of sulphuret of iron, arranged in strata of various compositions of these minerals. The action of the iron and the elements in times past had decomposed the ledge to a considerable depth, more particularly in the river bed, where it was found necessary to excavate to a depth of 17 feet into the ledge to obtain firm rock. The south bank was composed principally of gravel, with many variations in its composition, loam, boulders, cobble stones, gravel, sand, hardpan, clay, and in one corner quicksand was found; most of the materials were suitable for use in some part of the work.



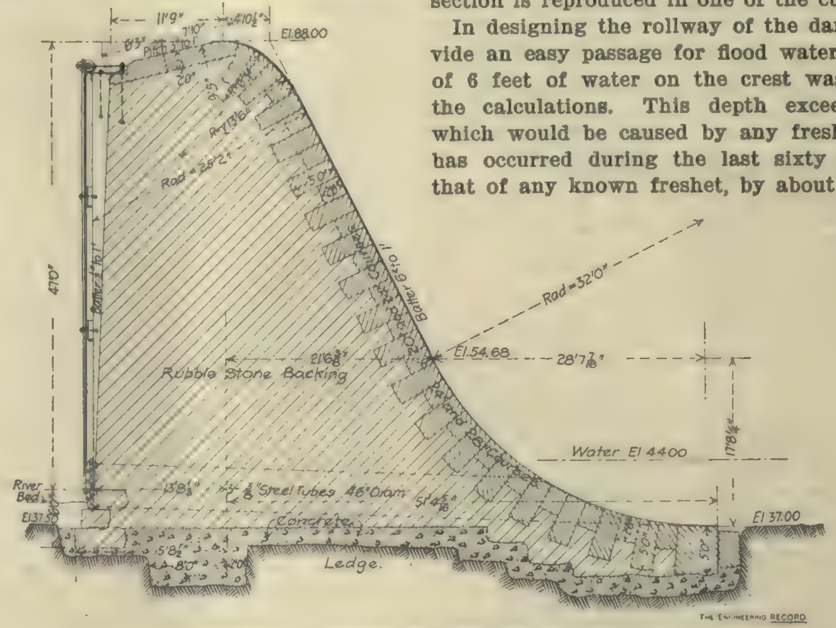
Earth Dike.

The dam is of earth, with a rollway portion of stone masonry, the general dimensions being: North dike, 165 feet long, 7 feet high; south dike, 316 feet long, 47 feet 6 inches high; rollway portion of stone dam, 300 feet on the crest line; bulkhead gates, 86 feet 2 inches, and small dike 13 feet long, or a total length of 880 feet 2 inches.

The dikes are 25 feet wide on the top, as shown in one of the sketches, and have side slopes of 2 feet horizontal to 1 foot vertical, the south dike being provided with a berme about midway of its height. The dikes enclose concrete core walls which extend their whole length, and under the stone dam and bulkhead they are 3 feet wide on the top, and increase 6 inches in thickness for every 4 feet in depth, forming ledges 3 inches wide on each side of the wall on which the forms were placed to receive the concrete.

Where the ledge was met with in the excavations, a channel was provided for the core wall, and where ledge was not found, 8-inch tongued-and-grooved Southern pine sheet piling was driven, two water jets being used in connection with the pile driver. The top of each pile was bolted to a 8 x 10-inch ranger, and all projected 5 feet into the concrete of the core wall.

Near the south dam abutment the core wall reached to a depth of 27½ feet below the natural surface of the ground, and at this point was 72½ feet high.



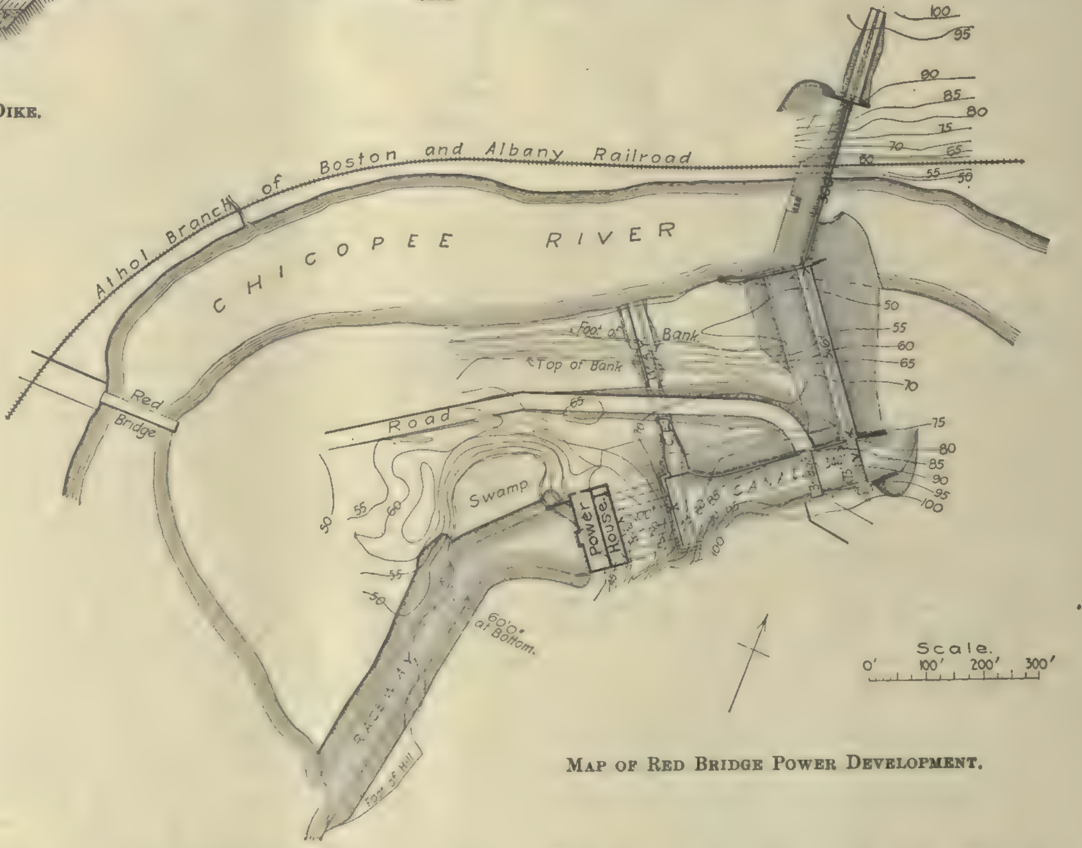
General Section of Masonry Dam.

The ledge runs diagonally across the river and has a pitch of about forty-five degrees upstream, a condition which was considered very favorable for permanent work.

The stone dam is 51 feet high from the top of the toe to the top of the crest, 18 feet thick at the top, and 65 feet at the toe. Its cross-section is reproduced in one of the cuts.

In designing the rollway of the dam to provide an easy passage for flood water, a depth of 6 feet of water on the crest was used in the calculations. This depth exceeded that which would be caused by any freshet which has occurred during the last sixty years, or that of any known freshet, by about 9 inches. The parabolic curve for that depth was then laid out and very much increased in dimensions so as to insure a form of curve which the water would follow without leaving it. The bottom is a true curve of 32 feet radius, and the face between the top and bottom curves has a batter of 6 inches horizontal to 1 foot vertical.

The whole structure is of Monson granite, with toe stones 4 feet wide and 5 feet deep.

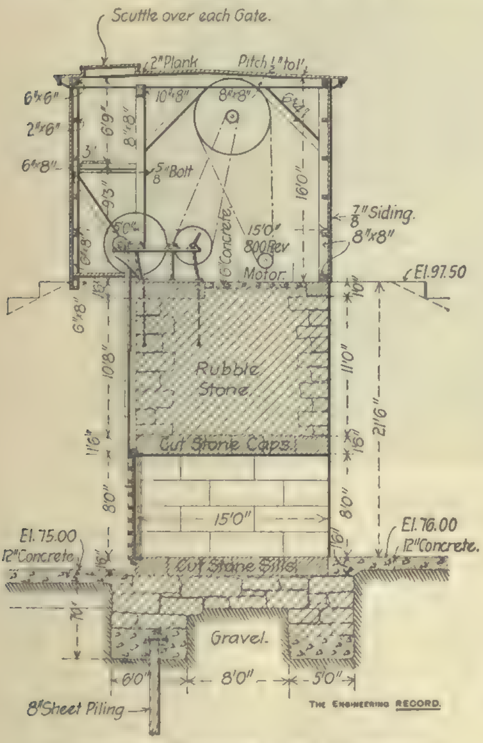


Map of Red Bridge Power Development.

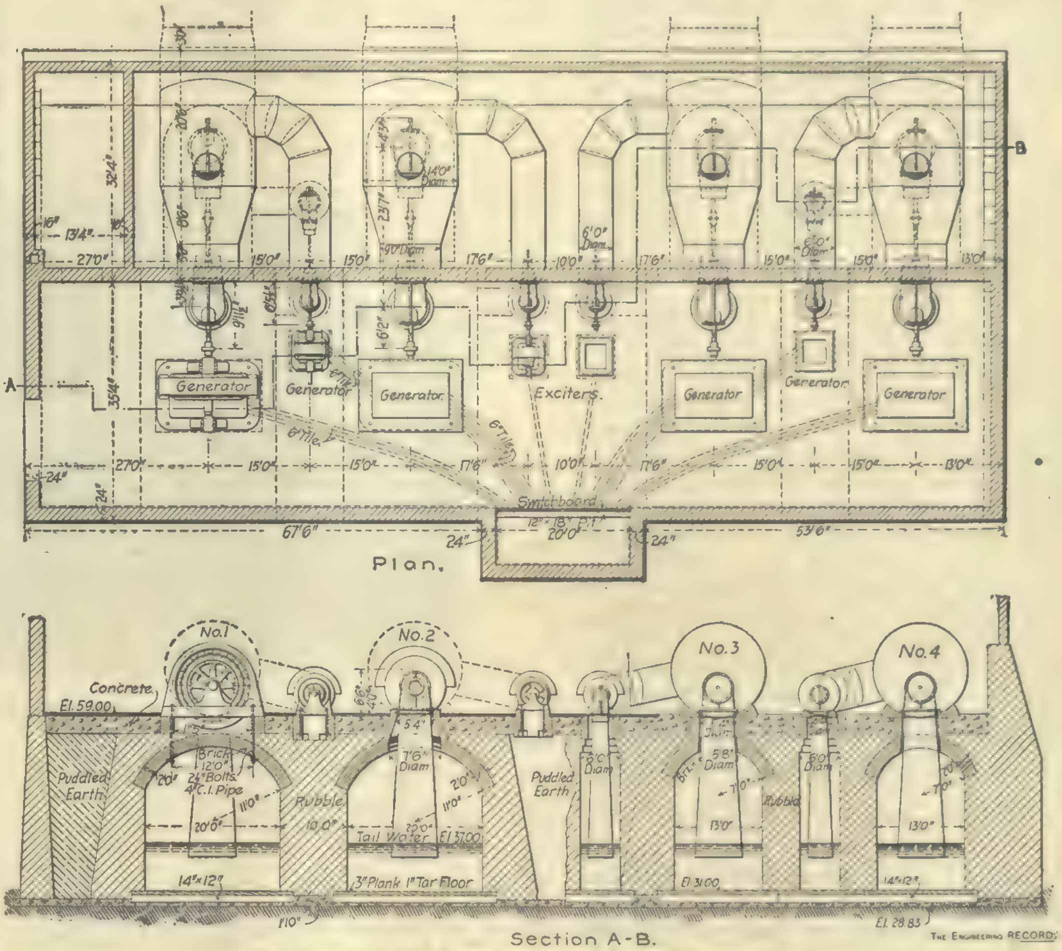
That part of the face of the dam below the top curve is faced with range stone, laid in 24-inch courses, arranged with two stretchers to each header, the stretchers being 30 inches thick and headers not less than 30 inches wide on the face and 5 feet deep.

The five courses in the top curve were 24 inches high, laid alternate headers and stretchers, and the headers were cut 2 inches wider on the face than at the back of the stretchers, the ends of the stretchers being cut to match, and forming a dovetail to bond the face stone to the body of the work.

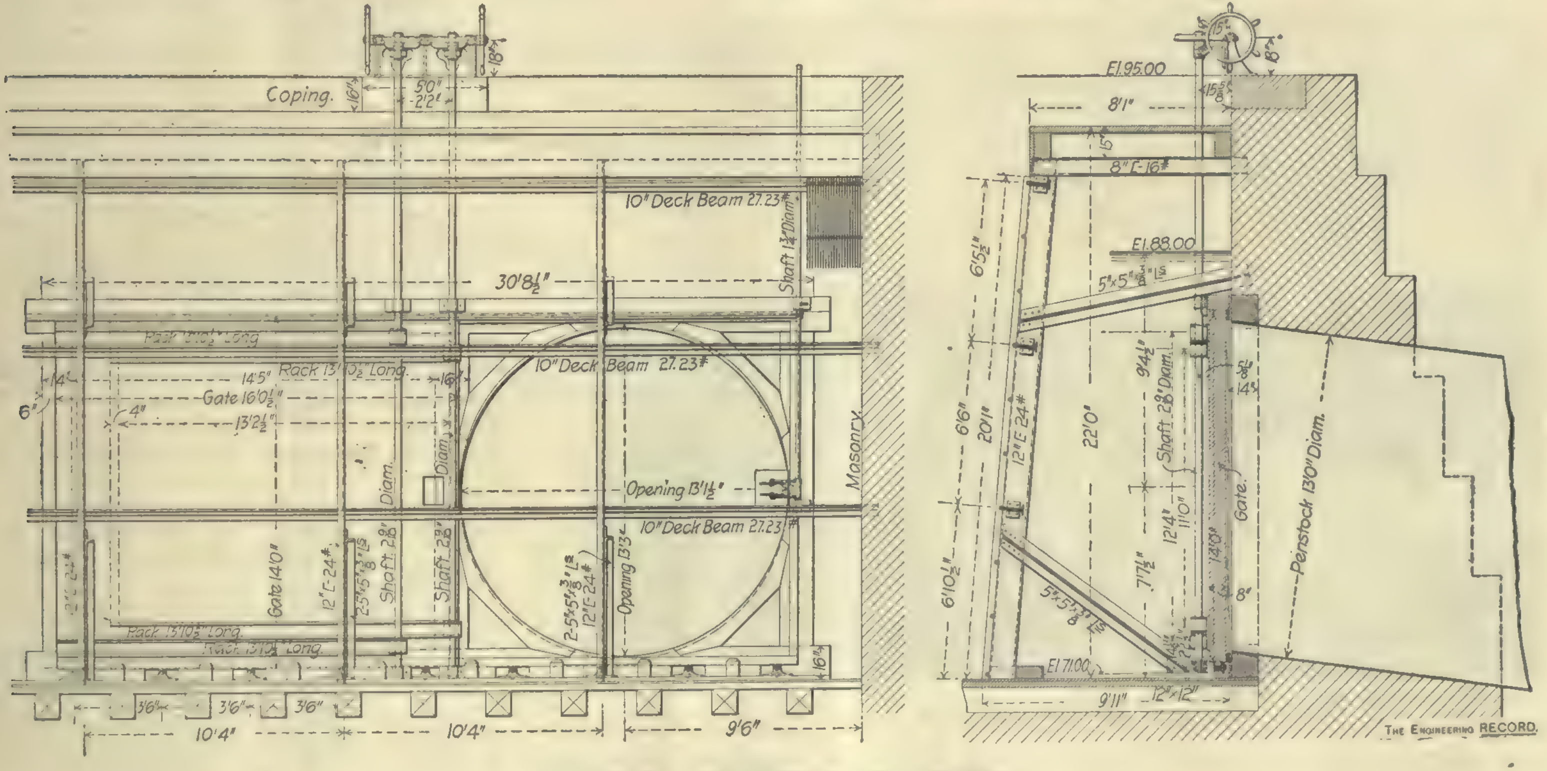
The center of the dam is of uncoursed rubble, faced on the upstream side with large block-stone, roughly hewn, to give small joints, and the whole structure is laid solid in Portland cement mortar made of one part cement to two parts sand. The cement was of the Alpha and Lehigh brands, and all was subjected to a rigid test before permission was given to use.



Section, Bulkhead and Gatehouse.



The General Arrangement of the Power Station.



HEAD-GATE AND RACK-FRAME DETAILS.

As the bottom of the canal is 32 feet above the water in the river at the dam at ordinary stages of the water, and for that reason could not be used to pass the water during the building of the dam, some provision had to be made to take care of the flow of the stream, and at the same time do away with the building of a series of cofferdams as the work was built up. For this purpose three steel sluice pipes, 4 feet 6 inches in diameter and 51 feet long, fitted at their upper ends with cast-iron frames, gates and hoists, were located near the middle of the dam, and just above the toe, which is about 7 feet in under water. It was estimated that under a head of 10 to 14 feet the three pipes would discharge twice the ordinary summer flow of the stream, which proved to be the case, and at only one time was more than one day lost on account of high water preventing access to the works.

The whole height of the north abutment is 34 feet, and of the south abutment 67 feet.

Generally, all concrete for the core walls or other purposes was mixed in proportions of one part cement, two parts sand and five parts of broken stone, except in exceptionally difficult places, when the proportion of stone was reduced to three parts. A cubical mixer was used, the concrete being taken to the work in carts.

The upstream face of the core wall was plastered with a half-inch coat of mortar and finished with a coat of neat Portland cement, troweled smooth to make it water-tight.

The dikes were built of selected material, put on in thin layers, watered, and rolled with heavy grooved rollers, that portion adjoining all walls being puddled. The upstream slope of the dike, from a point 4 feet below the top, measured on the slope for a distance of 28 feet, is paved with block stone 18 inches deep, laid on 6 inches of broken stone, below which the slope is covered with 18 inches of riprap laid on 6 inches of broken stone. The downstream slope is ripraped to the height of the berme.

The bulkhead is 80 feet 2 inches long, 15 feet wide and 22 feet 6 inches high. It has ten gate openings 5 feet wide by 8 feet high, which are provided with cast-iron gate frames and gates, steel channel-bar gate stems, and are operated by geared hoists arranged to be worked by hand or electrical power.

The canal is 73 feet wide at the bottom and 79 feet 4 inches at the top, 325 feet long and 19 feet deep, and, with its water level with the crest of the dam, will have a depth of water of 12 feet; the height of the walls will admit of using the full depth of the flood water on the dam in the canal, which will result in very little loss of head, which would be otherwise caused by back-water.

The canal is located on the hillside, and has walls of solid masonry, the wall on the river side being mostly built above the natural surface of the ground, as was also the head-gate wall for the wheels, and required embankments, which were built 30 feet wide on top, with slopes of 2 feet horizontally to 1 foot vertically. Six-inch tongued-and-grooved sheet piling was driven under these walls and extended from the sheeting of the bulkhead to and into the hillside at the head-gate wall, the top of the sheeting being enclosed in the mass of concrete forming the footing of the walls.

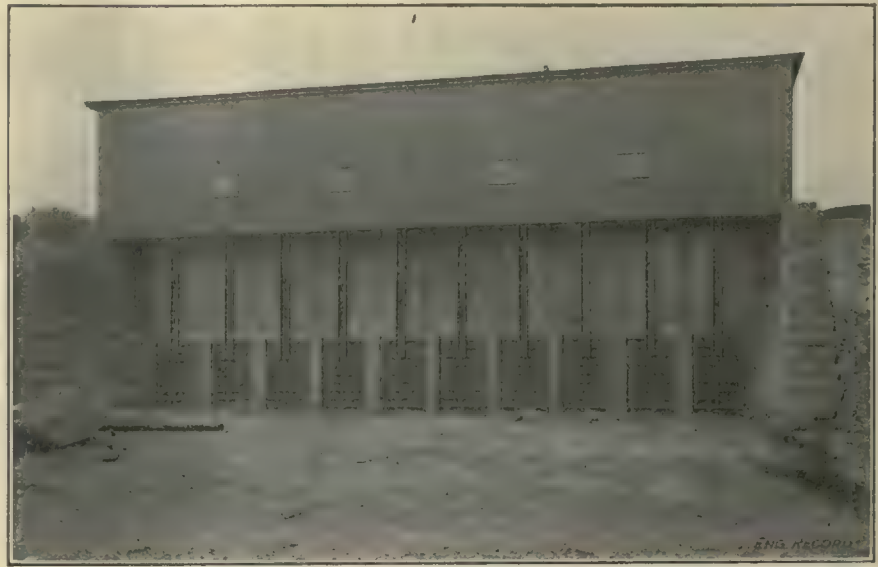
To secure firm foundations for the penstocks, which were located above the natural surface of the ground, heavy piers of masonry, spaced 10 feet on centers, were built, the penstocks resting in brick saddles built up from the piers, all being covered with puddled earth to a depth of 4 feet above the top of the penstocks.

The canal widens out to a depth of 124 feet at the head gates, which provides sufficient room for the rack, which is 124 feet long by 21 feet high, and the four horizontally sliding gates for the penstocks, each gate being 16 feet ½ inch long by 14 feet high, and made of 8-inch plank. These gates are fitted with double sets of racks and pinions, two pinion shafts, worm gears and hand wheels, and their unusual form is shown in the accompanying illustrations.

View of Red Bridge Masonry Dam during Construction.

From near the headgates a waste or iceway connects the canal with the river below the dam. At its canal end there is a stone waste-weir 30 feet long, and of the same elevation as the crest of the dam. At the waste-weir provision is made for flash boards of sufficient height to carry any flow of water which may be on the dam. At the bottom of the waste-weir is a waste pipe 3 feet in diameter, fitted with iron gate-frame and gate with hoisting gear, to be used in drawing off the canal when necessary, thereby avoiding using the water wheels for that purpose.

The iceway is 15 feet wide and has a pitch of 1 foot in 10 feet toward the river. To avoid a possibility of damage from the force of the discharge of the water from the canal, and from frost, the bottom of the iceway was first laid with 1 foot of Portland cement concrete and then paved with block-stone 18 inches thick, laid and grouted in Portland cement mortar.



General Arrangement of Bulkhead, Red Bridge Power Station.

In locating the canal it was necessary to change the location and grade of the highway for a distance of 989 feet. The grade of the old highway was very heavy in some places, the maximum being 13 per cent. In the new location a uniform grade of 6 per cent. was made, which required a fill at one point of 21 feet; and where the canal was crossed, a steel truss bridge 83 feet 4 inches long, with an 18-foot roadway, was provided.

The water is conveyed to the water wheels through four 13-foot penstocks 100 feet long, connecting with four wheel cases 14 feet in diameter, and enclosing in each case one pair of 36-inch Hercules wheels on a horizontal shaft, which is coupled direct to a 1,000-kilowatt generator. Adjoining the two large outside wheel cases are two 6-foot wheel cases, in each of which are a pair of 15-inch wheels on a horizontal shaft, which is coupled to a 200-kilowatt generator. Between the two large inside cases are two small cases, 5 feet in diameter, each enclosing a single horizontal wheel, which is direct-connected to an 82-kilowatt exciting dynamo.

All of the 15-inch wheels are of bronze and take their water from the large wheel cases; and all the wheels discharge their water through draft tubes 23 feet long.

The whole equipment will consist of four pairs of 36-inch, two pairs of 15-inch, and two single 15-inch wheels, with four 1,000-kilowatt and two 200-kilowatt generators, and two 82-kilowatt exciting dynamos. The large generators have a speed of 240 revolutions per minute, and the small ones 600 revolutions. The generators are of the three-phase type.

Only one-half of the equipment has been installed, the other half remaining to be put in at some future time. The wires from the dynamos are carried in tile pipes, laid in the concrete under the floor, to the switchboard, which is located under the arch between the dynamo room and the wire tower.

The power house is of brick, 145 feet long by 67 feet 8 inches wide, divided by a brick partition wall into a dynamo room, 141 feet long by 33 feet 4 inches wide and 32 feet high; a wheel room, 127 feet 8 inches long by 29 feet wide by 20 feet high, and a boiler room, 13 feet 4 inches by 29 feet by 20 feet high. On one side of the building is a wire tower, 24 feet by 8 feet 6 inches, which extends 16 feet 6 inches above the roof of the building, and is provided, on a level with the eaves of the building, with a balcony for use in arranging the wires.

The dynamo room is furnished with an overhead traveling crane of twelve tons capacity.

The foundation on which the building stands is generally of compact gravel, on which was laid 2 feet of Portland cement concrete, in which the floor timbers for the wheel pits were bedded. All the foundation and wheel pit walls were started from this bed of concrete and carried up in solid masonry, the large wheel pits covered with brick arches 24 feet thick, and between the large pits and built into the masonry are small pits 6 feet in diameter, for the small wheels. The wheel pits discharge their water into the river through a tail-race 600 feet long, with a width of 60 feet on the bottom and side slopes of 2 feet horizontal to 1 foot vertical, and with a depth of water of 6 feet.

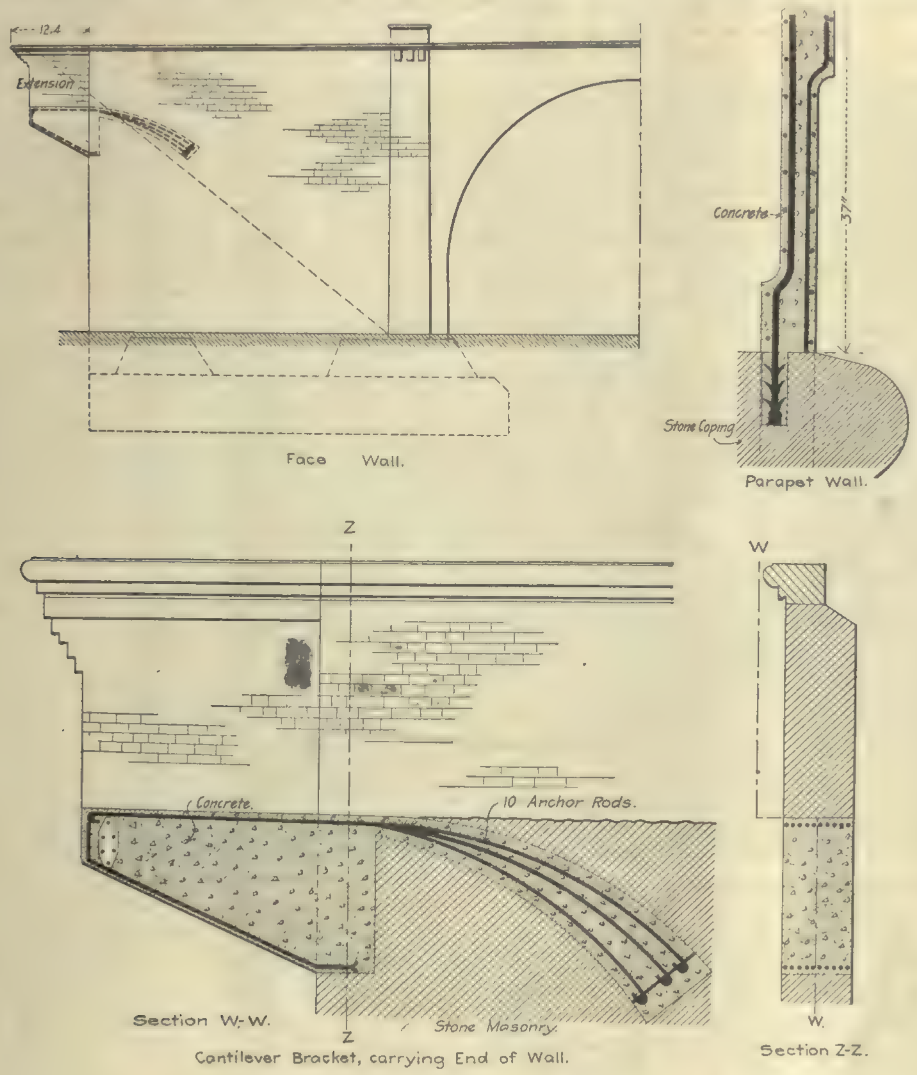
The dam flows back a distance of 1¾ miles, its greatest width of flowage being about 2,000 feet. The railroad, in its new location, crosses an arm of the pond on an embankment 30 feet high. A highway on the north side of the river crosses the pond at two places, which required the building of one dike 900 feet long and 15 feet high, and one 475 feet long, including a stone arch culvert 46 feet long, 12 feet wide and 12 feet high.

Mr. E. P. Ball, of Palmer, Mass., was chief engineer of this work and supervised its execution. Mr. Clemens Herschel acted as consulting engineer.

Concrete-Steel Details of French Viaducts.

The Issy viaduct on a new single-track railway from Paris to Versailles, is a curved structure 689 feet long, composed principally of full-centered masonry arches of 43¼ feet span. At one end the viaduct joins a very deep fill, and to avoid heavy foundations and economize in expensive masonry the face walls only are extended 12.4 feet over the top of the slope, beyond their foundations, by sections of masonry 10.8 feet high and 35 inches thick, supported on cantilever brackets of reinforced concrete. These are anchored to the stone masonry by ten curved ¾-inch rods, which are arranged in a horizontal plane in the upper edge of the bracket and beyond it are separated so as to form, at the foot of the anchorage, three vertical rows, about 1 foot apart. A recess 29 inches wide and 6½ feet high was cut out of the end of the face wall, and from the upper corner a groove about 16 feet long was cut in it for the anchor rods. A grillage 39 inches square, of 1⅛-inch rods crossed and wired together, was set in the bottom of the groove at an angle of about 45 degrees with the horizontal, and the lower ends of the anchor rods were hooked around its bars. These rods entered the top of the bracket and were run parallel around all its three outer surfaces, terminating in the lower part where it enters the stone masonry. Concrete was rammed into the groove around the anchor rods, and into the bracket mould, and, after it had set, the extension of the face wall, weighing 27½ tons, was built on top of the bracket.

In another viaduct on the same road there is a concrete parapet wall which is 37 inches high and only 4 inches thick in the middle. It is anchored every 30 inches by ⅞-inch vertical rods 31 inches long, which are drilled 6 inches into the coping stones. They are offset a little to follow the curves of the thickened base and hand rail, and are staggered so that alternate ones are close to the inner and outer surfaces of the concrete. Horizontal rods ¼ inch thick and about 3½ inches apart are wired to these rods and are spaced by 3/16-inch vertical rods, about the same distance apart, between the anchor bolts. This construction is described in a recent issue of the Paris "Genie Civil."



Face Wall.

Parapet Wall.

Section W-W.

Cantilever Bracket, carrying End of Wall.

Section Z-Z.

Concrete-Steel Brackets and Parapets.

The Importance of Sound Abutments for the core-wall of a dam is well shown by the experience of Supt. A. C. Mueller, of the Meriden, Conn., water-works with a leaky dam, through which half a million gallons sometimes passed under a total head of but 17 feet. Mr. Mueller dug into the bank at the probable point of leakage, and found at the end of the core-wall a number of crevices through which the water was passing. The native rock was broken and shattered, so he cut it out without blasting for 25 feet farther, and extended the core.

The Aramingo Drainage System, Philadelphia.

By Geo. E. Datesman, Principal Assistant Engineer Bureau of Surveys.

About 1847, after proper enactment, the citizens of what was then the District of Kensington, Philadelphia County, formed a company, under the title of the Gunner's Run Improvement Company, for the construction of a canal on the line of a tidal run known as Gunner's Run, traversing a low-lying territory submerged at low tide and separated from the Delaware River by higher ground more than a mile in width, in some cases. The canal was in operation by 1850, and its name was then changed to Aramingo.

As this community, which was largely interested in coastwise shipping, grew about the canal, streets were opened, crossing it by means of bridges of sufficient height to admit of the passage of canal boats. As the population increased, sewers were built, some of large size, both from the river side and the inland side, emptying into the canal, some a considerable distance below low tide, and more than a mile distant from the river, either across the outer high land or by the line of the canal.

After consolidation of the outlying districts with the city of Philadelphia in 1855, the maintenance of this sewer system as well as making provision for draining improved sections within the area devolved upon the city. The canal naturally received the drainage from the hilly portions of the city to the westward, and in time the filth which collected made of it a vast leeching cesspool, a menace to the health of the population, and an eyesore to the city at large.

The decreased traffic on the canal was taken as favorable for its abolishment altogether, but many years passed, fruitful in schemes, discussions, criticisms and complaints. Revisions of grades over the whole territory were finally authorized by Councils in February, 1887.

The problem presented was that of raising two thousand acres of territory in some cases 12 or 13 feet in order to obtain a slope from the higher portions to the river, to permit of constructing the large sewers required to carry off the drainage and provide a suitable earth covering for them. The grades at which these sewers could be built were necessarily light, and it was designed to have the surface grades of the streets generally conform to those of the sewers. For a distance of 2,500 feet back from the river the rise was to be 1 foot per 1,000, and in some cases, from this point for a distance of 5,200 feet, at the rate of 2 feet per 1,000. For circular sewers, 8 feet diameter was the limiting size for economy, it being intended that relief sewers should be built in adjacent streets when the necessity required it.

By considerable annual appropriations beginning in 1887 for the Aramingo main drainage system, sewers aggregating 10½ miles were built, draining 1,900 acres at a total approximate cost of $802,000. In addition the Somerset Street sewer and main tributaries, eight miles in length, draining 1,800 acres, passes through the area, but for some years discharged into Aramingo canal. The problem south of Somerset Street, or in the old canal bed, was more complicated. In order to gather up and deliver at the river the drainage which at the time was discharging through the old sewers at an elevation in some cases 3 feet below low water, at points a mile distant from the river, it would be necessary to reconstruct and raise long reaches of old sewers. This would require considerable changes in the grades of the streets, to the injury of numerous properties, and involve the city in litigation for extensive damages. Numerous plans were prepared, some providing for separating the sewage and carrying it by various streets intersecting Aramingo canal to the river, while others provided for carrying it through the natural channel to the river. By comparison of prices one of the latter plans was adopted, the limited covering requiring the use of twin sewers to provide the necessary capacity.

Appropriations were first made for doing the work in the old canal in 1893. The bottom on this part of the work being uncertain, test piles were driven and test borings taken. It was found that under the mud of the canal there was gravel overlying rock, suitable for a pile foundation.

Various expedients had been used by contractors for taking care of the flow through the canal in former constructions, the most satisfactory result being obtained by banking off a portion of the canal on the sides and at the ends of the sewer sections, forming a mud dam, and driving the piles with a land machine, the water in the basin being kept down by pumping. In this way various sections were built, and the final section of the sewer, consisting of circular twins, 8 feet each in diameter, was completed to the north side of Girard Avenue.

As to the damages, while the drains upon the city treasury by mandamus have been considerable, they have been much less than anticipated, due to the fact that places for city waste becoming scarce, the owners of low land in this territory were enabled to sell dumping privileges and at the same time have their land filled up to the new grades.

In 1899 an appropriation was made to extend the outlet of the Aramingo canal main sewer from its terminus at Girard Avenue to the Delaware River, a distance of 1,567 feet.

The work was to be done in the bed of an old canal 100 feet in width, spanned by three bridges, the sides bounded by old wharves, the bottom of soft mud, presenting slight lateral support for piles and overlying gravel and rock. At the terminus of the sewer already constructed the cut-off of piles was 1 foot below low water; at the new outlet it would be 3 feet below low water if the same section were carried down. After considerable study upon the comparative value of the twin-sewer section on platform, used north of Girard Avenue, and a concrete section resting directly upon piles without a grillage (with which construction the Bureau of Surveys had considerable recent experience on the Delaware River front several miles to the southward) it was considered feasible to construct the twin-sewer section for a distance of 932 feet, as investigation showed that the bounding wharves were of solid crib construction, and would be favorable to the use of a coffer dam. Beyond this point to the Delaware River, from the information obtainable, it was considered inadvisable to risk the construction of a coffer dam, and a concrete section with steel beams for a roof, was adopted.

The section adopted for the twin sewer, 8½ feet in diameter, with a grade of 1 foot per 1,000 feet, may be described as follows: The sewer is upon a foundation of piles required to measure 12 inches in diameter where cut off, driven 3 feet 2 inches on centers transversely, and 3 feet on centers longitudinally, capped with 8 x 8-inch lumber, laid transversely and spiked to the piles, the caps in turn covered by a 6-inch flooring laid longitudinally and spiked to the caps, the space between the underside of flooring and the top of mud being filled in with riprap as a support for the piles.

In order to broaden the base, and to resist any tendency to distortion, at every fourth bent two additional piles are driven beyond the line of platform on each side and the caps were extended, the total width of platform being 27 feet and the extreme length of the cap at the extension bents being 39 feet 6 inches.

All piles used were required to be of southern yellow pine, and they were not shod except where driven through old cribs. All lumber of dimension sizes was required to pass merchantable inspection. Portland cement was used in all mortar.

Upon the platform there was built of rubble masonry a cradle for the twin sewer, the outer sides being battered and a least thickness of 12 inches of masonry placed below the brick inverts. In the cradle were placed the brick inverts, each consisting of two rings laid in stretcher courses, the inner ring being plastered to the springing line with Portland cement mortar. The arch consists of 13½ inches of brickwork with a special bond, increasing on the haunches to 22½ inches at the springing line. The exterior surface of the arch is plastered before covering with 3 feet of earth filling.

At intervals of 300 feet on each side are built manholes, resting on the spring and arch, with cast-iron frames and covers, having galvanized wrought-iron steps for entrance to the sewer.

The twin sewer section was joined to the section below it by means of a junction chamber of concrete, 30 feet in length, the top covered by steel beams and brick arches, and the inverts of the two sewers gradually merging into one.

In that portion of the canal where it was designed to use the concrete section, the cut-off of the piles was 2 feet below low water, and the depth to hard bottom was 16 feet below the cut-off. The condition of the mud not being favorable for the support of the piles, it was determined to dredge out the mud and to fill in with selected gravel to a plane 4 feet below the cut-off. It was then intended to drive the piles with a floating machine and cut them off under water to a level, in the same manner as was used with such success on the Delaware River front work, described in The Engineering Record of April 13, 1901. Eight piles were driven in each row to form the support of the blocks, each pair of blocks having a bed 22 feet wide. In order to provide additional stiffness for the piles a riprap filling 4 feet in thickness was to be placed about their heads with a berm of several feet on each side.

In designing the concrete invert blocks it was contemplated to have them made near the work in either wooden or steel forms and set by a floating derrick scow. The general dimensions of the blocks are 6 x 11 x 4 feet, a segment of a 5-foot diameter circle forming the invert. Each block of the above dimensions weighed about 16 tons and formed half the invert only, the rights and lefts meeting to form the complete invert in an overlap joint, and each section of the completed invert meeting the adjoining section in a similar joint, the joints caulked with oakum. The least thickness of the concrete block under the invert is 16½ inches, the inside bottom of the block beyond the segmental invert rising with a gentle slope to the side walls. Holes were provided in the sides and through the blocks for the cables to lift them, the holes to be filled with concrete in bags after setting in position.

Before lowering the invert blocks, in order to provide an even bearing, it was designed to place upon the heads of the piles a mattress formed by spreading between two sheets of burlap a layer of 2 inches of cement and sand, 1 to 2, and lower it upon the heads of the piles in the same manner as described in The Engineering Record of April 13, 1901.

The concrete bottom blocks being set, the side walls were to be carried up in adjustable wooden forms to the under side of the beam seat. The side walls on the inner side were required to have a granolithic finish. In order to allow for expansion and for uneven settlement, at intervals not exceeding 30 feet, a vertical joint was to be made in the side walls over a joint in the invert blocks, and in it was to be placed two layers of three-ply tar paper.

Upon the side walls were placed beam seats consisting of a course of 8 x 15-inch blue-stone coping. On this again were set 18-inch 65-pound I-beams 3 feet apart on centers, tied by ¾-inch upset rods 3 feet apart. Wall plates measuring 10 x 15 x ¾ inch were set under the beams. The space between beams was filled in by 13½-inch brick arches, and above the arches and beams, covering the latter to a depth of 5½ inches, concrete was placed, and the side walls were also brought up to this height.

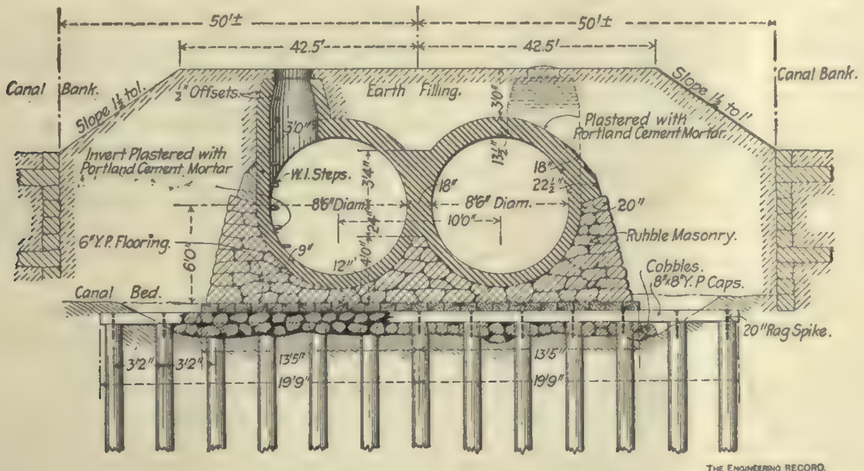
This part of the work being completed, it was intended to compensate for the inequalities in the setting of the invert blocks by the use of a fine concrete to obtain a perfect grade line and then line the invert with vitrified shale brick. For the better protection of the lower flanges of the I-beams exposed to the damp of the sewer, it was provided that sheet lead weighing 3 pounds per square foot should be used to cover them before the arches were built.

After considering the methods to be adopted for the retaining wall or bulkhead across the canal at the outlet of the sewer into the Delaware River, it was finally decided that in order to maintain 12 feet of water at the head of the dock a concrete wall carried to the bottom would give the best results. The bottom being about 24 feet below low water, a pile structure would not be suitable, owing to the shortness of the piles.

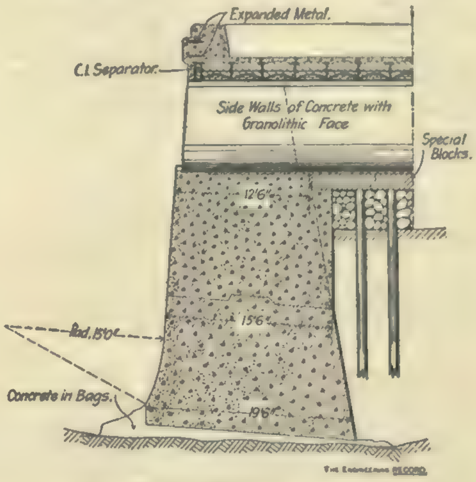
The blocks of which the concrete wall was to be composed were to be made in two sections, the lower section of blocks 19 feet 6 inches wide on the base, 15 feet 6 inches on top, 12 feet high and 6 feet wide, weighing 88½ tons. The top blocks were to fit over a tongue in the top of the bottom blocks and were to be 12 feet 6 inches on top and 12 feet in height, weighing 73 tons. A floating derrick of 100 tons capacity was available at the adjoining wharf. It was intended that the bottom rock should be benched off, a proper base formed of concrete in bags, the blocks set by the derrick, bringing the construction up to the elevation of low water, and the wall above low water to consist of granolithic-faced work, to be carried up in the same manner as the concrete section of the sewer. Special blocks were to be made for the sewer and the connection between bulkhead and sewer.

In the actual construction of the work there was some variation from the designs, as a consequence of the methods used by the contractor. Instead of arranging to drive piles from a floating machine the contractor elected to trust to cofferdams for the concrete section.

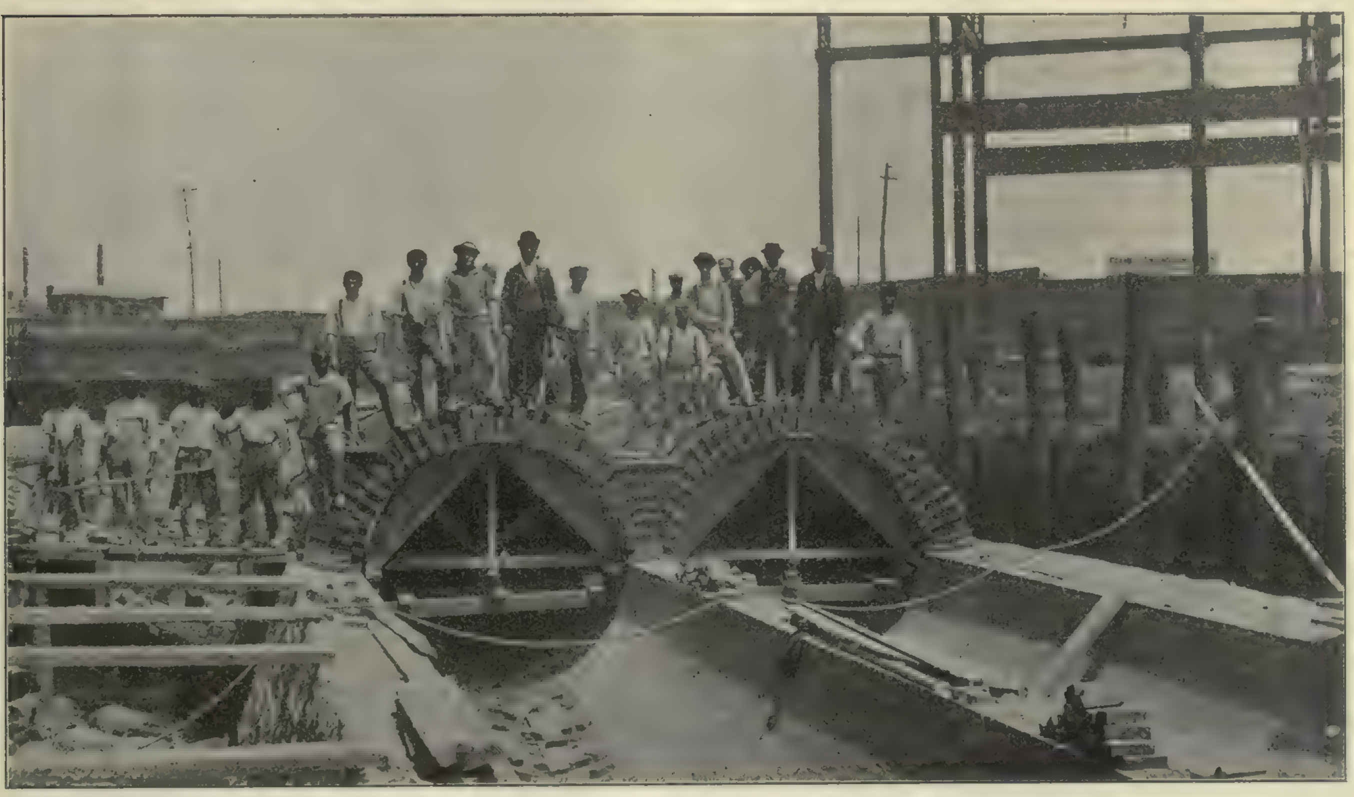
Three of these were built, and he was under the necessity of rebuilding all of them, owing to severe floods and high tides. They each consisted of two rows of heavy tongued-and-grooved sheathing tied and braced, with inclined piles for buttresses, the whole filled in with puddle, and earth dumped behind and in front of the sheathing, and the outer slope riprapped. A sluice gate was provided for draining off water at times of floods. The method adopted also required the construction of a large twin flume, of sufficient size to carry the dry-weather flow of two sewers 8 feet in diameter, for the whole length of the brick section. The flume supports consisted of three rows of piles on 10 foot centers longitudinally, the flume boxes being held in position by a yoke of scantling bolted above and below to the piles, with several intermediate yokes. The flume boxes were constructed of 2-inch tongued-and-grooved planed boards, the interior dimensions of each being 5 x 4 feet.

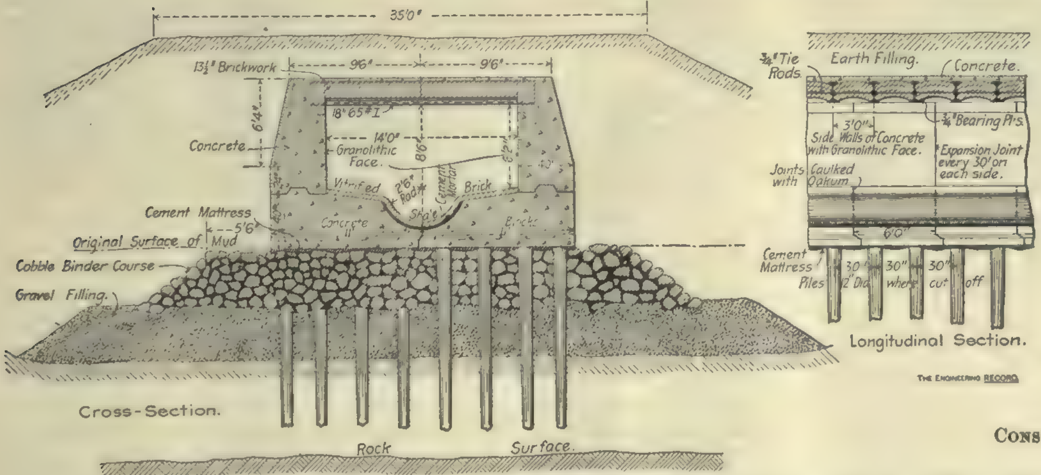


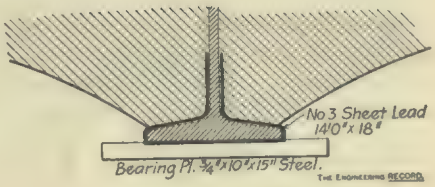
Twin Sewer, Aramingo Canal System.

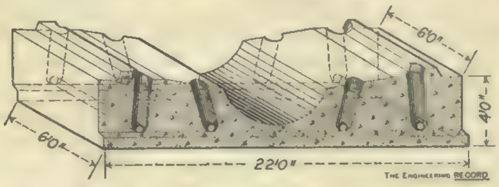


Sewer Outlet.


View of the Twin Sewers, Showing Special Bond of the Brick Arches




No 3 Sheet Lead 14'0" x 18"
Bearing Pl. ¾" x 10" x 15" Steel.
The Engineering Record
Protection of Beam Flange.



Construction of Concrete Sewers.

THE OUTLET SECTION OF THE ARAMINGO CANAL SEWER SYSTEM, PHILADELPHIA.

WM. C. HADDOCK, DIRECTOR OF PUBLIC WORKS; GEO. S. WEBSTER, CHIEF ENGINEER, BUREAU OF SURVEYS; GEO. E. DATESMAN, PRINCIPAL ASSISTANT ENGINEER; MICHAEL O'ROURKE, CONTRACTOR.

In the lower flume, 600 feet in length, there were but two rows of piles, 6 feet apart longitudinally, and a single 5 x 8-foot box. The upper brick section, as far as the junction chamber, was placed in service after the latter was built, a dam being built in the end of the chamber and the side carried up to the springing line, acting as a weir, over which the water flowed into the lower flume.

The principal changes made consisted in the substitution of gravel for at least 2 of the 4 feet of riprap, the placing of a platform over the piles, and building the concrete section in place, instead of forming the invert of blocks. Owing to the difficulty in guarding against vandalism, the lead covering of the beams was omitted in the lower section. Granolithic-faced concrete was also used in place of the shale-brick invert lining.

The concrete, composed of one part of cement, three of sand or gravel, and six of broken stone, was all mixed by hand. The forms consisted of frames of 3 x 6-inch scantling placed about 4 feet apart, and lined with 2-inch plank, planed on the inside. The specifications required the invert and side walls to have a granolithic face. In the construction of the sidewalls the method adopted for obtaining a smooth face was as follows: A wedge-shaped plank was placed against the inside of the form against which was tamped the coarse concrete in a layer 9 inches in thickness. There being considerable adhesion in the concrete, the wedge-shaped plank was then removed by handles on the edge and the space filled and tamped by means of an edge tool, with a granolithic mixture consisting of one part Portland cement, one part of sand and one part of granolithic grit.

The second day after placing, the forms were removed, and the face washed with a thin coat of cement to remove the marks. One portion of the work, the bulkhead, has not yet been completed. With the cofferdam constructed, the contractor has elected to drive sheet piling inside of the dam a sufficient distance from it to allow for the construction of the bulkhead, and it is his intention to excavate between the sheathing and the dam in the dry, and endeavor to construct the concrete blocks in place.

The sewer above described, built at a cost of more than $200,000, completes the improvement.

The work is being done under contract with the Department of Public Works, Mr. William C. Haddock, director, and was designed and executed under the supervision of the Bureau of Surveys, Mr. George S. Webster, M. Am. Soc. C. E., chief engineer. It was under the direct charge of Mr. George E. Datesman, principal assistant engineer, and Mr. Norman L. Stamm, assistant engineer. Mr. Michael O'Rourke is the contractor for the work.

Continuous Filters for Sewage, on a system devised by Mr. F. Wallis Stoddart, of Bristol, England, and used in several towns in that country, are described in "Engineering." He makes the filter of washed clinker 1½ inches and larger in size, or some equally coarse material. This is placed in a tank or simply heaped on a concrete floor, and the sewage, either screened or passed through a septic tank, is dropped in a constant rain at a rate which results in its flowing in a thin film over the stones. The liquid falls from metallic points, which suffer no loss of efficiency even if they become covered with a mucilaginous layer. Across the top of the filter there are placed a series of V-section zinc gutters, side by side, forming, as it were, a roof to the filter. Above, and at right angles to the length of these, there runs a distribution channel which receives the sewage from the tank. It is exactly level, and the sewage overflows its edge, falling into the gutters beneath in equal quantities. These gutters, which are closed at the ends, have notches cut in the edges, while there are pointed projections at frequent intervals along the bottom. The liquid, therefore, escaping at the notches run down the sides, and falls off the points in fine drops, there being 360 points to each square yard of filter. A filter of this type, 6 feet deep, at Knowle, Bristol, operated at a rate stated to be over 9,000,000 gallons per acre in 24 hours, reduced the saline ammonia to 52 per cent. of the original amount in the septic tank effluent it received, and the albumenoid ammonia to 26 per cent. The nitrogen as nitrates and nitrites was increased from none to 1.46 parts per 100,000, while the oxygen absorbea was reduced from 3.37 to 1.36.

Uniformity of Analysis in the Portland Cement Industry.

At the meeting of the New York Section of the Society of Chemical Industry, held at the Chemists' Club on the evening of December 20, the Sub-Committee of the Section on "Uniformity in the Analysis of Materials Pertaining to the Portland Cement Industry," presented its report through the Chairman, Mr. Clifford Richardson, the other members being Prof. S. B. Newberry and Mr. H. A. Schaffer.

This committee was organized in April of this year to endeavor to discover the cause of the great lack of uniormity in the results obtained by different chemists engaged in this line of work. For this purpose a circular was widely distributed asking for co-operation, and favorable responses were received from over thirty chemists who agreed to undertake the analysis, with a description of the methods employed, of samples of a raw rock mixture from the Lehigh Valley and a finished Portland cement. Results were returned by eighteen. The committee was fortunate in securing, through the Director of the U. S. Geological Survey, the cooperation of Mr. W. F. Hillebrand, who not only made a most careful and thorough analysis of the materials, but was good enough to review the results which were reported, criticize the methods, point out the causes of lack of uniformity and agreement in the results and also made some valuable suggestions as to a method proposed by the committee.

The results reported by the eighteen chemists showed great discrepancies, tne variations in the analyses being as follows:

	Raw Rock Mixture. Per cent.	Finished Cement. Per cent.
Silica	15.75 to 13.56	21.56 to 19.18
Average	2.19	2.38
Alumina and iron......	8.50 to 6.70	11.36 to 9.32
Average	1.80	2.04
Iron	2.73 to 1.26	3.76 to 2.30
Average	1.47	1.46
Lime	41.92 to 39.79	64.30 to 62.01
Average	2.13	2.29
Magnesia	2.14 to 1.10	3.13 to 2.52
Average	1.04	.61

The committee, in the light of the information conveyed by these results and methods, and guided by the advice of Mr. Hillebrand, has formulated a method of analysis which is described as follows:

Proposed Method of Analysis of Limestone, Raw Mixture and Portland Cement.

Solution.—One-half gram of the finely powdered substance is to be weighed out and, if a limestone or unburned mixture, strongly ignited in a platinum crucible over the blast for fifteen minutes. It is then transferred to an evaporting dish, preferably of platinum for the sake of celerity in evaporation, covered with a watch glass and 10 c.c. of HCl diluted with about 50 c.c. of water added. Digestion on the water bath is allowed to go on for about fifteen minutes when the substance should be entirely decomposed. (If anything remains undecomposed it should be separated, fused with a little No_2CO_3, dissolved and added to the original solution.) The cover glass is then removed, washed and the solution evaporated to dryness, as far as this may be possible on the bath.

Silica.—The residue, without further heating, is treated at first with 5 to 10 c.c. of strong HCl and then with as much water as the dish will comfortably hold. The cover is then replaced and digestion allowed to go on for 10 minutes on the bath, after which the solution is filtered and the separated silica washed thoroughly with hot water. The filtrate is again evaporated to dryness, the residue, without further heating, taken up with acid and water, and the small amount of silica it contains separated on another filter paper. The papers containing the residue are transferred wet to a weighed platinum crucible, dried, ignited, first over a Brunsen burner until the carbon of the filter was completely consumed, and finally over the blast for thirty minutes and checked by a further blasting of ten minutes or to constant weight. The silica, if great accuracy is desired, is treated in the crucible with about 10 c.c. of HFl and four drops of H_2SO_4 and evaporated over a low flame to complete dryness. The small residue is washed, finally blasted, cooled and weighed. The difference between this weight and the weight previously obtained gives the amount of silica. (For ordinary control work in the plant laboratory this correction may, perhaps, be neglected; the double evaporation never.)

Aluminum and iron oxides.—The filtrate, about 250 c.c., from the second evaporation for SiO_2, is made alkaline with NH_4OH and boiled to expel excess NH_3, or until there is but a faint odor of it, and the precipitated iron and aluminum hydrates, after settling, are washed once by decantation and slightly on the filter. Setting aside the filtrate the precipitate is dissolved in hot dilute HCl, the solution passing into the beaker in which the precipitation was made. The aluminum and iron are then reprecipitated by NH_4OH. The second precipitate is collected and washed on the same filter used in the first instance. The filter paper, with the precipitate, is then placed in a weighed platinum crucible, the paper burned off and the precipitate ignited and finally blasted ten minutes, with care to prevent reduction, cooled and weighed as $Al_2O_3 + Fe_2O_3$. (This precipitate contains TiO_2, P_2O_5, MnO.-

Iron oxide.—The combined iron and aluminum oxides are fused in a platinum crucible at a very low temperature with about 10 grams of $KHSO_4$, the melt taken up with hot water and 25 c.c. of dilute H_2SO_4. The clear solution is then digested on the steam bath for about ten minutes and, if accuracy is desired, the small amount of silica is filtered out, weighed and corrected by $HFl + H_2SO_4$. The filtrate is reduced by hydrogen sulphide, boiling out the excess afterward while passing CO_2 through the flask, and titrated with permanganate.. (In this way only is the influence of titanium to be avoided and a correct result obtained for iron.)

Lime.—To the combined filtrate from the $Al_2O_3 + Fe_2O_3$ precipitate, a few drops of NH_4OH were added and the solution brought to boiling. To the boiling solution 10 c.c. of a saturated solution of Ammon. oxalate is added and the boiling continued until the precipitated CaC_2O_4 assumes a well-defined granular form. It is allowed to stand for twenty minutes or until the precipitate has settled and then filtered. The precipitate and filter are placed wet in a platinum crucible, and the paper burned off over a small flame of a Bunsen burner. It is then ignited, redissolved in HCl and the solution made up to about 100 c.c. with water. Ammonia is added in slight excess and the liquid is boiled. The small amount of Al_2O_3 which is separated is filtered out, weighed and the amount added to that found in the first determination, when great accuracy is desired. The lime is then reprecipitated by ammonium oxalate, allowed to stand until settled, washed in a moderate amount of water, weighed as oxide by ignition and blasting to constant weight, or determined with standard permanganate. The accuracy of this method admits of criticism, but its convenience and rapidity demand its insertion.

Magnesium oxide.—The combined filtrates from the calcium precipitates are acidified with HCl and concentrated on the steam bath to about 150 c.c., 30 c.c. of a saturated solution of $Na(NH_4)HPO_4$ are added, and the solution transferred to a beaker and boiled for several minutes. It is then removed from the flame and cooled by placing the beaker in ice water. After cooling NH_4OH is added drop by drop with constant stirring until the crystalline ammon-magnesia ortho-phosphate begins to form and then in slight excess, the stirring being continued for several minutes. It is then set aside for several hours in a cool atmosphere and filtered. The precipitate is redissolved in hot dilute HCl, the solution made up to about 100 c.c., 2 c.c. of a saturated solution of $Na(NH_4)HPO_4$ added, and ammonia drop by drop, with constant stirring until the precipitate is again formed as described. It is then allowed to stand for about two hours, when it is filtered on paper or a Gooch crucible, cooled and weighed as $Mg_2P_2O_7$.

THE ENGINEERING RECORD EUROPEAN BRIDGE SERIES. XLVIII, DRESDEN, ELEVATED RAILWAY VIADUCT.
The central railway station, Dresden, showing also the railway tracks carried over the principal thoroughfare of the city. The space underneath is used for business purposes.

Potassium and sodium oxides.—For the determination of the alkalies, the well-known method of Prof. L. Lawrence Smith is to be followed, either with or without the addition of $CaCO_3$ with the NH_4Cl..

Sulphur trioxide.—One gram of the cement is dissolved in 15 c.c. of HCl, filtered and the residue washed thoroughly. (Evaporation to dryness is unnecessary, vide Hillebrand.) The solution is made up to 250 c.c. in a beaker and boiled. To the boiling solution 10 c.c. of a saturated solution of $BaCl_2$ is added slowly, drop by drop from a pipette and the boiling continued until the precipitate is well formed. It is then set aside overnight, filtered, ignited and weighed as $BaSO_4$.

Total sulphur.—One gram of material is weighed out in a large platinum crucible and fused with Na_2CO_3 and a little KNO_3, being careful to avoid contamination from sulphur in the gases from the source of heat. The melt is treated in the crucible with boiling water and the liquid poured into a tall narrow beaker and more hot water added until the mass is all dissolved. The solution is then filtered. The filtrate contained in a No. 4 beaker is to be acidulated with HCl and made up to about 250 c.c. with distilled water, boiled, the sulphur precipitated as $BaSO_4$ and allowed to stand overnight.

Loss on ignition.—Half a gram of the cement is to be weighed out in a platinum crucible and blasted fifteen minutes. The loss by weight, which is checked by a second blasting of five minutes, is loss on ignition.

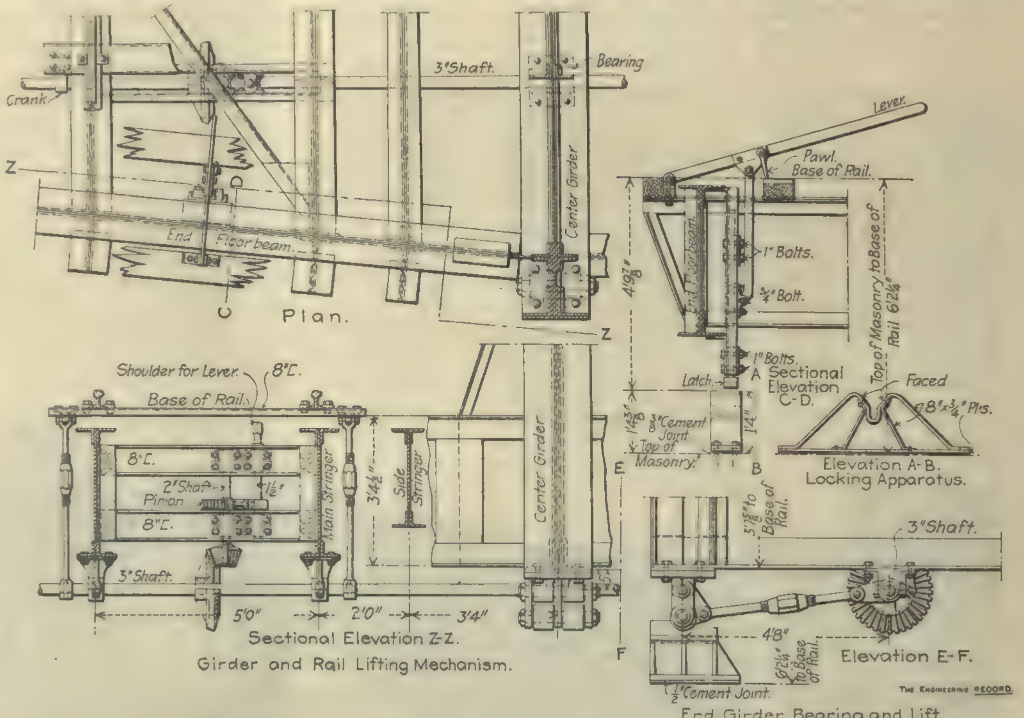
The committee earnestly requests all chemists to give this method a trial, and especially those who still have the samples distributed previously, and to report their results to the chairman with criticisms of it and suggestions for its modification.

The Little Calumet River Drawbridge.

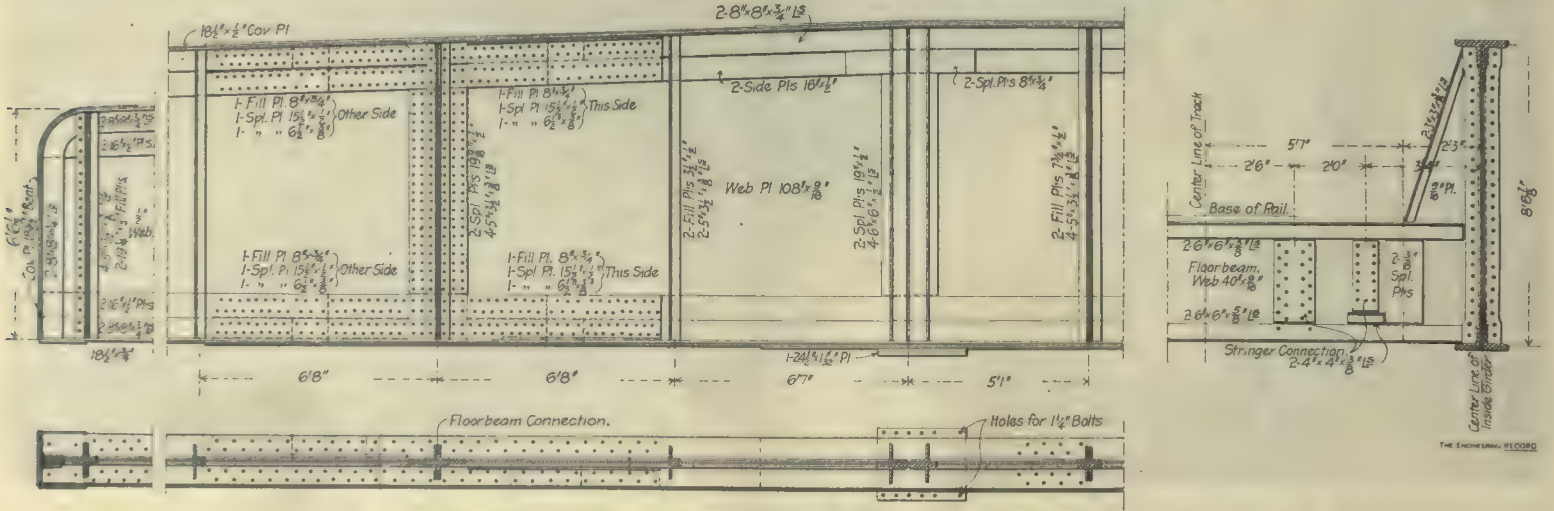
The Illinois Central Railroad crosses the Little Calumet River at Riverdale, Ill., on a double-track throughplate-girder draw-bridge of 171 1-3 feet span. The bridge is the farthest up-stream of any on the river, and has to be swung only occasionally for launches and small tugs, and very rarely for any other vessels. It has three lines of plate girders, which are seated directly across the top flange of a plate girder drum 32 feet 8 inches in diameter and 48 inches deep, which is supported by 60 coned 15-inch cast-steel wheels with 10-inch treads. The bridge is very compact, with heavy girders and simple connections to the drum, and the rail base is about 10 feet above the top of the coping of the pivot pier. The total weight of the moving part is about 720,000 pounds, and it can be swung open and closed in about six minutes by two men on each of the operating levers, which are on opposite sides of the drum.

The main girders are all of the same center height and general design, but the side girders are 3 feet shorter than the center girder, and are made with lighter materials. At the ends of the girders the upper corners are rounded to a radius of 16 inches, and the end web stiffener angles are curved to meet the top flange angles on the tangent with milled butt joints covered by 3/8-inch splice plates. The girders are divided into panels from 4 feet 3 inches long at the ends to 6 feet 8 inches long in the middle, by vertical web stiffener angles, which are fillered up to the plane of the 16-inch side plates and crimped over the webs of the flange angles. The flanges are reinforced by pairs of full-length 16-inch web plates, and by 18 x 1/2-inch cover plates with four rows of rivets. At intervals of 18 feet 4 inches the web stiffener angles are in sets of four and serve as web connections for the floorbeams; at other points they are in pairs, one angle on each side of the web.

Each girder was shipped in three sections, the middle one 55 feet long, and weighing, in the case of the center girder, 48,300 pounds. The field splices of the center girder each contained 506 web and 106 flange 7/8-inch rivets, all driven by pneumatic hammers. The side plates and flange angles are all full length in each section of the girder, overlapping at splices with milled broken joints. The adjacent plate and angle are spliced on the same side of the web and both have short pieces of their own sections for covers. The sections of web plate are from about 21 feet long at the ends of the girder to 13 1/4 feet long in the center, and are shop spliced similarly to the field splice, except that there the cover plates are only 13 inches wide and have only four vertical rows of rivets.



LIFTING AND LATCHING MECHANISM.



CENTER GIRDER SPLICE AND FLOORBEAM CONNECTION.

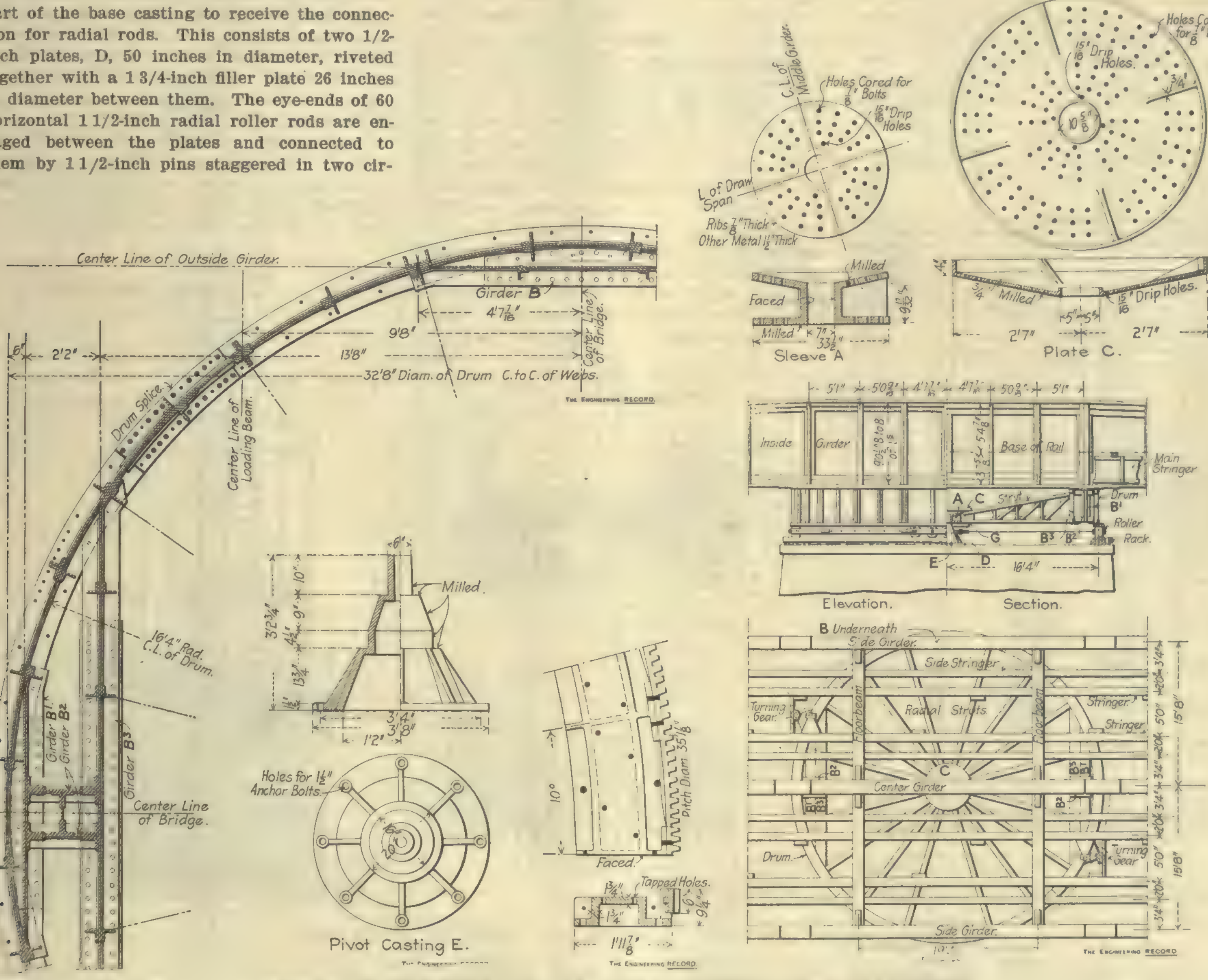
The floorbeams are web connected to the girders by gusset plates the full depth of the latter and 25 inches wide, which really form the end sections of the floorbeam webs and are shop spliced to them with double cover plates as shown in the cross-section through the center girder. The opposite end of the floorbeam corresponds to the end shown and is field riveted to the outside girder. Each track has two lines of main stringers 35 inches deep and two lines of outside stringers 26 inches deep, all web connected to the floorbeams in the usual manner and having angle clips riveted to the bottom flanges of the main stringers to connect them to the X-brace lateral angles, which are riveted to connection plates in the lower flanges of the girders.

The girders, floorbeams and stringers form a rigid platform, which is set close on top of the drum and is supported by it at sixteen points at the intersections of the center lines of the drum. main girders and center floorbeams. Each side girder has two drum flange bearings, at each of which there are two thick plates riveted to its lower flange and the lower one is planed on the bottom. The two middle floorbeams have drum flange bearings similar to those of the side girders, and are made much heavier than the other floorbeams to transfer part of the load of the span to the drum. Each floorbeam flange is reinforced by a 14x 1/2 inch cover plate, the web is reinforced from the center to the outside girder (over the drum bearing) by two 25 x 5/8-inch plates, and there are two vertical rows of rivets in the gusset plate connection to the main girder web.

The drum is made in four nearly equal sections about 25 1/2 feet long, with 1/2-inch web and two 6 x 6 x 5/8-inch angles in each flange. Vertical web stiffener angles with fillers divide it into panels of from about 2 1/2 to 3 1/2 feet long, and the ends are milled to radial joints. The butt joints of the sections are spliced together with double web cover plates having 66 field rivets each, and the flange angles are spliced with a 5 1/4 x 5/8-inch bar 4 1/2 feet long, with a rounded edge to fit the fillet, for a cover plate inside each flange of each angle. The drum is stiffened on four opposite sides by plate girders, which have a depth equal to that of the drum, and flanges flush with the drum flanges, and are connected to it by field rivets through the webs of the girders, which are bent tangent to the drum web. One of these girders, B, is parallel to and has its web nearly in the plane of the web of each of the main side girders; two other pairs of stiffening girders, B_1 and B_3, are at right angles to the first, and each one supports at the center point one end of a very short longitudinal double web girder, B^2. The center of girder B_2 is in the plane of the web of the center main girder, and it receives the bearing plate of the latter. One-fourth of the total load of the girder is, therefore, transmitted to each of these transverse girders, B_1 and B_2, and one-half of that amount is transmitted to each of the end connections to the drum web.

The drum is stiffened by sixteen equidistant radial struts in vertical planes, part of which are riveted at the outer end to the vertical web stiffener angles of the drum and the others have bent web plate connections to the webs of the stiffening girders. The struts are simple lattice girders with T-shaped top and bottom chords, which, with the web members, are made of 3 x 3 and 3 x 2-inch angles. The bottom chords are horizontal and the top chords are inclined so as to give the struts a depth of 3 1/4 feet at the drum and about 1 foot at the pivot, where the lower chord angles are bolted to a 3/8-inch horizontal steel center plate, G, 61 inches in diameter. This plate has a circular stiffening flange angle on the under side, and is bolted to the under side of the double flange cast-steel sleeve, A, which revolves on the upper part of the pivot casting. The upper flange of the sleeve is dished and has bolted to it the conical surface of a cast-steel plate, C, 62 inches in diameter, which is flanged on the outer edge and slopes to receive the top chord angles of the radial struts, each of which is fastened to it with six 7/8-inch bolts. The sleeve is bushed with phosphor-bronze and fits the 6-inch vertical spindle on top of the pivot casting.

A 16-inch shoulder is turned on the lower part of the base casting to receive the connection for radial rods. This consists of two 1/2-inch plates, D, 50 inches in diameter, riveted together with a 1 3/4-inch filler plate 26 inches in diameter between them. The eye-ends of 60 horizontal 1 1/2-inch radial roller rods are engaged between the plates and connected to them by 1 1/2-inch pins staggered in two circular rows. At the outer ends the rods are upset to 1 3/4 inches to form axles for the coned rollers, which are set in a live ring composed of two concentric 6-inch channels with butt joints and web cover plate splices bolted on so that the sections are separately removable. The channel webs are vertical and are bored to fit the ends of the rods, which have a forged shoulder bearing on the inside of the inner channel and a nut bearing on the outside of the outer channel.



DETAILS OF THE DRUM OF THE LITTLE CALUMET RIVER DRAW-BRIDGE.

The wheels have an upper track made of 2-inch beveled steel plates in 36 segments, with oblique butt joints countersunk, bolted to the under side of the lower drum flange. The bottom tread is composed of nine cast-iron segments about 7 feet long, 2 feet wide and 7 inches high, with radial vertical flange bolted joints. Finished rolled steel track plates, like those on the drum flange, are secured to the upper surface with countersunk tap bolts. The rack forms a complete circle and is made in eighteen segments, bolted as shown in the detail to the vertical surfaces of lugs on the outside of the track segments. The rack segments have no shrouding nor flanges, but are stiffened by a horizontal center web and are secured by 7/8-inch bolts countersunk between the teeth.

Each end of the bridge is lifted by an independent hand gear, which is attached to a frame between the center stringers of one track, and operates a 3-inch horizontal transverse shaft just below the lower flanges of the main girders. This shaft is about 4 1/2 feet from the end of the center girder and has, in the plane of each girder, a crank shaft with a long adjustable link pivoted to it. The opposite end of the link is pivoted to a roller bearing suspended from the under side of the girder so as to form a toggle joint. When the toggle is operated the roller bearing is forced into a vertical position, as shown in the accompanying elevation, and seats against a concave stop on the pedestal, lifting the end of the girder and locking itself against the side of the casting. The ends of the bridge are thus raised when it is closed fo r use of trains, and are lowered by the action of the toggles and cams in order to open it. When the ends of the bridge are lowered before swinging them off from the abutments, the end of each rail is simultaneously raised in cast-iron guide shoes, by a vertical rod pivoted at the top to the cross bar under the track, and at the bottom to an eccentric on the transverse main shaft.

The bridge is locked by a latch on the lower end of a vertical bar sliding in cast-iron bearings, bolted to the inside of the web of a channel bracketed out from the end floorbeam. The latch is operated by a lever, which lies flat between the tracks, clearing trains when the bridge is locked. When the bridge is unlocked the lever projects obliquely above the track and is supported in that position by a pawl engaging one of the cross ties. The latch seat is made of 8 x 3/4-inch bent plates riveted together and bolted to the masonry with four 1-inch bolts.

The turning gear multiplies about twenty times, and, like the lifting gear, is operated by a key wrench which consists of a bent rolled-steel bar bolted to a cast-steel socket, which receives the square stem of the vertical driving shaft.

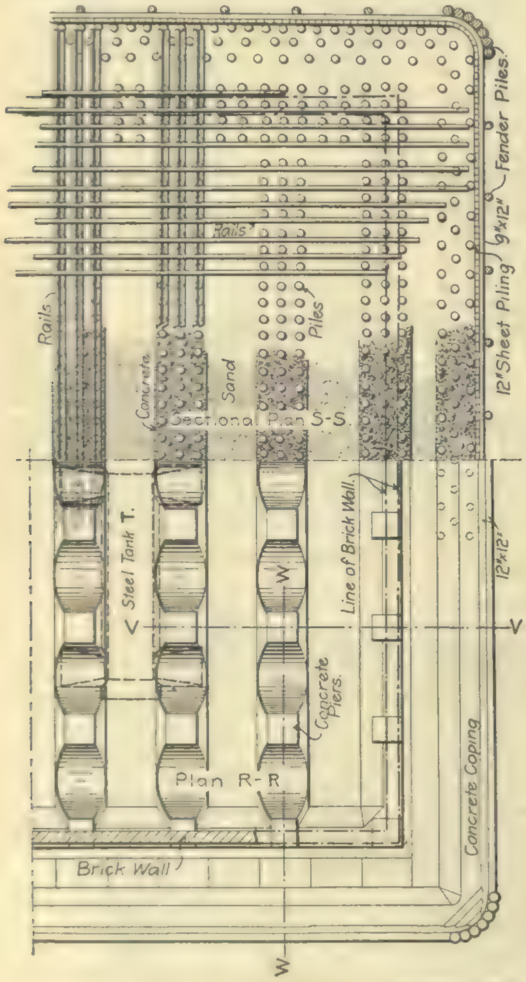
This bridge replaced a trussed draw-span, and when erection was commenced in the winter the river was frozen, and only two small tugs passed through the falsework on which the tracks were supported, the old trusses removed and the new span erected. The main girder sections were handled by traveling derricks mounted on flat cars, which also handled the floorbeams and stringers. The drum and center girders were handled by a stationary boom derrick.

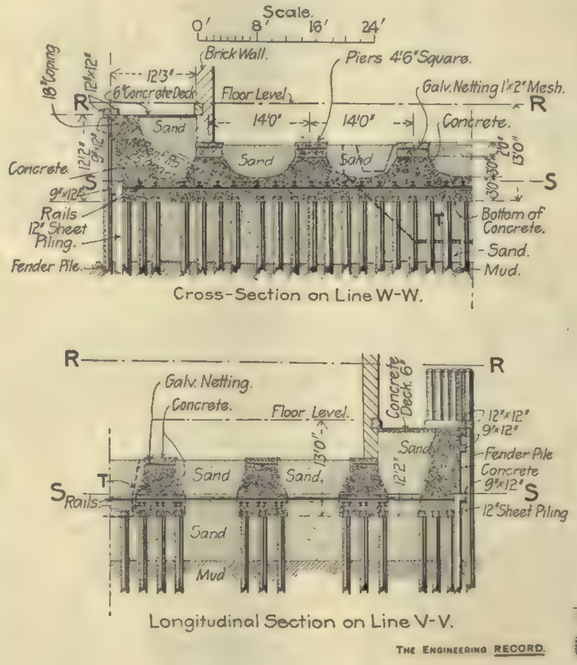
The detail drawings were made in the railroad company's office under the direction of Mr. H. W. Parkhurst, engineer of bridges and buildings, Mr. R. E. Gaut, chief draughtsman. The span was built by the American plant of the American Bridge Company, and erected by the superintendent of bridges of the Illinois Central Railroad.

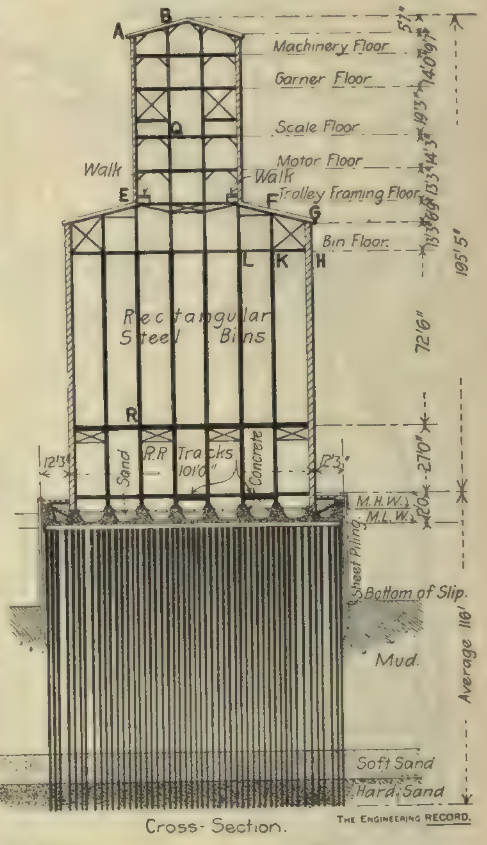
The Weehawken Elevator.

A fireproof grain elevator of 2,000,000 bushels total capacity is being built at Pier 7, Hudson River, Weehawken, N. J., at the eastern terminus of the West Shore Railroad, one of the New York Central lines. The main building, 353 feet 8 inches long, 101 feet wide, and about 200 feet high, will be constructed of steel, brick and concrete, with concrete footings on a pile foundation about 390 feet long and 125 feet wide. The depth of water in the adjacent slips is about 32 feet at mean low water, and the test borings indicate mud extending from 75 to 110 feet below low water, below which there is fine sand.

Around the four sides of the site there are driven three rows of round piles, 2 feet 6 inches apart. The piles are about 4 feet apart in the rows and staggered, except in the outer rows, in the long sides of the pier, where they are only 28 inches apart on centers. There are triple rows of piles across the site under the transverse rows of columns, and quadruple rows under the longitudinal rows of wall columns, all of them about 3 feet apart on centers, longitudinally and transversely. There are about 5,000 round piles, from 90 to 115 feet long, in the foundation, and they were required to be driven with a 3,000-pound Warrington steam pile driver hammer. About 3,800 piles are made in two sections, butt-jointed and spliced with a 1¾ x 18-inch dowel and six 3 x 6-inch white-oak fish plates 16 feet long, which have chamfered ends, and are secured to the piles by 10-inch spikes. The upper sections of the piles are from 60 to 75 feet long, varying so that the splices are not in the same horizontal plane. They have diameters of at least 12 inches at the cut-off, 15 inches at the splice and 8 inches at the point.







STEEL FRAME AND FOUNDATIONS OF THE WEEHAWKEN ELEVATOR.

A space of about 390 x 126 feet between the slips was dredged to a depth of 8 feet below mean low water and the piles driven there and cut off at a uniform level of 3 inches below mean low water. The space around and between them was filled with sand up to a level of 1 foot below low water and the top leveled, rammed, and covered with a layer of 1:3:5 Portland cement concrete of a minimum thickness of 3 feet. The concrete was made with broken stone from ⅛-inch to 2 inches in size, and was required to conform to very complete specifications for cement tests and details of mixing and laying. The concrete forms a continuous wall, 5 feet wide at the base and 12 feet 2 inches high all around the four sides of the pier, and following the arrangement of the rows of piles, connects the long side walls with a gridiron of transverse footings 7 feet wide at the base, and 14 feet apart on centers. The spaces between the transverse footings, about 7 x 91 feet on the bottom, were rammed full of sand up to within 4 inches of the top of the concrete and covered with 3¼ inches of 1:3:6 Portland cement concrete made with coarse sand and ¾-inch broken stone, and finished with ¾-inch of 1:1 cement mortar, troweled smooth. A pair of old steel rails was embedded in the concrete 9 inches above each transverse row of piles, and a second tier of continuously spliced rails was laid across them, over each longitudinal row of piles. These rails passed through the alternate beds of sand filling and tied all the footings together with a grillage platform, which derived tensile strength from the six-bolt splices with which the rails in each line were connected. The flanges of the rails were nicked or bent to secure bond with the concrete.

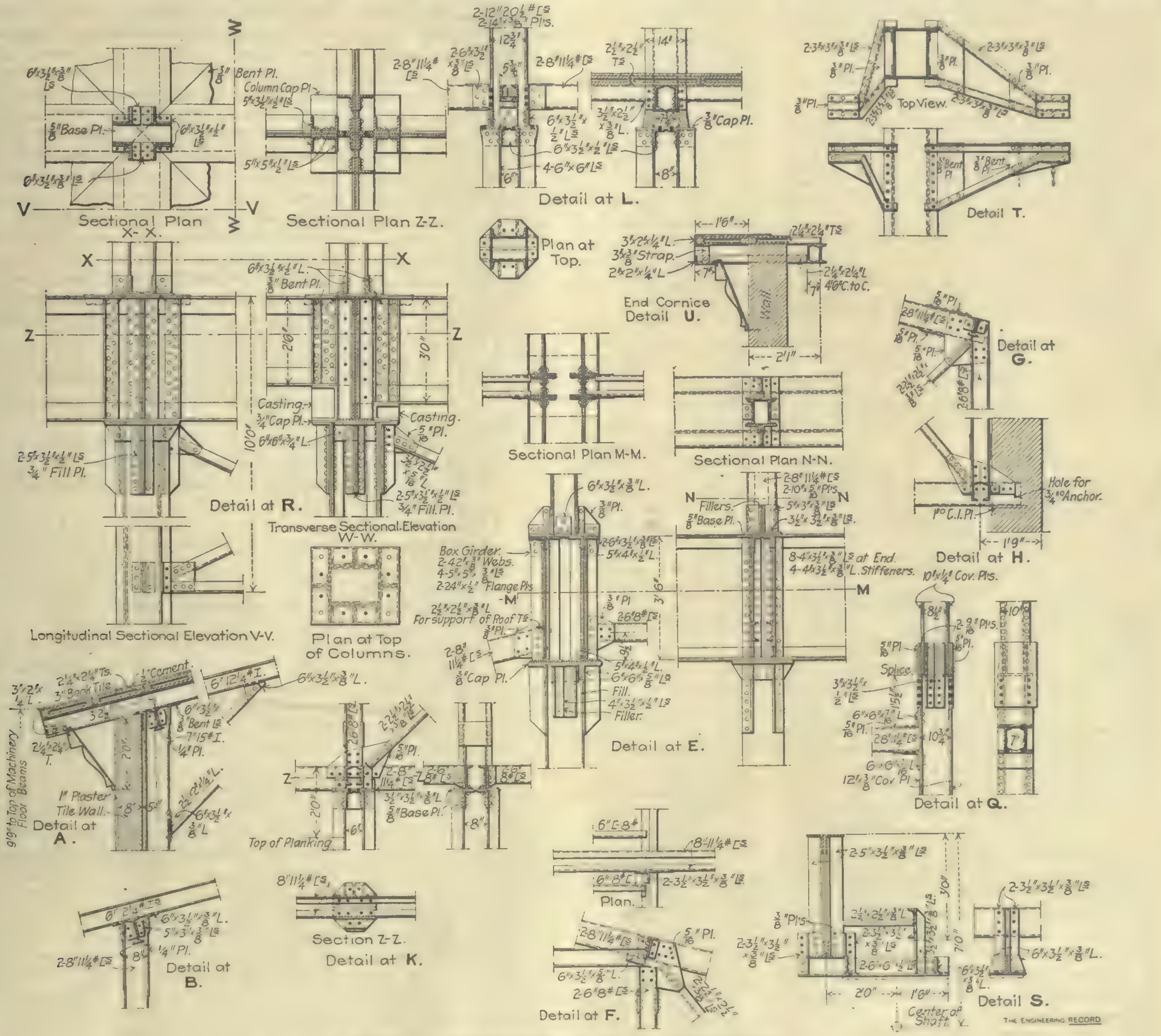
Each transverse triple row of piles supports six intermediate column bases 4½ feet square and 2 feet deep, made of 1:1:2 concrete, with broken stone from 1/16 to ¾ inch in diameter. Each base has bedded in it a square horizontal piece of galvanized-iron netting with 1 x 2-inch mesh. The bases are set on top of the concrete footings, which between them take the form of inverted transverse arches, with clear span and versed sine of 9½ feet and 3 feet respectively. The walls are built on similar continuous concrete footings 3½ feet wide, which are anchored to the retaining walls on the sides of the pier by bent rails, like oblique dogs, 25 feet apart. Between the transverse footings there are steel tanks sunk 6½ feet below the low water level and supported on piles and plank grillages to receive the elevator boots. The concrete was rammed in 6-inch layers with two-man rammers weighing not less than 30 pounds each. When concreting was stopped at night or at other times before a section was completed, the edges were left clean and true without steps or irregularities, and were cleaned, wet and washed, with neat Portland cement when the work was resumed. All exposed surfaces were covered with canvas until thoroughly set. The 6-inch layers of concrete in the bulkhead walls were laid with vertical faces and small offsets in the exposed faces corresponding to the batter. Over these offsets was plastered 1 : 2 Portland cement mortar of an average thickness of 1 inch, which was deposited simultaneously with the backing to give the smooth inclined face. The space around the elevator, between the pier wall and the building, is paved with 6 inches of 1 : 3 : 6 Portland cement concrete made with 3¼-inch broken stone and laid on the sand filling. This concrete is laid off in blocks of about 40 square feet each with expansion joints between them, and is covered with 2 : 3 Portland cement mortar, floated smooth and rubbed on top.

The elevator sub-structure, including the concrete bulkhead walls, is entirely enclosed by 12 x 12-inch sheet piles 50 feet long. They have 2 x 4-inch strips spiked to them to make tongues and grooves, and have the lower ends beveled to make them draw close together in driving. The tops are cut off about a foot above low water and have a 9 x 12-inch walling piece spiked on outside. A horizontal 2-inch forged bolt is secured with six 1-inch bolts to the web of each transverse grillage rail at the end and passing through the adjacent sheet pile has bearing on the outside of the waling piece with a special cast-iron socket nut having the outer end closed and the inner end provided with a 6-inch flange 1 inch thick. In the center of each space between the transverse footings there is an eye-bolt through the sheet piles and walling pieces, which has at the inner end two 2-inch hook bolts connected to it. These are adjustable by sleeve nuts in the middle and extend obliquely, in a horizontal plane, to the webs of the transverse grillage rails to which they are connected by six 1-inch bolts. White oak fender piles 10 feet apart are driven outside the sheet piling and in clusters at the corners of the pier. All places where timbers cross each other and are in contact, and the surfaces of joined portions have a preservative treatment of dead oil.

The superstructure of the elevator covers all of the pier except a deck 10 or 12 feet wide around the sides and end, and up to the eaves of the main roof has a height of about 122 feet above the column bases, which is divided into three stories and is devoted to the storage bins and railroad tracks. The brick walls are self-supporting and nearly independent of the steel framework which carries the floors and roof. This framework is supported on eight longitudinal rows of twenty-six steel columns each which are spaced 14 feet apart on centers in both directions. The roof is carried on the first and second rows of columns each side of the center line and by the side walls, and has a pitch of 1 : 4. The middle four rows of columns are extended to the top of the upper part of the building, which is 44 1/3 feet wide over all, 82¼ feet high above the main eaves, and extends the full length of the building. Its walls are supported directly by the columns, and it is divided into five stories which are used for the motors, machinery, scales and for weighing, cleaning and handling the grain.

At the river end of the building there is a 14-foot brick spiral-stair tower extending to the top of the main walls, and at the shore end there is a 16 x 20-foot brick stair tower to the top of the highest story. On the east end of the south side there is a 12 x 30-foot steel frame tower about 93 feet high, which contains a dock elevator. There are eight receiving elevator legs with shovel apparatus for unloading cars; eight shipping elevator legs for loading; one elevator leg for cleaning and transfer purposes, and one elevator leg for screenings. Nearly all of the first-story columns for a length of about 29 feet are made with four 6-inch Z-bars, one 14-inch web-plate, and two 21-inch flange-plates; the exterior columns, however, are made with two channels and one I-beam. The wall columns are 12 x 14 inches and the interior columns are 16 x 18 inches. They have bottom connection angles and base plates bolted to square cast pedestals with reinforced webs and extended bases. The tops have thick, reinforced cap plates across which are seated, as shown by the accompanying details, the rectangular steel bins 72½ feet high. The wall columns terminate at the second floor level and the six interior rows are continued through the bin story with special 72½-foot sections which are seated on the cap plates of the first-story columns and terminate just below the bin floor. At this point they are capped with horizontal plates to which are bolted the bases of the upper sections of the columns which are made of pairs of channels latticed or having cover plates. The bin columns are each made with four 8 x 8, 6 x 6 or 5 x 5-inch angles arranged to make a star-shape cross section and spliced in 16½-foot lengths with ⅜-inch bent plates countersunk riveted on the insides. The four angles of each column are not connected together, and each one receives the steel plate forming the vertical side of a bin. Above the bin floor the column beam construction is of the ordinary type, and the connections are simple angle and gusset plate joints riveted up without bolts.

In the first story of the building in each of two of the seven aisles between the longitudinal rows of columns is a single railroad track from end to end, carried by 20-inch 60-pound I-beam stringers, one under each rail. The stringers are web connected to 24-inch transverse plate girders, which are in turn web connected to the column cover plates. In all the other aisles there is a 4-inch concrete floor supported on 10-inch 25-pound longitudinal I-beams and 15-inch 42-pound transverse I-beam girders. At the top of the first story there is no floor, and the bottoms of the plates in the steel bin walls there are stiffened by pairs of 5 x 3½-inch angles which correspond to the lower flanges of plate girders, are seated on the column caps and divide the space into 14-foot-square panels. About half of the panels are subdivided, thus making half-size bins, which have their wall plates stiffened with Z-bars. The tops of the



PRINCIPAL CONNECTIONS OF STEEL FRAMEWORK.

bin-wall plates are stiffened with pairs of horizontal 2½ x 2½-inch flange angles. The floor surface is of 3-inch book tile, laid in cement on 2½ x 2½-inch 5 5-pound tees 2 feet apart.

The lower roof rafters are pairs of 8-inch channels with double gusset plate connections to the webs of the outer columns. At the upper ends they are connected to the webs of the box girders 3½ feet deep, which carry the side walls of the upper part of the building and at the lower ends they rest on the 13-inch brick wall. The tops of the outside angle-posts are connected to the rafters by means of gusset plates, and the vertical transverse panel is X-braced by pairs of 4 x 3½-inch angles riveted together back to back. The roof is covered with 3-inch book tile laid in ½-inch cement on 2¼ x 2¼-inch T-bars 18 inches apart on 6-inch purlin I-beams, 4 feet 8 inches apart.

At the level of the top of the side roofs there is no floor in the center part of the building, but there is a concrete sidewalk bracketed out from the top of the longitudinal box girders, and there are pairs of 6-inch channels to make transverse and logitudinal girders and as many transverse intermediate beams as are needed for the trolley framing. The upper floors are made with 6 to 9-inch beam and channel joists except in the center panel of the scale floor where there are 15-inch and 18-inch transverse girders supporting pairs of 12-inch longitudinal channel girders. The floors are 3-inch concrete slabs. The roof is laid with book tiles similar to those in the side roofs, and supported on 8-inch channel rafters, 7 feet apart, which rest across the top flanges of 7-inch longitudinal I-beams normal to them, riveted to the tops of the column webs.

There are knee braces and X-braces in the upper part of the building in every bent. Besides these braces there is no lateral, transverse or longitudinal bracing, except what is afforded by the solid floor construction.

Most of the first-story columns are made with four 6-inch Z-bars, one 14-inch web plate and two 21-inch flange plates, and have a cap plate riveted to side angles, which are reinforced in the center by a pair of vertical stiffener angles. The horizontal lower flange angles of the bin-wall plates meet in the centers of the caps and are riveted to them. Where the bin plates are spliced their edges are bent up at an angle of 45 degrees, as indicated by dotted lines in detail R, thus deflecting the contents of the bin from the joint.

Cars are pulled through the building on the longitudinal surface tracks by a ⅝-inch wire cable passing over horizontal sheaves and wound on the drum of an electric hoist. The shafting for this service and for the double receivers is supported on column-brackets. The pairs of 5 x 5-inch horizontal transverse angles which support the roller guides of the belt conveyors are hung from the first floor main longitudinal I-beams by 2½ x 2½-inch angles web-connected to them with angle clips.

Girders are supported eccentrically from the first-story columns by cantilever brackets made of bent plates and angles riveted to the column flanges, as shown in detail T. The third-story columns are seated directly on the second-story columns, and the floor beams are connected to them as shown in detail L. In detail K the floor is removed and in detail G the corresponding connection is shown at the top of the outer row of columns where there is transverse X-bracing in the wall panel. Detail H shows the wall conections, and the support at the opposite end of the floorbeam, and detail G is taken at the opposite end of the X-brace and shows the connection at the eaves of the side roof.

The side walls in the upper part of the building are carried by box girders 3½ feet deep, which are supported on the column tops as shown in detail E. The column has an extended cap plate riveted to stiffened side angles, and receives, without rivets, the lower flanges of the girders, which are butted together on its center line, but which are not connected to each other. The adjacent floorbeams and rafters are riveted to connection plates on their vertical web stiffeners, and eight 4 x 3½-inch vertical web stiffener angles are fitted against the flanges to transmit the stress from the upper to the lower column sections. The upper column section is thoroughly riveted to the top of the box girder and has solid web transverse knee braces.

The upper sections of the columns are spliced a little more than a foot above the floor line. Where the column channels change from 10 to 8 inches there is a ⅝-inch thick cap plate or horizontal diaphragm cut to exactly fit the top of the lower section, and set loose between the adjacent column ends, as shown in detail Q, to distribute the load from the upper section of the column on the end of the lower one. The side splice plates are shop riveted to the upper column and fillered out from it to make jaws having clearance to engage the lower section. On the other two faces of the column the joint is stiffened by the pairs of vertical angles used instead of plates to connect the channel webs which are in the same vertical plane in both column sections. At splices where the sizes of the column channels do not change, the splice is similar, except that the horizontal diaphragm is omitted.

At the tops of the columns 7 and 8-inch longitudinal beams, supporting the intermediate rafters, are riveted to their webs, as shown in detail B, with their top flanges in the inclined plane of the bottom flanges of the rafter beams. The other rafters are supported directly on the beveled tops of the columns, and are braced to them with knee-brace angles, which have angle-clip connections to the columns and to the lower flanges of the rafters. At the peak the rafter beams are mitered together and each has a flange angle shop-riveted to each side of the web at the end. The outstanding flanges of these angles are in vertical planes, and are field-riveted together through the web of the 8-inch ridge purlin. At the eaves the rafters pass with slight clearance through notches in the top of the wall, and project about 2 feet clear beyond it to support the cornice, as shown in detail A. The ends of the rafters are connected by fascia angles; and to them and to diagonal bent iron straps, which are built into the brickwork at intervals the galvanized-iron cornice is attached. At the ends of the building the inclined gable cornice of similar patterns is supported, as shown in detail U, by pairs of horizontal cantilever angles anchored to the interior beams and supported on the brickwork.

The upper walls are built of 8-inch partition tiles with ⅝-inch web and 12 x 12-inch face. They are thoroughly anchored to each other and to the steel framework with galvanized-iron straps, and the exterior surface is covered with ¾-inch of 1 : 3 Portland cement mortar and a finishing coat of 1 : 1 mortar. The bricks in the lower 32 feet of the lower walls, and in all of the stair tower, are laid in 1 : 3 Portland cement mortar, the remainder of the brickwork is laid in 1 : 4 lime mortar.

All steel work encased in brick is coated with a 1-inch layer of cement mortar, with which also the columns are covered, and then enclosed with 3-inch hollow tiles with rounded corners.

The hose system for fire protection is supplied by a 10-inch connection with the street main which is valved and metered at the shore end of the building, just inside the meter there is an 8-inch vertical branch, which rises in the stair tower to the first cupola floor and there supplies a horizontal longitudinal distributing main extending to within 30 feet of the opposite end of the buildinf. In this main there are five double T's, from each of which a riser is carried up five stories and down one story, with 2½-inch valves and 50 feet of hose in each story. These risers are 5 inches in diameter at the distribution main, decrease to 2½ inches at the extremities, and serve all parts of the building above the tops of the bins. From just inside the foot of the 8-inch riser a transverse pipe runs nearly across the building and supplies three equi-distant longitudinal mains, which run under the first floor nearly to the river end of the building. These reduce from 4 or 5 to 2½ inches in diameter, and each of them has six 2½-inch vertical branches, terminating just above the first floor with a valve and 50 feet of 2½-inch hose. One branch is continued to the stird story of the marine tower; the other stories of which are served from a riser connected to the longitudinal main on the first cupola floor. This system is intended to be always under city pressure, and to have check valves and connections to a fire pump in the elevator so that it can at any time be used for high pressure.

The general designs of the elevator were prepared under the direction of the engineering department of the New York Central & Hudson River Railroad Company, Mr. W. J. Wilgus chief engineer, and Mr. Olaf Hoff engineer of bridges and buildings. George Moulton & Company, Chicago, are the general contractors, and designed the superstructure and mechanical equipment. Mr. Bernard Rolf is the contractor for the substructure, and the American Bridge Company is the contractor for the structural steel.

A Brick Warehouse Building at Columbus.

A 166 x 62-foot five-story and basement slow-burning warehouse building at the corner of Gay and Front Streets, Columbus, Ohio, was designed by Mr. Frank L. Packard to meet the special requirements of the Eldridge & Higgins Company, wholesale grocers and jobbers, to whom the building has been leased for a long term. As the owner wished a building of exceptional durability the structure contains many interesting features.

The footings of the walls and columns are carried down through gravel and quicksand to solid blue clay, and so much water was encountered that the construction of the foundations was difficult. Atlas Portland cement concrete, made 1 : 2 : 5, was mixed in a rotary machine and poured, with a fall of 10 feet, into the trenches and spread there in 1-foot layers, which were allowed to set under water. Large flat-bed limestone blocks 10 inches thick were laid on top of the concrete footings, and the brick walls, from 25 to 30 inches thick at the bottom, were started on them. All masonry to a height of 1 foot above the basement floor is of vitrified paving brick, 3½ inches thick, 4½ inches wide and 9 inches long, which will not absorb more than 2 per cent. of water and are laid header and stretcher, Flemish bond, with ¾-inch joints. The upper parts of the walls are offset to reduced thicknesses and are faced with paving brick and backed with wire-cut tunnel brick, all laid in 1 : 2 Portland cement mortar.

The walls are self-supporting and, with two longitudinal rows of interior columns, carry the floors and roof. The columns are 12½ feet apart, in rows 20 feet apart and about 20 feet from the side walls, on centers. They have offset concrete footings 7½ feet square, with 4 x 4-foot brick piers which directly carry the first-floor girders. As the street grade slopes down 7 feet from front to rear on the long side of the building, and the basement is made with a level floor throughout, it is over 14 feet high in front, under the office rooms, which are 13½ feet high to the top of the second floor beams. In the rear part of the building, the first floor is 5 feet below that of the offices, making the basement ceiling there correspondingly lower. In the rear of the basement the column piers are 7 feet high, with one stone bonding course and a cap stone; in the front part they are 12 feet high, with three stone bonding courses and stone caps.

The columns are made in five sections each, reducing in size from the bottom upwards, and have projecting flanged cast-iron caps supporting the floor girders at every story. In the first story the columns are 16 x 16 inches, in the second 12 x 12, in the third 10 x 10, in the fourth 8 x 8, and in the fifth 6 x 6 inches. The ends of the columns are seated on the webs of the cast-iron caps, which project beyond them far enough to receive the longitudinal floor girders, which are 16 x 16 inches for the second floor, 14 x 16 for the third floor, 12 x 14 for the fourth and fifth floors, and 6 x 14 for the roof. The first-floor girders, resting on the piers, have clear spans of only 8½ feet and are 14 x 16-inch beams. The transverse beams are 10 x 14-inch for the first and third floors, 12 x 14 for the second floor, 6 x 14 for the fourth and fifth floors, and 4 x 14 for the roof. They are spaced about 3 feet apart on centers, and are carried on top of the girders, to which they are anchored by angles spiked to the tops of the girders with their vertical flanges engaging notches cut across the bottoms of the beams.

The outer ends of the roof beams rest on the tops of the walls; all other beams supported by the brickwork are carried in iron stirrups. Where the longitudinal girders are supported by the brick walls, they are encased in Goetz-Mitchell wall boxes, and where they are supported by lintels they are hung in stirrups. All exposed beams and girders in the office portion of the building are dressed and shellaced, and, as soon as set, were wrapped with heavy building paper and had boards nailed on top projecting ½ inch past the edges, to protect them during the construction of the building.

As soon as the brickwork was finished the 2 x 4-inch matched roof sheeting was laid, and then the sub-floors were laid with diagonal ⅞ x 2¼-inch oak strips laid on edge and spiked together every foot. On top of this was laid asbestos sea-grass quilting and then ⅞ x 2 1/3-inch finished tongue-and-groove beech flooring, matched sides and ends, laid longitudinally and secretly nailed to the sub-flooring. The basement floor was leveled and covered with a thin, tamped coat of dry cinders, on which was laid 4 inches of 1 : 2 : 5 Atlas Portland cement concrete, finished, before it had thoroughly set, with an inch of 1 : 1 cement mortar, troweled and graded to cesspools.

The roof sheathing is covered with one thickness of heavy rosin-coated building paper and four thicknesses of best 50-pound wool roofing felt, mopped solid between laps with Eagle brand asphalt cement, then flooded with 125 pounds of the same cement to each square of the roof and sprinkled, while hot, with clean, washed gravel. The roofing paper and felt were flashed 12 inches up the walls, cemented to the brickwork with asphalt, and counter-flashed with No. 26 gauge galvanized iron let ¾ inch into the brick joint, secured with metallic plugs and pointed with cement mortar. The roof was made with a guarantee to be storm-proof for ten years.

In one corner of the building, adjacent to a stair-well, there is in every story a brick vault and a fireproof room, 18 x 34 feet inside. These rooms are used for the storage of syrups, matches, tobacco and fruits. They have brick walls and brick arch floors grouted, keyed with slate, and supported on 12-inch transverse I-beams 4 feet apart. The floors are concreted and asphalted and the rooms have automatic fireproof doors.

The jambs of all doorways are faced 7 feet high with ¼-inch boiler iron riveted to angles, and the windows which are exposed to other buildings have metal frames glazed with wire glass. Kinnear steel rolling doors are used for the shipping room and elevator shaft. The doors to the fireproof rooms and to all stairways are made with a well braced 2¼ x 6-inch wooden frame covered with 3/16-inch asbestos cardboard tacked in place and sheathed with No. 22 gauge galvanized iron, with double interlocking joints covering all nail heads. They are hung on rollers on overhead tracks, inclined so as to keep the doors always closed.

Stock is carried down from the upper stories to the first story shipping room and thence to the basement on 45-degree chutes with reversed curves at the bottom, which enable it to be handled rapidly for outgoing orders. Where the chutes pass through the floors the openings are provided with fireproof doors held open by fusible links which, in case of fire, would melt and allow the doors to close by gravity. Should any story be flooded with water the chute would carry it off and save the goods on the lower floors from damage by it. The two Otis elevators have a carrying capacity of 2,000 pounds at a speed of 100 feet per minute, and are enclosed in brick hatchways with fireproof doors and Richmond safety gates.

The offices are finished in white oak and are plastered and heated; the broken package room on the third floor is the only other part of the building which is heated, and no other rooms are plastered. The capacities per square foot of distributed load on the different floors are as follows: First, 250 pounds; second, 450 pounds; third, fourth and fifth, 250 pounds each, all with a factor of safety of four, and the columns calculated for the same full loads on all floors simultaneously.

The hot-water heating system in the basement is guaranteed to maintain a temperature of 70 degrees when the outside temperature is 10 degrees below zero. The plumbing includes a fifth floor iron sink, men's and women's toilet rooms and a private office toilet room on the office floor. The sink and all wash basins are supplied with hot water furnished by a Ruud heater in the basement, which is operated by gas. The elevators are run by electricity, with which, as well as by gas, the building is lighted. Switches and fuse block controlling the lights on each floor are set on slate backs in asbestos-lined wooden cabinets at the heads of the stairs in each story. There is a system of ventilating flues connected with electric exhaust fans discharging above the roof.

The total cost of the building was about $85,000, and when it was inspected by the Ohio building inspector for the board of underwriters it was pronounced the best fire risk for that class of building which they had ever taken, and the minimum rate was allowed for the insurance premium.

A Septic Tank Installation similar to that at Wauwatosa, described in The Engineering Record of December 14, has just been completed at Lake Forest, Ill., from the plans of Messrs. Alvord & Shields, of Chicago. The plant comprises a septic tank, distributing chamber and ten intermittent sand filters. It has a capacity of 200,000 gallons per day and cost about $7,000.

The Centenary Collegiate Institute, Hackettstown, N. J.

The Centenary Collegiate Institute has recently erected at Hackettstown, N. J., a group of buildings to replace a number which were burned some time ago. The new group is particularly interesting architecturally, and the first-floor plan of the new structures is given in an accompanying drawing. Incidentally, mention may be made of the heating plant, which is a central one, with a vacuum system of circulation, and of the provisions for illuminating, which include electric lighting supplied from a public service and an acetylent gas installation.

The new buildings comprise the main or administration building, which has a large kitchen wing, and two dormitories, one for the girls and the other for the boys, making practically four buildings, all of which are connected by covered corridors. The arrangement is indicated in the drawing referred to. The curved plan of the dormitories is the result of a desire on the part of the administration to avoid long, unobstructed, straight corridors, which give the boys a chance to roll heavy balls throughout their length during the small hours of the night. Before the plan shown was accepted, several geometric shapes were considered, but these, as well as doors to divide a proposed straight corridor into independent parts were considered ineffective. At one time it was also planned to have the dormitories more or less semi-circular, facing outward from the kitchen wing; this enclosed a semi-circular court, cutting off greatly the view of the inner or court rooms, and on account of the natural beauty of the place it was decided to expand the curves and give all rooms as great an expanse of view as possible. The kitchen wing extending between the dormitories breaks direct communication between those two buildings, as was also desired.

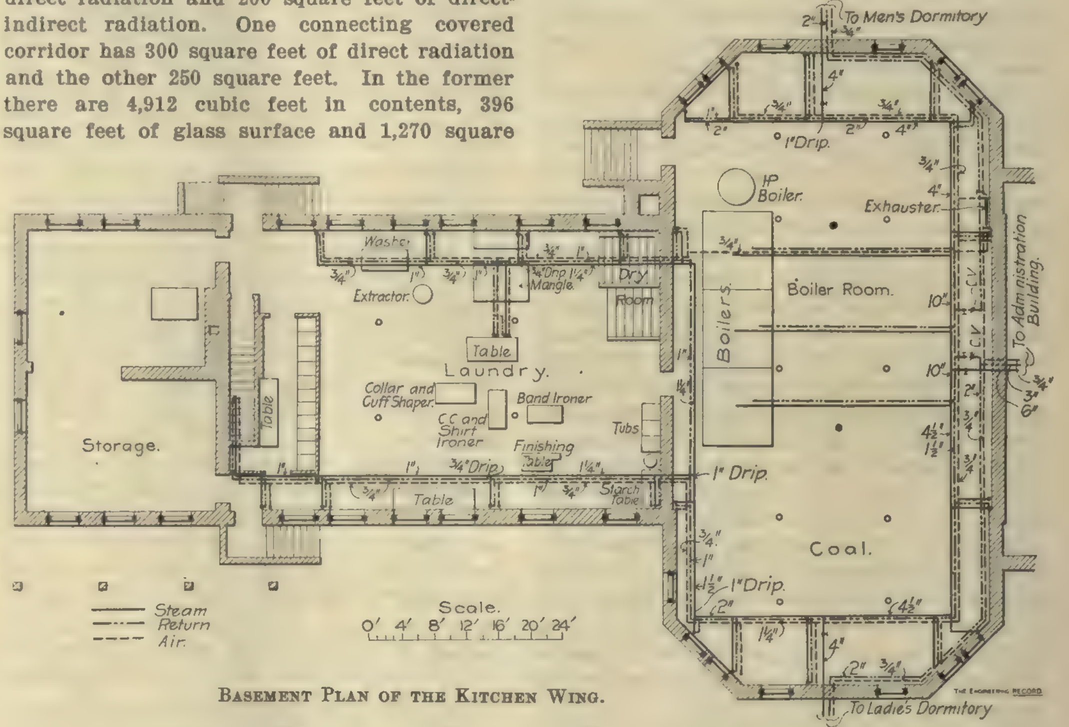
The buildings are three stories in height, those of the administration building being loftier and at a slightly higher level, bringing that building somewhat above the dormitories, which flank the colony. The main building is entered through a porte cochere, and the center above the entrance is surmounted by a dome. The basement facade rises some 20 feet above ground in soft gray-colored brick, laid in rusticated courses, with cornice and water table of cream-white terra-cotta. The walls above the basement stage are of light cream-colored brick, with pilasters.

The first floor of the main building contains a number of parlors and the offices of the Institute. In the second and third stories are a number of recitation rooms and a chapel, or auditorium, the latter over the central portion of the building. On the first floor of the auditorium are six recitation rooms; on the third or gallery floor of the auditorium are eight recitation rooms. In the basement are bicycle rooms and photographic rooms, and at opposite ends of the buildings are the physical and chemical laboratories, respectively, each of the same floor space as the main parlor, including its semi-circular bay. The first floor of the kitchen wing, as shown, contains the main dining room, back of which, in order, are the serving room, the kitchen and the bakery. Underneath the dining room is the boiler room, and underneath the kitchen and serving room is the laundry. A drawing of this, reproduced principally to indicate the general method of distributing the steam for warming, is given herewith. The whole space above the dining room is devoted one-half to fine arts and the other to the library. Over this a number of rooms have been set apart for the sick, and these are provided with separate kitchens. The rest of the rooms in the wing are bedrooms for the help. The arrangement of rooms in the dormitories is indicated in the first-floor plan. The two floors above are similarly arranged, except that there is no room projecting beyond the wall line like the dormitory parlors. In both cases each floor of the dormitories has a teacher's room at each end of the corridor.

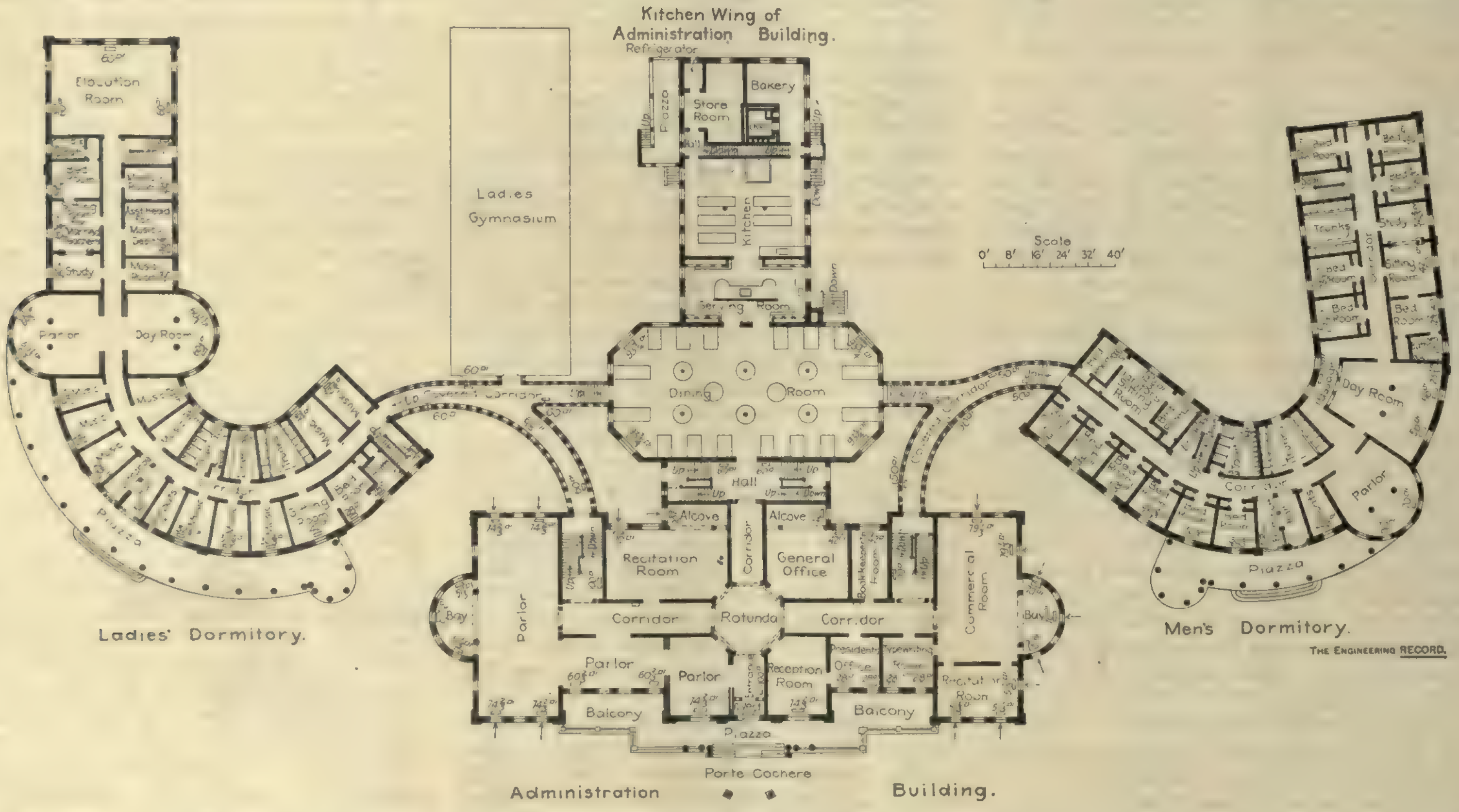
The boiler equipment consists of three No. 5½ Mills boilers, made by the H. B. Smith Company, of New York, and a small high-pressure boiler for the laundry. The plan of the steam piping, though not shown exactly as it was installed, will indicate the scheme of distribution. The boilers feed a 10-inch steam main, which is carried around the basement of the dining room, reducing in size as the branches are taken from it. A 6-inch main feeds the administration building, and a 4-inch main, each of the dormitories. The latter pass under the floors of the connecting corridors. The apparatus is a gravity one, so far as the return of water is concerned, but the Paul vacuum system has been installed, as stated, to accelerate circulation, and in particular to render the distribution of steam to the farthest points as positive as possible. The exhauster for this work is mounted, as usual, on a panelboard, which is located in the boiler room. This induces a suction on the air lines, which are connected to the thermostatic air valves on the radiators in the usual way to remove the air as fast as it collects near them. A ¾-inch pipe line, which leads to the apparatus from opposite directions, is the largest air pipe required. The pipes under the floor of the covered corridors are at a higher level than the piping in the boiler room, and at the dormitories they are lifted to the basement ceilings, the gravity return of the water being thus readily accomplished.

The total radiation is as follows: In the girls' dormitory there are about 237,200 cubic feet of contents, for which 3,007 square feet of direct radiation has been installed. In the boys' dormitory there are 237,280 cubic feet in cubical contents, for which 2,950 square feet of radiation were installed. The administration building encloses about 370,000 cubic feet of space, and there are 2,200 square feet of direct radiation and 4,100 square feet of direct-indirect radiation, the latter in rooms indicated in the accompanying first-floor plan. The kitchen wing contains 146,500 cubic feet of space, of which 111,000 cubic feet are heated; in this building there are 1,220 square feet of direct radiation and 200 square feet of direct-indirect radiation. One connecting covered corridor has 300 square feet of direct radiation and the other 250 square feet. In the former there are 4,912 cubic feet in contents, 396 square feet of glass surface and 1,270 square feet of wall surface; in the latter there are 4,224 cubic feet of space, 337 square feet of glass surface and 990 square feet of wall surface.

The acetylene-gas plant includes a generator made by the J. B. Colt Company, of New York. This is a No. 300 machine, and has a rated capacity of 400 burners for 5 hours, 266 for 7½ hours, and 200 for 10 hours. The generator is of the carbide feed type and has a capacity of 200 pounds of carbide.



BASEMENT PLAN OF THE KITCHEN WING.



FIRST FLOOR PLAN, NEW BUILDINGS, CENTENARY COLLEGIATE INSTITUTE, HACKETTSTOWN, N. J.

OSCAR S. TEALE, NEW YORK, ARCHITECT.

The Rev. Dr. Charles W. McCormick is president of the Institute. Mr. Oscar S. Teale, of New York City, was the architect, and the Baldwin Engineering Company of the same city, contractor for the heating work.

Crusher Sand; produced by setting the jaws of stone crushers for 1¼-inch broken stone, was largely used in the construction of the Burrator dam of the Plymouth, England, water-works. According to Mr. Edward Sandeman, engineer of the works, a cubic yard of crushed granite prepared in this manner contained 10.24 cubic feet of stone over ½ inch in size, 5.69 feet of ¼ to ½-inch stone, 2.56 feet of 3/16 to ¼-inch stone, and 8.51 feet of sand under 3/16 inch. Briquettes made with this sand averaged 27 per cent. stronger than those made with washed sand produced by the natural decomposition of the granite.

The Use of Compressed Air in Bridge Work.

Abstract of a paper presented to the Association of Railway Superintendents by George W. Andrews.

The use of compressed air in large shops is too well known to need much criticism; by its use mechanics have demonstrated its utility in both construction and repairs of various kinds of machinery, in the operation of the various cranes and hoisting appliances of the shops; in fact, its powers are almost unlimited. If this is so for shops, why is it not equally useful for field work? Having seen its advantages in shop work and knowing that it had been extensively used in erection, the writer, having a large amount of bridge work to do, principally strengthening, asked for a plant sufficiently extensive to demonstrate its practical utility. The request was granted, and the result proved the move a wise one.

The plant consists of an air compressor, capacity 95 feet of free air per minute, a 25-horsepower boiler, a water tank of 300 gallons capacity, and an air receiver of 150 pounds capacity. This plant is mounted on a car, which, when in use, is placed on a side track as near as possible to the bridge on which the work is to be done; ¾ or 1-inch wrought pipes are then connected to the air receiver or reservoir, and run to the bridge. At intervals along the bridge hose connections and globe valves are placed in line of pipe for connections to various tools. The tools ordinarily used consist of drills, riveting hammers and chipping hammers; forges can also be arranged to be operated by the air. In operating care must be taken to occasionally blow out this pipe to prevent the accumulation of rust or dirt. Good wire-bound rubber hose should be connected to the pipe for tool use, as flexibility is required for moving tools from point to point.

In locating the plant for operation, it is necessary to consider the water supply, as considerable of this is needed, not only for the boiler, but for the cooling of cylinders of air compressor. This is just as important where gasoline or gas engines are used. For this purpose the writer has installed with the plant a small steam pump, which can be set up at the nearest stream, spring or well, and 1-inch pipe run to the car on which the compressor is installed, and by this means an ample water supply can be furnished at small cost. Steam for operating this pump is supplied from the boiler operating the compressor.

Of the tools used, there are a number of various manufacture in the market, all of which possess more or less merit. The kind the writer has in use are as follows: Little Giant air drill press, Boyer short-stroke riveting hammer No. 0, Boyer long-stroke riveting hammer, Boyer chipping hammer No. 1, Boyer yoke hammer. In the drill press Morse twist drills are used, the shanks of the various size drills being made to fit the press. For chipping hammers, cape chisels, etc., blanks are furnished by the manufacturers to be made up into the style necessary, or the same can be made in one's own shop. The style of tools necessary will be developed by the class of work to be done.

As before stated, the plant should be placed as close to the work as possible. This is, however, only as a matter of economy in the running of pipe. The writer has operated it as far as half a mile from the bridge on which work was done. A plant such as described, exclusive of air pipe for conveying air from plant to bridge, will cost about $1,600.

The cost of operating a plant of this character depends in a great measure on the foreman in charge of the work. The man in charge of the plant should not only see to the proper firing of boiler and running of compressor, but should do the drilling, or assist in same, for all work such as plates, angles, etc., that can be done at car. By doing work of this kind, the actual expense of men for running plant will be reduced at least one-half. The amount of coal used will approximate about one-quarter ton per day.

Ordinary repairs to compressor can be made by the gang in charge. In the eighteen months that our machine has been in use the repairs have been very slight, and the machine is still in excellent condition. For the drills and riveting hammers the expense is heavier, but as extra valves are supplied, and of which at least two should be carried in stock, there need be no delay in loss of tools while waiting for repairs, as the workmen soon become skilled in the handling of the tools, and can make all ordinary repairs, such as replacing valves, etc.

The writer has been asked by many where he found economy in a plant costing $1,600, and which could only be used by one gang at a time; this he answers by claiming the same superiority of this method over the old, slow-plodding use of hand drills, as the steam hammer is above the hand hammer and anvil, as the use of air in large shops is above the old method of hand work for every purpose, as the electric motor is above the horse car.

In the use of air drill we find that two men can, under ordinary conditions, drill from five to six holes to one by hand by the same number of men. The drills can be used under ordinary conditions wherever hand drills can be used.

In riveting two men will, under ordinary conditions, do the work of three men with hand tools. As is well known by all bridgemen, we use, as a rule, three men besides the heater, for riveting, one to hold on, two to drive. With the pneumatic hammer, one to hold and one to drive is all that is necessary. An additional advantage in this tool is that any intelligent helper can be taught the use of it by a skilled foreman in a day, whereas, under the old hand method, skilled riveters must be employed. Of course this method, like the hand driving, must be watched to avoid loose rivets. The writer's experience in this has taught that up to ⅞ rivets, this method is not only effectual, but highly economical.

In the handling of this plant it must not be overlooked that after drilling and riveting on large jobs are completed, there is still another use for the compressor. It is a well-known fact that in painting bridges, one of the most expensive operations is cleaning the metal before applying paint. By having a sand-blast machine, of which there are a number in the market, attached to outfit, bridges can be cleaned in not only less time, but much better.

Personal Notes.

Mr. J. W. Wilcox has been reappointed city engineer of Macon, Ga., for a term of two years.

Mr. James E. Kelley has been elected a member of the Board of Public Works, of Woburn, Mass., for a term of four years.

Mr. Michael J. Garvin has been appointed superintendent of buildings of the Borough of The Bronx, New York City, where he has designed a number of prominent buildings.

The Engineers' Club of St. Louis has elected the following officers for the ensuing year: President, Prof. J. H. Kinealy; vice-president, J. L. Van Ornum; secretary, D. W. Roper; treasurer, Geo. I. Bouton; librarian, Edw. B. Fay; dirctors, A. L. Johnson and E. J. Spencer; members of board of managers, F. R. Fish and J. A. Laird.

Mr. David Lee, superintendent of maintenance of way of the Baltimore & Ohio Railroad west of the Ohio River, has been made consulting engineer with headquarters at Zanesville, O., and Mr. G. B. Owen, at present superintendent of maintenance of way east of the Ohio, has been made a division engineer. Mr. M. L. Byers, M. Am. Soc. C. E., will be engineer of maintenance of way, reporting to the chief engineer.

The Rochester, N. Y., Engineering Society has elected the following officers: President, George A. Hotchkiss, superintendent of water-works; first vice-president, Chas. E. Turner, superintendent of motive power, Buffalo, Rochester & Pittsburg Railway; second vice-president, Chas. O. Harris, superintendent of Rochester Telephone Company; secretary, John F. Skinner, special water-works assistant engineer; treasurer, Robert Cartwright, M. Am. Soc. C. E.

Robert Temple, M. Am. Soc. C. E., died suddenly at his home in Richmond, December 23, at the age of 70 years. He commenced his railroad engineering career as a rodman on the was with the Georgia, Carolina & Nortnern Railway in 1852, and his last prominent engagement was with the Georgia, Carolina & Northern Railway, in the Atlanta extension of the Seaboard system. During the civil war he was connected with the engineering department of the Confederate government.

Colonel Garrett J. Lydecker, Corps of Engincers, U. S. A., has been ordered to Cincinnati, where he will relieve Lieut.-Col. Thomas H. Handbury of the duties of division engineer of the central division, and Major William H. Bixby of the duties of engineer of the fourteenth lighthouse district. Lieut.-Col. Handbury is to take up the work of Lieut.-Col. C. E. L. B. Davis, at San Francisco, and Major Bixby will assume charge of the construction, up to the present time under the direction of Colonel Lydecker at Detroit. Lieut.-Col. Davis is to go to Manila, P. I., for duty as engineer officer on the staff of the commanding general, Division of the Philippines, and will relieve Major Clinton B Sears, who has been assigned to the command of the second battalion of engineers, now serving in the Philippines.

The Lawrence Water Filter has an area of 2½ acres, divided into 25 beds. According to the annual report of the Water Board for 1900, the average number of scrapings of the filter was 15.9 per bed. The maximum and minimum periods between scrapings were 31 and 11 days. The cost of the work ranged from $32.50 to $130.70 per acre, and during its progress 2,223 cubic yards of sand were wheeled out. Sand washing cost 49.9 cents per yard. During the year the underdrains of several beds were relaid, resulting in a marked improvement in the quantity of water obtainable. The trench required sheathing in each bed, and the quicksand nature of the material penetrated at the bottom of the beds made it necessary to lay the pipe on a cradle of cypress plank.

The Engineer School of Application at Washington Barracks, D. C., of which Major William M. Black, Corps of Engineers, U. S. A., is the head, is intended "to impart instruction to such officers of the army as may be detailed under the Regulations; to prepare the junior officers of the Corps of Engineers for the active duties of their profession; to provide for thorough theoretical and practical instruction of the engineer troops; to make researches in such branches of science as relate to the duties of the Corps of Engineers, and to disseminate information so obtained; and to make such experiments and recommendations and give such instruction as may be necessary for the military engineering work of the Army." Instruction will be given in military, civil and electrical engineering and in ordnance and armor subjects. The course for officers requires two years and, on graduation, a diploma will be granted.

The London Underground Railways will be equipped after all with electrical apparatus of an American type; at least, the London Stock Exchange is so sure of the fact that a $25 rise in certain shares of interested companies occurred a few days ago. It is understood that Westinghouse apparatus will be used very largely in the power plant, but until the appearance of the report of the arbitrator who has been taking evidence on the merits of the various projects, the details of the accepted plan cannot be definitely learned. The proceedings before the arbitrator, reported at much length in British engineering publications, were remarkable for the high professional standing of many of the witnesses and for the positiveness of many of the engineering predictions they made. The outcome, if it should be as report indicates, is an achievement of which Mr. Yerkes may well be proud. His progressive methods at the start were checked rudely and early by the substantial bumper of conservatism and then followed the prolonged legal controversy just ended.

Municipal Electric Lighting was in an amusing condition in Columbus in 1900, which is described as follows in the belated report of Director Kauffman for 1900: "In consequence of the action of the Council Committee and the Tax Commission, who, in 1899, formulated the levy for 1900, no appropriation was made for the operation of the municipal light plant, and the gas and light levy was not sufficient to pay for the lights maintained under a contract made in 1896, even with the number of lights reduced to the minimum of the contract. This fact was communicated to Council very early in the year, and they were requested to take some action in the matter and advise the Director what course they wished him to pursue. From early in March until late in June, Council considered the matter, and finally reported that should the Director continue to operate the municipal plant, he must do so at the expense of himself and his bondsmen. While your Director is inclined to philanthropy, yet neither that sentiment nor his purse would allow him to continue the operation of the plant upon that basis, so that the said plant was closed on the 5th day of July, and has since been under lock and key."

An Unsatisfactory Septic Tank Experiment was tried at Ilford, England, not long ago, according to a paper read by Mr. R. G. Hetherington before the Society of Engineers. Three open tanks holding about 7,000,000 gallons each, built for the chemical precipitation of sewage, were utilized as septic tanks, although only half large enough for the purpose. "At the end of the six months the tanks were found to be practically full of solid matter; in fact, such was their condition that a man was able to walk across them. The sewage flow had made small channels for itself through the body of the solid sludge, and only passed over the weir wall at certain places. The effluent leaving the tanks was very foul and contained a large amount of suspended matter. At this period it was necessary that the tanks should be cleaned out, which proved a long and noxious process, and in the autumn of the same year they were again run as open septic tanks, and were found on this occasion to have filled up in four months. Apparently the difference of two months in the time taken for them to fill up was caused by the different temperature, the septic tank principle working better under the hotter than under the colder conditions."

A New Extensometer has lately been adopted by the State engineers of Holland in place of the Manet instruments employed previously. It was designed by Mr. Kist and some particulars of it are given in the "Ingenieur," and abstracted by the Institution of Civil Engineers. To a point of the bar, the strain of which is to be investigated, is fastened one end of a steel band lying along the bar and having its other end formed into a hook which engages the pin of a small crank. The shaft of this crank rotates in bearings fixed to a second point of the bridge, and it is evident that any change of the length between the two fixed points will cause a rotation of the diminutive shaft; and to measure the change of length a long pointer, having a scale at its outer end, is fixed to the shaft. A small projection from the pointer leaves its trace on a surface of lampblack and so indicates the maximum strain. The steel band is kept taut by a special spring fixed to the pointer and some other part of the instrument. The actual change of length is enlarged forty times at the end of the pointer. To obtain a record of the variations of the strain, instead of its maximum value only, a pointer is used having a Berlin silver point, which scratches its record on a strip of metallic paper wound round a drum fixed in position by screws. The rotation of the drum is effected by clockwork fixed to any convenient point of the bridge and communicating its motion to the drum by cords and small pulleys.

The Shipment of a 65-ton casting from Sheffield to Manchester caused a great deal of unnecessary bother, according to the account in "Engineering." The casting was set directly on the floor in the center of a heavily framed platform car called a "50-ton well trolley," and a short ten-ton platform car was run up close to each end of it. In the middle of each ten-ton car there was a transverse bolster on which, as a fulcrum, was set a horizontal lever 50 feet long. This was composed of three timbers, apparently about 18 inches square, clamped together, one above the other, with top and bottom projecting cross pieces and pairs of vertical screw rods close to the sides of the timbers. The timbers did not appear in the engraving to be keyed together, but wedges were driven between the sides of the timbers and the vertical rods, apparently to tighten the latter. The two lower timbers were each about 40 feet long, staggered 10 feet, and the upper timber, about 12 feet long, was over the fulcrum, which was about 17 feet from the end toward the casting. This end was chained down to the floor of the 50-ton car, and at the other end of the lever a 3-ton counterbalance weight, consisting of hollow cylinders, was suspended. This produced an upward reaction of 6 tons, tending to lift the middle car, so that both end cars together carried 12 tons of the load of the center car. The counter-weights were suspended free and clear beyond the ends of the cars, and the casting was shipped on a Sunday, when, very properly, all the traffic on the road in both directions was stopped while it was in transit. In comparison with this method it is interesting to note the loading of a 70-ton girder on two cars, as described in The Engineering Record of October 6, 1900, and the similar arrangements which have frequently been described in these columns, all of them securing the necessary distribution of load and providing considerable rigidity, with enough play to allow for passing around curves.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS, AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

For Proposals see pages xiii, xiv aud xxiii.

WATER.

Pawtucket, R. I.—In the annual report of Commissioner of Public Works Barclay, a recommendation is made that the city double its pumping capacity in the Water Department by installing a 12,000,000 gal. pumping plant at a cost of $70,000.

Atlantic City, N. J.—Bids are wanted Jan. 13 (readvertised) for furnishing cast-iron pipe, as advertised in The Engineering Record.

Ft. Morgan, Colo.—The Morgan County Reservoir & Development Co. has been incorporated by George S. Redfield, James P. Curry, Charles I. Colwell and others, to operate at Ft. Morgan. Capital stock, $250,000.

Flint, Mich.—The question of issuing $225,000 municipal water bonds is said to be under consideration.

Long Beach, Cal.—Press reports state that the Sea Side Water Co. will erect and equip an electric power house and water-works. Estimated cost, $100,000.

McRae, Ga.—Press reports state that the citizens have voted to issue bonds for a water and light plant.

Philadelphia, N. Y.—Local press reports state that a system of water-works is to be constructed. H. E. Morse, of Clayton, N. Y., is one of the commissioners.

Elgin, Ill.—Local press reports state that $25,000 bonds are to be issued for the completion of the water-works plant.

Cloverdale, Cal.—The citizens of Cloverdale are considering the advisability of building a dam across Sulphur Creek in the vicinity of Livermore Flats. It is proposed to use the force thus obtained for the purpose of supplying the Orange City electric lights and motive power, and to use the water for irrigation.

Marlin, Tex.—The Attorney General has approved an issue of $54,000 bonds for this city, to be used to a system of water-works and a school house.

Lynchburg, Va.—The Council Committee on Water has decided to investigate the plan to secure a water supply for the city, by gravitation, from the mountains of Amherst County.

Florence, S. C.—Bonds to the amount of $40,000 have been sold for the construction of a system of water-works.

Grahamtown, Md.—The Frostburg-Grahamtown Water Co. has been incorporated by James Hanson, William H. Hawkins, George O. Cook and others. The capital is $1,500, and the object is to furnish water to the people of Grahamtown.

Keswisk, Cal.—The Keswick Water-Works Co. has been incorporated with a capital stock of $200,000. Incorporators: Edward T. Johnson, G. A. Petterson, A. R. Kanaga and others.

Vancouver, Wash.—Press reports state that the Vancouver Water-Works Co. has purchased the plant and business of the Columbia Land & Improvement Co., and that the plant will be improved, new machinery added and new mains laid.

La Grande, Ore.—The Union County Artesian Well Co., of La Grande, has been incorporated with a capital of $4,000. Incorporators: W. G. Hunter, P. A. McDonald, E. W. Oliver.

Springhill, N. S.—The Town Clerk writes that a system of water-works is to be constructed at a probable cost of $120,000. Contracts will not be let until the summer season of 1902. E. Hopson, of Sydney, N. S., Engr. in Charge.

Revelstoke, B. C.—Press reports state that A. P. Cummins is preparing plans and estimates for the extension of the Water, Light and Power Co.'s water system

Seattle, Wash.—City Engineer Thomson has completed plans for the proposed extension of the city system to Fremont. Cost about $73,000.

Chicago Heights, Ill.—Bids will be received Jan. 6 for furnishing, delivering and erecting pumping machinery in the pumping station. P, F. Jirtle, City Clk.

Calcutta, Ind.—Bids will be received by the Commissioners, addressed to the Vice-Chairman, Municipal Office, Corporation of Calcutta, Water Works Department, until Feb. 5, for furnishing and delivering, c. i. f. Calcutta, 50 6-in. and 12 4-in. water waste meters. The meters shall be so constructed as to permit the taking of diagrams for 6 hours, 24 hours, and 7 days, and the price tendered should include cost of all necessary clocks and gear for the taking of these diagrams. Fred. Gainford, Corporation Sec'y.

Myrtle Point, Ore.——Bids are wanted Jan. 20 for $18,000 water works bonds. L. A. Roberts, City Recorder.

Streator, Ill.—The Streator Aqueduct Co. will build a dam for storage of water, and erect a standpipe 20 ft. in diameter and 120 ft. high, next summer.

Springfield, Ill.—The Mayor and Corporation Counsel have been authorized to receive bids for a filter having a capacity of 4,000,000 gals. per day, the water to be 94 per cent. pure. Frank H. Hamilton, City Engr.

Blocton, Ala.—Alber & Byrne, of Birmingham, Ala., are preparing plans and specifications for a water-works plant at Blocton, E. D. Reynolds, Mayor. The plans will be ready to commence the construction work early in the coming year.

Liberty, Mo.—A vote will soon be taken on the proposition to issue bonds for the construction of municipal water works.

Victoria, Tex.—Geo. C. Hascall, Cleveland, O., of the Victoria Rice & Irrigation Co., writes that contracts are now being made for the construction of an irrigation plant, at Victoria, estimated to cost $60,000. P. L. Ward, of Victoria, Engr. in Charge.

Arcadia, Wis.—Village Clk. Geo. Mathys writes that on Dec. 17 it was voted to issue $15,000 bonds for the construction of a system of water works.

Onawa, Ia.—The Town Clerk writes that on Dec. 16 it was voted to issue bonds for the improvement and extension of the water works.

Harmony, Minn.—Recorder I. Larson writes that on Dec. 17 it was voted to issue $9,000 bonds for water works.

Des Moines, Ia.—The City Council has failed to pass, over the Mayor's veto, the resolution to lend the water company $50,000 to build an army post water main.

Lake Providence, La.—F. J. Powell, Secy. of the town of Providence, La., Lake Providence, writes that the following bids were opened Dec. 19 for the construction of a combined water works and electric light plant: G. Jaeger, Rich Hill, Mo., $22,260; E. J. O'Beirne, Birmingham, Ala., $22,247; Ben. Johnson, Greenville, Miss., $20,243 (awarded).

Ben Lomond, Cal.—F. A. Cody writes that bids will be opened Jan. 1 for improvements and extensions estimated to cost about $2,000; there will be required about 1 mile of 6-in. pipe.

Southington, Conn.—T. H. McKenzie, Secy. and Treas., writes that the Southington Water Co. proposes to extend the mains to Milldale, next April, at a probable cost of $4,500. The work will require 1 mile of 6-in. pipe.

Appleton, Wis.—Bids are wanted Jan. 21 for furnishing material and labor for the construction of a system of water works, as advertised in The Engineering Record.

Paulding, O.—Bids are wanted now for sinking test wells for water works, to cast $35,000; contract for plant to be let about April 1. W. A. Savage, Clk. Water Works' Trustees.

Dayton, O.—The Trustees of the Water Works have asked the Council to issue $100,000 bonds, of which it is proposed to use $50,000 for boiler house and boilers, stand pipe connections and mains.

Buffalo, N. Y.—Bids for constructing the proposed Louisiana St. viaduct were opened by the Grade Crossings Commission, Dec. 20. The plans call for a structure 700 ft. long, covering the New York Central, the West Shore, the Lake Shore and the Erie tracks. 1,200 tons of steel will be used in the superstructure. Press reports state that the Buffalo Structural Steel Co.'s bids of $114,400 and $105,539, under alternate specifications, was the lowest for the superstructure, and Thomas McKeown the lowest bidder for the substructure, his proposal being $82,495.

The only bid received by the Board of Public Works, Dec. 24, for the construction of a Scherzer roller lift bridge at South Michigan St. is reported to have been submitted by the American Bridge Co., for $65,000.

Long Branch, N. J.—The special engineers and the City Surveyor, appointed to investigate the question of municipal ownership of water works for this town, have reported that a plant can be installed for about $200,000.

Alexandria, La.—Bids are wanted Jan. 7 for furnishing an air compressor for the city water and light plant. Ira W. Sylvester, City Engr.

Mechanicsville, Ia.—It is stated that bids are wanted Mar. 3 for constructing water works to cost $12,000. C. H. Meredith, Engr., Cedar Rapids, Ia.

Sandusky, O.—Bids are wanted Dec. 30 for furnishing 2,609 ft. of 3, 4, 6 and 8-in. cast iron water pipe. F. W. Bauer, Supt. Water Works; J. L. Missig, Secy., Bd. Water Wks.

Worcester, Mass.—Local press reports state that the city is planning to take Asnebumskit Brook for a further increase of the water supply.

Salt Lake City, Utah—Press reports state that the Interior Department, Washington, has approved the application of the Deseret Improvement Co.., and the Deseret & Salt Lake Agricultural & Manufacturing Canal Co. for a franchise for a reservoir site in Millard County, Utah.

Vallejo, Cal.—Press reports state that the City Trustees have voted to lay 12 miles of 13-in. water pipe, and the citizens will be asked to vote $100,000 bonds for said purpose.

Springdale, Ark.—A. L. Dabney, of Kansas City, Mo., has been engaged to prepare plans for a $15,000 water works system.

Ft. Wayne, Ind.—The contract for a 6,000,000 gal. horizontal compound condensing engine is stated to have been awarded to the Holly Mfg. Co., Lockport, N. Y., for $27,400.

SEWERAGE AND SEWAGE DISPOSAL.

Williamsport, Pa.—Bids are wanted Jan 29 for the construction of a storm sewer, as advertised in The Engineering Record.

Newark, O.—Plans have been prepared for about 3,500 ft. of 24-in. sewer construction.

St. Paul, Minn.—Bids are wanted Dec. 30 for constructing sewers in portions of Whitehall, Clark and Westminster Sts. C. H. Bronson, Clk. Bd. Pub. Wks.

St. Louis, Mo.—Bids will be received Dec. 31 for the construction of sewers and steel pipe outfall sewers for World's Fair work at Forest Park. This consists of about 3,000 ft. of 4-in. brick sewer, some 21 and 18-in., also a 24-in. steel outfall sewer for pumping from the pump well to the city sewers. Plans and specifications are on file at office of Richard H. Phillips, Ch. Engr.; Isaac S. Taylor, Dir. Dept. of Wks., Louisiana Purchase Exposition Co.

Clairton, Allegeheny Co., Pa.—Bids will be received by the St. Clair Improvement Co. until Dec. 30 for constructing 710 ft. of 18, 660 ft. of 15, 8,379 ft. of 12 and 639 ft. of 9-in. sewer in Clairton. E. L. Farren, Ch. Engr.

Eureka, Cal.—Local press reports state that on Dec. 16 this city voted $115,000 for municipal improvements, of which $85,000 will be used for sewers and $30,000 for schools.

Oakland, Cal.—Councilmen Ruch and Bon have been appointed a special committee to act with Chairman Wixson, of the Street Committee, and City Engineer Turner, in deciding upon the line of proposed main outfall sewer in the annexed district.

Avalon, N. J.—It is stated that a special election will be held Jan. 14 to decide the proposition of the borough building a sewerage system.

Mansfield, Wis.—Press reports state that a committee has been appointed to investigate the matter of establishing a sewer system.

Milwaukee, Wis.—Plans are said to be under consideration for the purification of Menominee River of sewage by the establishing of septic tanks.

St. Paul, Minn.—The lowest bid received for constructing York St. sewer was from W. J. Preston, at $14,600.

Moundsville, W. Va.—Plans and specifications are said to have been completed by H. T. Hirst for the proposed sewerage system.

Asbury Park, N. J.—The Inland Sewer and Sewage Disposal Co. has been incorporated with a capital of $100,000. The object of it is said to be to establish and maintain a complete sewerage system in Neptune Township. Incorporators: Edward Hill McCray, of New York; Geo. W. Pittenger, Appleby Bldg., Asbury Park; Nathan J. Taylor and others.

Southbridge, R. I.—Petitions are being circulated for the construction of sewers on certain streets.

Ottawa, Ill.—Plans are under consideration for the construction of a sewer system for West Ottawa.

Topeka, Kan.—City Engineer McCabe estimates the cost of constructing the proposed sewer to Washburn College, as $7,000.

Iola, Kan.—City Clk. W. M. Knapp writes that it is proposed to construct a sewerage system.

Nashville, Tenn.—City Engr. Wm. W. Southgate writes that the following bids were opened Dec. 19 for sewer construction; the work to include 1,936 ft. of 11 ft. 6-in. to 11 ft. 10-in. brick sewers, 7 manholes and 19 catchbasins; the trench to average 13 ft. in depth and be excavated mostly in rock: Thomas J. Pease, $41,797; (awarded); Middle Tenn. Const. Co., $43,684; Adams Bros., Zanesville, O., $44,386; Nashville Roofing & Paving Co., $44,415; N. Breen, $44,988; Foster & Creighton, $46,004; Jos. Lightman, $46,240; E. T. Lewis & Co., $47,951; Nashville Plumbing Co., $56,094; Guild & Co., Chattanooga, Tenn., $56,900; M. A. Talbot & Co., Logansport, Ind., $60,485; C. J. Sheehan & Co., Chicago, Ill., $63,152; Nash Bros., Chicago, Ill., $102,344. Address of bidders, Nashville, unless otherwise stated.

Rossville, Ill.—The Council has adopted plans and specifications for sewer construction, and local press reports state that bids for the work are now being received.

Lewiston, Pa.—Local press reports state that it is proposed to construct a sewerage system, estimated to cost $46,000.

Bessemer, Ala.—The City Council is said to be arranging for the extension of the sewerage system.

Barberton, O.—Press reports state that $4,000 bonds have been issued for the construction of sewers.

Chicago, Ill.—Local press reports state that the contract for 4 pumping engines, to be installed in the sewage pumping station at 39th St., has been awarded to the Allis-Chalmers Co., of Milwaukee. For bids received Dec. 6, see The Engineering Record of Dec. 14.

Golden, Colo.—The Council is stated to have granted to C. P. Hoyt, J. C. Davidson and J. H. Linder a franchise to construct and maintain a system of sewers in the section of the city east of Washington Ave.

Bedford, Ind.—It is stated that this city proposes to establish a sanitary sewer system about 7 miles in length. G. C. Houston, City Eng.

BRIDGES.

Victoria, B. C.—The date for receiving bids, for the construction of a combined traffic and railway bridge for Fraser River. at New Westminster, has been extended from Jan. 8 to Jan. 25, as advartised in The Engineering Record.

Grandledge, Mich.—See "Electric Railways."

Iowa City, Ia.—The American Bridge Co. is stated to have received the contract for the construction of a bridge across Iowa River, for $10,000.

Yazoo City, Miss.—It is stated that bids are wanted Jan. 6 for constructing a bridge across Twelve Mile Bayou, near Sunflower. S. S. Griffin, Clk.

Waterloo, Ia.—The City Engineer has been instructed to prepare plans and specifications for a steel girder bridge at Fourth St. Probable cost, $50,000.

Le Roy, N. Y.—Press reports state that the construction of a $50,000 bridge across Chautauqua Lake is contemplated.

Perth Amboy, N. J.—Press reports state that a trolley company, in which Senator Kean and ex-Governor Voorhees are interested, is planning to construct a bridge across Raritan River.

West Bay City, Mich.—H. C. Thompson, City Engineer, writes that bids will be received until Jan. 4 for constructing the substructure of a bridge.

Lansing, Mich.—Bids will be received Jan. 27 for constructing a bridge across Grand River at Washington Ave., South. C. J. McCullough, City Clk.; H. A. Collar, City Engr.

Dakotah, Ia.—Bids are wanted Jan. 7 for constructing a steel bridge, having 2 90-ft. spans, each span to have 6 15-ft. panels, near Hunick Ford, on the west fork of the Des Moines River. Bids, with plans, will also be received at the same time, for constructing a steel bridge, having 2 78-ft. spans, 5 panels to the span. John Cunningham, Co. Aud.

Denison, Ia.—Bids are wanted by the Board of County Supervisors until Jan. 7 for building and repairing county bridge during the year 1902. M. J. Collins, Co. Aud.

Pwembina, N. D.—Bids will be received by the County Commissioners until Jan. 9 for constructing 4 steel bridges.

Lemonweir, Wis.—The construction of an iron bridge across Lemonweir River is contemplated.

Elizabethton, Tenn.—Press reports state that 4 bridges, across Watauga River, on the Virginia & Southwestern R. R., have been washed away.

Sioux City, Ia.—The Chicago Great Western Ry. Co. is said to have decided to construct 5 steel bridges on its proposed extension to Sioux City. Four of these bridges are to have single spans, ranging from 70 to 180 ft., and the other is to have 2 100-ft. spans. H. Fernstrom, Ch. Engr., St. Paul, Minn.

Lansing, Mich.—The Council has been petitioned to construct a bridge and extend Pennsylvania Ave.

Bay City, Mich.—Gov. Engr. Carbet has been notified by the Secretary of War, to request Mayor Foeltzer and the Highway Commissioners of Benton Township, to have bridges crossing Paw Paw River in their territory, equipped with the necessary swings or lifts.

Norfolk, Va.—The Norfolk, Portsmouth & Newport News Ry. Co. has applied to the Harbor Commissioners for permission to construct a draw bridge across the Western Branch, for the proposed extension of its branch to Big Point.

La Salle, Ill.—The Highway Commissioners have petitioned the County Board to assist in the raising and improving of the bridge across Big Vermilion River, between La Salle and Deer Park Townships. The cost of this improvement is placed at $13,300, and the county has been asked to pay one-half.

Birdsboro, Pa.—Press reports state that the Reading Ry. officials are considering the construction of a bridge across Schuylkill River at Birdsboro.

Port Huron, Mich.—City Engr. W. W. Phelps writes that it is proposed to construct a bridge across Black River at Lincoln Ave., but estimates for same have not yet been made.

Portland, Ore.—See "Electric Railways."

Nebraska City, Neb.—City Engr. A. M. Munn is preparing plans for county bridges.

Duluth, Minn.—Bids are wanted Jan. 7 for constructing a steel bridge having a 130-ft. span across St. Louis River, connecting Bryne and fron Junction and Eveleth Roads. O. Halden, Co. Aud.

Sioux Falls, S. D.—Bids are wanted Jan. 9 for constructing a 160-ft. steel bridge at Railroad St. C. A. Grinde, Co. Aud.

Wilmington, N. C.—This city contemplates building a steel bridge over the W. W. R. R. at 5th St. Bridge to be 50 ft. wide, with 120-ft. span, 2 driveways and 2 footways.

Saginaw, Mich.—The following bids were opened Dec. 12 for building a bridge at Genesee Ave.: The American Bridge Co., $169,000, $179,000 and $188,000; the National Bridge Co., bid on Plan A (revolving draw) and Plan B (bascule draw), respectively, with buckle plate floor, $160,000 and $190,000; curved plate floor, $158,000 and $188,000; concrete steel floor, $152,000 and $184,000.

Fayette, Miss.—Bids will be received by the County Commissioners until Feb. 3 for constructing a steel bridge across Coler Creek.

Boise, Idaho.—Local press reports state that Pueble Bridbe Co. has secured the contract for constructing Eagle Island bridge, for $19,784.

Indianapolis, Ind.—City Engineer Nelson, in his report to the Board of Public Works, recommends the immediate repair of W. Washington St. bridge, at a probable cost of $3,000.

Joplin, Mo.—The County Court has recommended the construction of 3 bridges, at a total cost of $13,680.

Holyoke, Mass.—Local press reports state that plans are being prepared for an iron bridge, to replace present canal structure at Main St.

Buffalo, N. Y.—Bids are wanted Jan. 7 for the construction of the superstructure for a viaduct over the N. Y., C. & St. L. R. R., the W. N. Y. & P. Ry. and the B. C. R. R., in Elk St., as advertised in The Engineering Record.

PAVING AND ROADMAKING.

Nashville, Tenn.—City Engr. Wm. W. Southgate writes that the contracts for paving in 3 streets, with granite, on foundation prepared by the city, pitch filler, have been awarded to the Nashville Roofing & Paving Co., Nashville, at $1.83 per sq. yd. for all streets. Totals, $13,990, $17,923 and $5,673. Other bids received were as follows: Venable Bros., Atlanta, $1.90 and $1.88; Adamant Stone & Roofing Co., Nashville., at $1.93, $1.89 and $1.94; Nashville Bridge & Construction Co., Nashville, at $2.19 3/4; Nashville Plumbing Co., Nashville, $2.38.

Wilson, N. C.—Bids are wanted Jan. 14 for the construction of 2 or more miles of macadam streets and setting curbs, as advertised in The Engineering Record.

Poughkeepsie, N. Y.—The Dutchess County Board of Supervisors has passed a resolution calling for the construction of a macadam road on Violet Ave., at a cost of $30,000, of which $16,225 is to be paid by the state.

Saratoga Springs, N. Y.—The Board of Supervisors of Saratoga County has received from the state engineer plans and specifications for the new state road, over 3 miles long, from Saratoga Springs to Glens Falls and from Waterford to Cohoes, a distance of 1 mile. Both roads are to be macadamized.

Holyoke, Mass.—In his annual report City Engineer Tighe recommends that a portion of Dwight St. be paved with brick; also that Appletion St. be paved from Beech to Linden St.

Wilmington, N. C.—Mayor Waddell, Chmn. of the Streets and Wharves Committee, has announced that Orange St. is to be macadamized from Front to 7th Sts.

Jeffersonville, Ind.—The contract for improving Chestnut St. has been awarded to L. F. Perdue, of Terre Haute, Ind., for $8,753.

Covington, Ky.—An ordinance is before the Board of Public Service providing for the paving of a portion of Harrison Ave. with asphalt.

Dayton, O.—City Engr. Turner submitted to the Board of City Affairs the following estimates for improving portions of several streets, petitioned for by the National Cash Register Co., Stewart St., $8,902; K St., $8,811; Rubican St., $6,739; and Main St., $9,634.

St. Paul, Minn.—The final order for paving 8th St. with asphalt has been approved by the Board of Aldermen.

Bradford, Pa.—The Common Council has passed an ordinance authorizing a loan of $25,000 for the repaving of sections of Main and Congress Sts.

Niagara Falls, N. Y.—The final estimates of City Engineer Very for pacing a portion of First St. with asphalt, place the cost exclusive of intersections at $8,533; cost of intersections, $924.

Bellefontaine, O.—The City Council has passed ordinances for the improvement of portion of Detroit St. with brick, and a portion of Sandusky Ave. with macadam, brick or asphalt.

Jacksonville, Fla.—The City Council has passed 28 ordinances for paving, work to begin in March.

Duluth, Minn.—Property owners are said to be in favor of the paving of East Superior St. with asphalt. The cost to pave with the different materials would be, according to City Engineer Patton: Creosoted blocks, $169,730; asphalt, $166,716; vitrified brick, $136,004; tar macadam, $95,708.

Chicopee, Mass.—In his annual report, Maurice Kennedy, Supt. of Streets, recommends an appropriation of $15,000 for highways during 1902, and a special appropriation of $12,000 for permanent work.

Salt Lake City, Utah—Petitions to the City Council are being circulated for the paving of a portion of South Temple St. with asphalt. Estimated cost, $150,000.

Evanston, Ill.—A portion of Ridge Ave. has been ordered paved at a cost of $23,000.

Toledo, O.—H. G. Jennison has, according to reports, secured the contract to pave with asphalt block, on sand foundation, a portion of Parkwood Ave., for $6,107.

New Albany, Ind.—A resolution has been passed to pave a portion of Market St. with brick.

Cohoes, N. Y.—The Public Improvement Commission has decided to pave portions of several streets, in all about 3 miles.

Jackson, Miss.—The Council is said to be considering the question of issuing $100,000 street paving bonds.

Tonawanda, N. Y.—If plans are approved by the Erie County Board of Supervisors, the River road, between Upper Grand Island ferry and Tonawanda, will be graded and macadamized at a cost of about $22,000.

Somerville, N. J.—Bids will be received by the County Commissioners until Jan. 15 for constructing 8 miles of rock or macadam road in Somerset County. A. P. Sutphen, Clk. Bd.

St. Louis, Mo.—Local press reports state that the contract for resurfacing asphalt streets has been awarded to the Barber Asphalt Paving Co. By the terms of this contract said company binds itself to maintain the downtown asphalt streets for 10 years at a total cost of about $133,369. The price stipulated is $1.50 per year for each square of 100 superficial feet. The contract covers 8,913 squares. Thus the annual cost for maintenance of 8,913 squares will be $13,369.

Moscow, Idaho.—City Clk. H. H. Robinson writes that on Dec. 6 it was voted to issue $4,000 street improvement bonds.

Denver, Colo.—Mayor R. R. Wright, Jr., has recommended the appropriation of $25,000 for the repair of paved streets during 1902.

Jersey City, N. J.—Bids are wanted Dec. 31 for 3,280 sq. yds. asphalt paving on Jewett Ave.; also for 230 sq. yds. Belgian paving on Perrine St. Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

POWER PLANTS, GAS AND ELECTRICITY.

Holland, Mich.—The Grand Rapids, Holland & Lake Michigan Ry. Co. is stated to have secured franchises in Holland Township and in the one adjoining to supply electricity for lights to residents. A lighting station will be built at once on the site of the present power house here.

Cloverdale, Cal.—See "Water."

East Pittsburg, Pa.—The Borough Council is reported to be considering the advisability of erecting a municipal electric light plant.

Lincoln, Neb.—Articles of incorporation of the Lincoln Gas & Electric Co. have been filed with the Secretary of State; capital, $2,500,000. Incorporators: A. Lincoln Eglinton and Frank W. Fraueauff.

McRae, Ga.—See "Water."

West Superior, Wis.—A press report states that the Water & Light Company of West Superior has petitioned for an extension of franchise, and if granted will construct a new gas plant.

Long Beach, Cal.—See "Water."

Circleville, O.—An ordinance is stated to have been introduced in Council granting permission to Wm. Heffner, W. E. Crist and others to construct and maintain an electric light plant.

Muscatine, Ia.—The Council is stated to have granted Roach & Giesler a franchise for an electric light plant.

New Orleans, La.—Bids are wanted Mar. 24 for constructing a system for lighting, with electricity, the public highways and operating the same for a period of 10 years, after completion, at which time the ownership of the system will revert to the city. V. Tujague, City Compt.

Jersey City, N. J.—Bids are wanted Dec. 31 for furnishing, lighting, extinguishing and maintaining electric arc lights, for the period ending Nov. 30, 1902, and for the further period extending to Nov. 30, 1906 (each proposition to be separate). Geo. T. Bouton, Clk. Bd. Street & Water Commrs.

Temple, Tex.—The Council is stated to have granted J. F. Strickland, of Waxahachie, a franchise for an electric light plant.

Jonesboro, Ark.—The People's Light & Power Co., of Jonesboro, is stated to have been incorporated with a capital of $20,000. Directors: H. H. Houghton, B. Gregg and others.

Bonham, Tex.—The Bonham Electric Light & Power Co. is stated to have issued $10,000 bonds for improvements.

Holland Patent, N. Y.—The Board of Trustees is stated to have authorized its president and clerk to investigate the cost of installing an electric light plant.

Lorain, O.—The Council is stated to have passed an ordinance granting a 20-year franchise for a heating plant, to the Smead Htg. Co.

Independence, Mo.—The Council is stated to have granted a franchise to the Independence Gas & Coke Co.

Indianapolis, Ind.—It is stated that merchants on S. Meridian St., including M. O'Connor and Kipp Bros., are about to petition the Board of Public Works for permission to construct an electric light plant.

Upper Sandusky, O.—The Council is stated to have granted H. E. Hill, of Marion, and J. W. Baker, of Columbus, a franchise for a heating plant.

Baker City, Ore.—A. B. Frame, of Portland, is about to petition the City Council for a franchise to furnish electric light and power to the city for a period of 30 years. If franchise is secured a plant of 4,000-H. P. will be constructed, to cost about $200,000.

Mobile,. Ala.—The Electric Lighting Co., of Mobile, is stated to have secured the contract for lighting the city with electricity for 5 years, at $75 per light per year.

Ossining, N. Y.—The Hudson Valley Light & Power Co. is stated to have been incoporated, to operate in Ossining, Mt. Pleasant, Newcastle, Cortlandt, Northcastle and Greenburg; capital, $25,000. Directors: Harry M. Shaw, H. C. Willis and P. C. Ackerman.

Poughkeepsie, N. Y.—The Council is stated to have granted franchises asked for by the Consolidated Electric Light & Power Co., of Poughkeepsie, to construct and place all equipments necessary to the business of the company in this city.

Amherst, Mass.—The Amherst Gas Co. is stated to have decided to expend about $30,000 in improving its electric plant.

Mason City, Ia.—The Brier Gas & Electric Co. is stated to have accepted plans for an electric light plant, to cost $50,000.

Rusk, Tex.—It is reported that an electric plant will be put in by the Rusk Brick Mfg. Co.

Fertile, Minn.—Isaac N. Smith, of Staples, Minn., is reported to have submitted a proposition to install an electric light plant.

Auburn, N. Y.—The Auburn Gas Co., of Auburn, is stated to have been incorporated with a capital of $500,000.

Milwaukee, Wis.—Jesse C. Coogan, C. N. Forrestal and W. H. McCoy have incorporated the Western Lighting & Electric Co. with a capital of $25,000, to engage in a general light and heating business. The new firm has a contract for lighting certain streets of Milwaukee with naphtha.

Lake Providence, La.—See "Water."

La Crosse, Wis.—It is reported that the La Crosse Gas & Electric Co. will make extensive improvements to its gas and electric plant. Geo. McMillan, Mgr.

Portland, Ore.—R. Green has petitioned the Council for an electric light and power franchise.

Chicago, Ill.—Local press reports state that bids will be received by City Electrician Ellicott until Jan. 4, for lighting the city with electricity, gas and gasoline.

Cincinnati, O.—Bids are wanted Jan. 21 for furnishing and installing in the public library an engine and generator unit, with all the connections necessary for its operation in connection with the electric plant already installed in said building. Wm. A. Hopkins, Clk. Bd. Library Trust.

ELECTRIC RAILWAYS.

Trenton, N. J.—The Council has granted the Camden & Trenton Ry. Co. a franchise to extend its line. M. B. Perkins, Mgr., Beverly.

Leipsic, O.—Corp. Clk. Andrew A. Kober writes that the contract for constructing and operating street railway route No. 1, has been awarded to the Toledo & Lima Traction Co., of Toledo.

Greenville, Ind.—The Richmond & Greenville Electric Ry. Co. is stated to have been organized with J. A. Royer, Pres., and W. S. Roser, Secy., both of Greenville. The purpose of the company is to build, in both directions, from Greenville. The line will enter Wayne County near Hollandsburg and will pass through Whitewater. Richmond will be the western terminus.

Versailles, Ky.—The Woodford Fiscal Court is stated to have granted a franchise to the Bluegrass Consolidated Traction Co. C. J. Bronston and John R. Aller, both of Lexington, are among the incorporators.

Churchville, N. Y.—The Buffalo & Williamsville Electric Ry. Co. is stated to have petitioned the Highway Commissioners of the town of Riga and the village of Churchville, for permission to construct and maintain a double-track electric railway on certain highways.

Doylestown, O.—The Council is stated to have granted a franchise to the Canton, Lodi & Medina Electric Ry. Co.

Belton, Tex.—J. M. Carter, Mgr. Texas Steel Rail & Equipment Co., Dallas, and J. F. Strickland, Waxahachie, Tex., are interested in the proposed interurban electric railway to connect Belton and Temple. The line will be 12 miles long and a power house will be erected midway between the two cities. The rights of way have been secured and work of construction will begin in January.

Portland, Ore.—The Council has granted a franchise to the City & Suburban Ry. Co. for a line along E. 28th St. It is stated that the company will construct a bridge across Sullivan's Gulch. H. C. Campbell, Mgr., Portland.

El Reno, Okla. Ter.—The El Reno Power & St. Ry. Co. has been incorporated, with a capital of $50,000, to construct and operate a street railway in El Reno. Directors: Thos. R. Reid and others, of El Reno, and W. W. Israel, of Fairfield, Ia.

Fond du Lac, Wis.—The Southern Ry. Co. is stated to have secured a right-of-way for the greater part of the distance between this city and Ripon, and will build an electric road next summer.

Xenia, O.—The Greene County Commissioners are stated to have granted Harry Frey, of Springfield, a franchise to construct an electric railway from Clifton to the south line of Greene County.

Angola, Ind.—John H. Roberts, of Grand Rapids, is stated to have petitioned the Town Board for a franchise through the town. The proposed line is to run from Jackson, Mich., to Fort Wayne, Ind.

Washington C. H., O.—It is stated that the Springfield & Washington (C. H.) Traction Co. will construct a line between this city and Springfield. O. F. Dillman, Secy., Dayton, O.

Amherst, Mass.—The Hampshire St. Ry. Co. is stated to have been formed, with a capital of $100,000, to construct an electric railway about 12 miles in length, from the Amherst boundary line, between Belchertown and Granby, to a point near and connecting with the tracks of the Holyoke St. Ry. Co.

Washington, D. C.—A press report states that the Washington & Annapolis Electric Ry. Co., office in Bond Bldg., will construct an electric railway during the year 1902 from Baltimore to Washington and Annapolis, a distance of about 64 miles. A power house will be constructed on the Patuxent River.

Oneida, N. Y.—The Syracuse & Suburban R. R. Co. (H. H. Thompson, Supt., Syracuse), and the Oneida St. R. R. Co. (G. Leggett, Supt., Oneida) are stated to have petitioned the Council for franchises.

Gloversville, N. Y.—The Council is stated to have granted a franchise to the Ballston Terminal R. R. Co. J. H. Morris, Supt., Ballston Spa.

Temple, Tex.—The Council is stated to have granted a franchise to J. M. Carter, of Dallas, for a street railway from Temple to Delton.

Ottumwa, Ia.—The Eldon & St. Louis Ry. Co. filed articles of incorporation Dec. 18. The company has been in business for some years, and it is reported that next year considerable construction work will be executed. S. H. Sawyer, Pres., and J. E. Highland, Secy., both of Eldon.

Owenton, Ky.—J. H. Gayle, Wm. Lindsay and others, are reported interested in the construction of a steam or electric railway between Owenton and Sparta or Landers.

Oklahoma, Okla. Ter.—The Council is stated to have granted a franchise to Harold R. Perry, of New York, N. Y., and A. H. Craney, of St. Louis, Mo.

New Hope, Pa.—Dr. Howard M. Griffee, of Taylorville, is stated to be interested in the construction of an electric railway from New Hope to Yardley.

New Washington, O.—The Council is stated to have granted a franchise to the Buckeye Traction Co.

Westfield, N. J.—It is stated that a power house will soon be constructed by the Elizabeth, Plainfield & Central New Jersey Ry. Co., at Westfield.

Madisonville, O.—Philip Swing, Secy. of the Cincinnati & Columbus Traction Co., is stated to have petitioned the County Commissioners for permission to construct and maintain an electric railroad on the Madison pike from Madisonville to Oakley.

Ft. Wayne, Ind.—The following two companies were incoroprated Dec. 18, each with a capital of $25,000, by Wm. B. McKinley, of Champaign, Ill.; R. L. Nelson, and others, of Ft. Wayne: The Ft. Wayne Northern Traction Co., to construct a line from Ft. Wayne to Goshen; and the Ft. Wayne Southern Traction Co., to build and operate a line from Ft. Wayne to Richmond.

Greenspring, O.—The Council is stated to have granted a franchise to the Sandusky, Tiffin & Southern Electric Ry. Co.

Redwood City, Cal.—The San Francisco & San Mateo Electric R. R. Co. is stated to have petitioned the San Mateo Supervisors for a franchise.

Grandledge, Mich.—The Council is stated to have granted a franchise to Hawks & Angus. It is stated that they will construct a bridge over Grand River, below this city.

Newcastle, Ind.—The County Commissioners are stated to have granted a franchise to the Muncie, Middletown & Greenfield Electric Ry Co.

Albion, N. Y.—Albion Electric Ry. Co. has been incorporated, to operate an electric railway 3 miles long in Albion. Capital, $30,000.

RAILROADS

Fall River, Mass.—City Engr. Philip D. Borden writes that it is now thought that work on the abolition of grade crossings will be begun early in the spring of 1902.

Guthrie, Okla.—The Missouri, Kansas & Texas R. R. Co. is reported incorporated, to construct 3 extensions in Oklahoma and Indian Territory. The main line to run from Guthrie to Stevens, I. T., length 135 miles; a branch of the line from Oklahoma City to this main line, length 35 miles, and a branch from this main line to the Missouri, Kansas & Texas at Wybark, I. T., length 80 miles. The entire cost of the extensions will be $10,000,000. Principal places of business will be at Guthrie, St. Louis and New York.

PUBLIC BUILDINGS.

(See also Schools and Government Work.)

Armour, S. D.—Bids are wanted Jan. 11 for furnishing material and erecting a fireproof building. John W. McKee, Co. Aud.

Washington, Ga.—L. Smith, Clk. of County Commrs., writes that Frank P. Milburn, of Columbia, S. C., has been selected to prepare plans for a $35,000 court house.

Fall River, Mass.—Louis G. Destremps has prepared plans for a $75,000 brick R. C. church, to be built for the St. Dominique Parish. Rev. Dr. D. V. Dellemare, Pastor. Contracts for construction will soon be let.

Rock Island, Ill.—Fred Borgolte, of Rock Island, has prepared plans for a $30,000 addition to the St. Anthony's Hospital.

Lufkin, Tex.—O. H. P. Rudesill & Son, of Houston, are stated to have prepared plans for the proposed $30,000 court house for Angelina County.

Philadelphia, Pa.—The Councils' Finance Committee is stated to have approved an appropriation of $1,250,000 for the purchase of a site and the erection of buildings, to be used as an almhouse, a hospital for the insane poor and a municipal hospital for contagious diseases. The committee also approved of an appropriation of $80,000 for the erection of pavilions for consumptives.

Denver, Colo.—F. E. Edbrooke, Opera House Blk., is stated to have been employed to prepare plans for rebuilding the city hall recently burned.

Cleveland, O.—It is stated that plans are being prepared for a new edifice to be erected on Euclid and Streator Aves., for the Euclid Avenue Christian Church. H. E. McMillan, Chm. Bldg. Com.

Cambridge, Mass.—Van Brunt & Horne, Boston, have prepared plans for a $30,000 stone and steel addition for the Cambridge Public Library. Builder, Wm. Crane.

Mankato, Minn.—City Engr. J. R. Thompson writes that the Library Board, on Dec. 17, opened bids for constructing the Public Library Bldg. as follows: Fred C. Norlander, St. Paul, $43,987; J. B. Nelson & Co., Mankato, $41,260. Both bids were rejected, and the architects, Jardine, Kent & Jardine, of New York, will be asked to revise the plans so as to bring the cost down to $30,000.

Springfield, Ill.—The Culver Construction Co., of Springfield, Ill., has been awarded the contract for building the State arsenal and armory. Bids were as follows: Culver Construction Co., $146,000; Jobst & Son, Peoria, $147,673; John Evans & Sons, Bloomington, $269,990.

Andrew Carnegie is stated to have made the following cities offers for public libraries: Akron, O., $70,000; Danville, Ill,, $40,000; Huntington, Ind., $25,000, and Nyack, N. Y., $15,000.

Williamson, W. Va.—It is stated that bids are wanted Jan. 28 for erecting a court house. Jas. Damron, Clk. Co. Commrs.; Frank P. Milburn, Archt., Columbia, S. C.

Beaverfalls, Minn.—Press reports state that bids will be received by the County Auditor in January for erecting a court house.

Bay City, Mich.—It is stated that plans have been prepared for a $39,000 addition to the Michigan State Home for Feeble Minded .

Hart, Mich.—Bids are wanted Jan. 15 for furnishing material and erecting a county jail, to cost about $15,000. Plans and specifications to be furnished with bids. John R. Butler, Chmn. Bldg. Com.

Des Moines, Ia.—County Aud. Fred A. Cope writes that contracts (bids opened Dec. 20) for work on the Polk County Court House, have been awarded as follows: Mason work to the Capital City Brick & Pipe Co., of Des Moines, for $84,875; cut stone work to H. W. Schleuter of Chicago, Ill., for $148,000.

Baraboo, Wis.—It is stated that an $18,000 edifice will be erected for St. Joseph's R. C. Church.

Pittsburg, Pa.—Wm. Kerr's Sons, Lewis Bldg., are stated to have secured the contract for erecting a police station at Center Ave. and Devilliers St., for $30,940.

BUSINESS BUILDINGS.

Neenah, Wis.—The Building Committee for the Neenah Opera House is stated to have selected a site on Wisconsin Ave., and will now call for plans for the proposed structure.

Austin, Tex.—Plans are being prepared by O. J. Lorehn, Binz Bldg., for a passenger depot to be erected at Austin for the Houston & Texas Central R. R. Co. Cost about $20,000. The building to be of pressed brick with stone trimmings, fireproof construction.

Long Beach, Cal.—Plans, prepared by Ed. Neisser, of Los Angeles, are stated to have been accepted for the $75,000 bath house to be built by the Seaside Water Co.

San Antonio, Tex.—James Wahrember, and Coughlin & Ayres, architects, of San Antonio, will soon be ready for bids for a 5-story fireproof building, to be erected of granite and brick, for the Alamo National Bank.

Manistee, Mich.—T. J. Famsdell, of Manistee, has purchased a site in this city, and proposes to erect a $25,000 opera house next spring.

Muscatine, Ia.—It is stated that a union depot is to be erected on Iowa Ave. and Cedar St., to cost about $175,000. The Chicago, Rock Island & Pacific R. R. (A. J. Hitt, Gen. Mgr., Chicago, Ill.), is one of the companies interested in the depot.

Dallas, Tex.—J. Rieley Gordon, of Dallas, is stated to be preparing plans for a building for the Elks Club, to cost about $20,000.

Los Angeles, Cal.—Wilson & Marshall, 218 La Salle St., Chicago, Ill., are stated to have been selected to prepare plans for a theater to be erected on Bway. and 1st St., for John A. Mason, to cost about $400,000.

Long Beach, Cal.—Plans prepared by Ed. Neisser, of Los Angeles, are stated to have been accepted for the $75,000 bath house to be built by the Seaside Water Co.

Marshalltown, Ia.—The Chicago Great Western R. R. Co. is stated to have decided to erect a depot here, to cost about $40,000. Saml. C. Stickney, Gen. Mgr., St. Paul, Minn.

Mankato, Minn.—It is stated that plans have been completed for a brick and stone depot to be erected here by the Chicago, Milwaukee & St. Paul R. R. D. J. Whittemore, Ch. Engr., Chicago, Ill.

Los Angeles, Cal.—Howard, Train & Williams, Los Angeles, have prepared plans for a 6-story business and office building to be erected on 3d and Hill Sts., for the F. H. Ruidge & Conservative Life Insurance Co. Builder, F. O. Engstrum, 525 Towne Ave. Cost, $120,000.

Niagara Falls, N. Y.—R. P. Rogers, Engr. of MacPherson Switch & Frog Co., Niagara Falls, N. Y., writes that the contract for erecting a steel frame machine shop at Niagara Falls, Ont., has been awarded to the Hamilton Bridgs Wks., Lim., of Hamilton, Ont.

Boston, Mass.—The following plans have been filed with the Building Commissioners:

Mercantile Bldg., 6 stories, brick and stone, 44 x 65 ft; cost, $51,000; owner, J. A. & A. C. Ratshesky, 28 Court St.; architect, John A. Hasty, 68 Devonshire St.

Stable, 3 stories, 61 x 125 ft.; mill construction, to be located on Kemble, near Magazine Sts.; owner, Charles Duncan & Son, 11 Hunneman St.; architect, C. A. Russell, 54 Warren St.; cost, $20,000.

Worcester, Mass.—It is stated that plans have been prepared for a 4-story building to be erected on Exchange and Main Sts. for F. H. Dewey, to cost about $50,000.

Buffalo, N. Y.—Kehr & Felton are stated to have secured the contract for erecting the Y. M. C. A. building for $258,158.

Grand Rapids, Mich.—B. R. Thompson, of Grand Rapids, is reported interested in the erection of a $250,000 theatre.

Monterey, Mex.—Alfred Giles, of San Antonio, Tex., has prepared plans for a 4-story building to be erected for the Nuero Leon Bank.

Logansport, Ind.—The Terre Haute & Logansport Ry. Co. is about to construct a repair shop here, 70 x 120 ft. F. T. Hatch, Supt., Logansport.

Chicago, Ill.—Kley & Gauger are stated to have prepared plans for a store, office and flat building, to be erected on Flourney St. and 40th Ave., for Dr. W. H. Copeland, to cost $26,000.

It is stated that John Kranz will reconstruct the 4-story building at 41-45 State St., at a cost of $30,000, from plans of Hill & Woltersdorf, 70 La Salle St.

Birmingham, Ala.—Miller & Martin, Hood Bldg., are stated to have prepared plans for a 3-story building for the Birmingham Athletic Association.

Schenectady, N. Y.—It is stated that the Y. M. C. A. will erect a gymnasium, to cost about $35,000.

Kansas City, Mo.—It is stated that the Avery Mfg. Co., of Peoria, Ill., will erect a 7-story warehouse on 10th and Santa Fe Sts., at a cost of $60,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

210 to 214 Cherry St, br factory; c, $40,000; o, Samuel Strasbourger; a, Horenburger & Straub.

355 and 257 W 12th St and 88 & 90 Jane St, br and stone warehouse; c, $54,850; o, Hygeia Distilled Water Co; a, S E Gage.

William St & Exchange Place, br and stone office bldg; c, $1,250,000; o, The Wall Street Exchange Building Association; a, Clinton & Russell; b, Geo A Fuller & Co.

41st St & 7th Ave, br warehouse; c, $150,000; o & a, Hamilton Realty Co.

163 E 70th St, br and stone stable; c, $21,000; o, Jules S Bache; a, C P H Gilbert.

165 & 167 E 65th St, br and stone stable; c, $26,000; o, H P Wertheim; a, C P H Gilbert.

66th St & North River, br tool house; c, $45,000; o, Consolidated Gas Co; a, Walter Dickson.

ALTERATIONS.

285 5th Ave, raise rear of bldg 2 stories; c, $30,000; o, J Reginald H Sayre; a, J Oscar Bunce; b, Jones Construction Co.

69th St & 5th Ave, 3 sty & cellar extension; c, $40,000; o, Robt M Thompson; a, F L Pell & Hunt & Hunt.

DWELLINGS.

Boston, Mass.—Plans have been filed for a block of 5 double dwelling houses, brick and limestone trimmings. Cost, $15,000 each double house; location, Watson St., near Columbus Ave.; owner and builder, Carl W. Watson, 817 Tremont Bldg.

Newark, N. J.—John H. and Wilson C. Ely, 756 Broad St., are stated to have prepared plans for a 4-story brick bachelor apartment house, to be erected on New St. for Wm. S. Fairchild.

South Bend, Ind.—It is stated that Andrew Kunstman will erect a $20,000 flat. Chas. A. Brehmer, Archt., 217 W. Jefferson St.

Grosse Pointe, Mich—W. T. Cooper & Son, of Saginaw, are stated to have prepared plans for a dwelling for W. A. Avery, of Detroit, to be erected at Grosse Pointe, at a cost of $18,000.

New York City.

Permits for the following buildings have been issued: c, signifies cost; o, owner; a, architect; and b, builder.

5th Ave & 87th St, br and stone dwellg, c, $100,000; o, Henry Phipps, a, Trowbridge & Livingston; b, Marc Eidlitz & Son.

94th St & Amsterdam Ave, br and stone flat, c, $90,000; o & a, James D Matthews.

94th St & West End Ave, br and stone tenement, c, $65,000; o, Jacob Axelrod, a, G F Pelham.

1 W 50th St, 6 sty extension, c, $20,000; o, Wm P Clyde; a, C P H Gilbert.

SCHOOLS.

Des Moines, Ia.—The contract for the erection of the addition to West Des Moines High School has been awarded to Benson & Marxer, of Des Moines, for $108,875. Heating apparatus awarded to B. F. Sturtevant Htg. Co., Chicago, Ill., for $21,623. Plumbing to L. H. Kurtz, of Des Moines, for $5,514.

Anderson, Ind.—The Lincoln High School is stated to have been destroyed by fire Dec. 18.

South Orange, N. J.—The Township Board of Education is stated to have decided to erect a $30,000 school in the Maplewood Section.

Bellevue, Pa.—The School Board is stated to have decided to erect a $40,000 school.

Kearny, N. J.—The Town Council is stated to have authorized the issue of $30,000 bonds for the erection of a school at Pine and Spruce Sts., in the 4th Ward.

Milwaukee, Wis.—It is stated that competitive plans and outline specifications will be received by the Board of Public Works until Jan. 3, for a school on Fratney and Concordia Sts., the cost not to exceed $55,000. Chas. J. Poetsch, Chmn.

Eureka, Cal.—See "Sewage and Sewage Disposal."

Buffalo, N. Y.—Bids are wanted Jan. 2 for a ventilating and heating system for the new Lafayette High School. R. C. Parsons, Secy. Bd. Pub. Wks.

Salt Lake City, Utah.—The Physical Laboratory of the University of Utah is stated to have been destroyed by fire Dec. 18.

Grand Rapids, Wis.—The School Board is stated to have decided to erect a $50,000 high school.

Ann Arbor, Mich.—The Board of University Regents is stated to have decided to erect an Engineering Building, to cost about $100,000.

Marlin, Tex.—See "Water."

Aberdeen, S. D.—The Aberdeen State Normal School is stated to have been burned Dec. 18.

Saginaw, Mich.—Haug & Scheurman, Barnard Bldg., are preparing plans for a $10,000 school for Rev. Fr. Lipinski, Saginaw E. S.

Brooklyn, N. Y.—The following bids were opened Dec. 23 by the Committee on Bldgs., Bd. of Education, for installing heating and ventilating apparatus in School 132, Borough of Brooklyn: Phillips, Doup & Co., $17,320; John Hankin & Bro., $16,864; Blake & Williams, $15,934; E. Rutzler, $16,300; Walker & Chambers, $16,700; Williams & Gerstle, 347 E. 44th St., $15,746 (awarded); Frank Dobson, $16,833; W. H. Curtin, $17,458.

Pocatello, Idaho.—Bids will be received by J. M. Bennett, Pres. of the Board, until Dec. 31, for erecting the Academy of Idaho. J. E. Tourtellotte, Archt., Boise.

STREET CLEANING AND GARBAGE DISPOSAL.

Denver, Colo.—Mayor R. R. Wright, Jr., has recommended an appropriation of $40,000 for street cleaning during 1902.

Rochester, N. Y.—Local press reports state that C. Henry Perry has refused to accept the garbage contract recently awarded to him, and the Board of Contract & Supply has awarded said contract, which is for collection and disposal of garbage for 1902, to Thomas Holahan, for $26,300.

Cincinnati, O.—The following bids were opened Dec. 11 for the collection, removal and disposal of garbage: Bidders: A, M. H. Chamberlin and J. B. Corliss, Detroit, Mich (awarded); B, The Jones Fertilizer Co., Cincinnati, O.; C, Henry Rauh, Indianapolis, Ind.

	A.	B.	C.
1902	$43,600	$47,600	$47,000
1903	76,600	81,600	82,200
1904	77,500	81,600	83,500
1905	78.500	81,600	85,100
1906	80,400	81,600	82,700
1907	35,400	34,000	37,800
Total	392,000	408,000	418,300

GOVERNMENT WORK.

Ft. Warren, Mass.—Bids are wanted Jan. 20 for constructing a brick guard house. Address, Lieut. Edw. Hill, Q. M.

Wilkes Barre, Pa.—The U. S. Government has accepted the title of property on Main and South Sts., and plans are being prepared to erect a government building thereon. Cost, $110,000.

Key West, Fla.—The following bids were opened Dec. 21 at the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for completing the construction of 2 coal sheds, 2 steel piers and 24 steel channel beacons at Dry Tortugas, Fla.; A. O. Goldensberger, New York City, $132,650; Snare & Triest, New York City, $125,214; Hoffman Eng. & Con. Co., Philadelphia, Pa., $134,640.

Portsmouth, N. H.—Bids are wanted Jan. 2 for furnishing, at the Navy Yard, Portsmouth, a quantity of cast-iron pipe and fittings, bricks, cement, crushed stone, tank steel, steel plates and shapes, paving tiles, sheet steel, etc. A. S. Kenny, Paymaster Gen., Bureau of Supplies & Accounts, Navy Dept., Washington, D. C.

Buffalo, N. Y.—Bids are wanted Jan. 7 for constructing the foundations, retaining walls, etc., for a life saving station at Buffalo. S. I. Kimball, Gen. Supt., Treas. Dept., office of the U. S. Life Saving Service, Washington, D. C.

Boston, Mass.—Bids are wanted Jan. 11 for dredging at the Navy Yard, Boston. Estimated cost, $19,900. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Mobile, Ala.—Bids are wanted Jan. 15 for furnishing material and labor and making repairs to the New Canal Light Station, La. Lieut.-Col. A. N. Damrell, Light House Engr., U. S. A.

Pensacola, Fla.—Bids are wanted Jan. 16 for furnishing material and making repairs to wharves and buildings at the Santa Rosa Quarantine Station, Pensacola. Address, R. C. White, Passed Asst. Surgeon, M. H. S., in command of station.

Philadelphia, Pa.—Bids are wanted Jan. 18 for erecting a brick and steel building at the Navy Yard, League Island, Pa. Appropriation $30,000. Mordecai T. Endicott, Ch. Bureau of Yards & Docks, Navy Dept., Washington, D. C.

Tampa, Fla.—Bids are wanted Jan. 21 at the U. S. Engineer Office, Tampa, for completing rear communications of gun battery at Key West, Fla., as advertised in The Engineering Record.

Tampa, Fla.—Bids are wanted Feb. 3 at the Treasury Dept., Washington, D. C., for the construction (except heating apparatus, electric wiring and conduits) of the U. S. Court House, Post Office, etc., at Tampa, as advertised in The Engineering Record.

Ft. Logan H. Roots, Ark.—Bids are wanted Jan. 20 for furnishing and installing a hot-water heating plant in a hospital at Ft. Logan H. Roots. Address, Jno. W. Pullman, Ch. Q. M., Omaha, Neb.

MISCELLANEOUS.

Sioux City, Ia.—City Engineer Lewis is said to be preparing plans and specifications for the bear-trap dam to be built by the city, in Floyd River.

Syracuse, N. Y.—Consulting Engr. Henry T. Beach has estimated that the cost of widening and deepening Onondaga Creek at $220,000 from Spencer St. to Cortland Ave., or $300,000 if the improvement is continued to the southern city limits.

New Orleans, La.—The Fifth District Levee Board on Dec. 16 sold bonds to the amount of $175,000.

Providence, R. I.—The contract for furnishing and delivering about 5,000 bbbls. of Portland and 7,000 bbls. of natural cement for use in the Sewer, Water, Highway and Bridge Departments during the season of 1902, has been awarded to H. R. Horton Co., of Providence, as follows. Prices are per bbl.: 94 cts. for natural cement in barrels, with allowance of 5 cts. for each empty barrel; 80 cts. for natural cement in bags, with extra charge of 10 cts. for each bag and an allowance of 10 cts. for each empty bag returned; $1.64 for Portland cement in barrels; $1.39 for Portland cement in bags, with extra charge and allowance as above.

Boston, Mass.—Mayor Hart has signed the loan order for $25,000 to be expended for park purposes in Brighton.

Two Harbors, Minn.—Local press reports state that the contract for rebuilding No. 4 dock of the Duluth & Iron Range R. R. Co. has been awarded to Frankman Bros. & Morris, of St. Paul. Total amount of contract said to be about $160,000.

Honolulu, Hawaii.—Press reports state that the lowest bid received for constructing two wharves upon the lands of the Bishop estate at Kakaako,, was from Cotton Bros., of Oakland, Cal., which firm agreed to make excavations, construct wharves and construct railroad lines in 10 months, for $143,082.

Delphi, Ind.—Bids are wanted Jan. 4 for constructing a ditch in Burlington Township, also one in Deer Creek Township. Jas. C. Smock, Co. Aud.

Newark, N. J.—Bids are wanted Jan. 2 for furnishing material and labor and constructing 300 lin. ft. of track, upon which to operate and carry a steam dredge along the banks of the Peddie St. canal for the city of Newark, and for one "yard clamshell bucket dredge," mounted on a platform car. J. C. Mundy, Gen. Supt. of Wks., Bd. Street & Water Commrs.

Utica, N. Y.—Ch. Engr. S. E. Babcock, of Little Falls, N. Y., writes that the following are the bids opened Dec. 20 by the Mohawk River Commissioners for the work, complete, of changing, straightening and turning Mohawk River at Utica. Harries & Letteney, of Boston, Mass., $119,979 (awarded); Daniel L. Mott, of Utica, $141,000. The principal item of the work is the excavation (about 551,000 cu. yds.) and bids on same were 20 cts. and 23 cts., respectively.

Braddock, Pa.—Bids are wanted Jan. 6 for $101,000 borough funding and improvements bonds. L. L. Todd, Boro. Secy.

Ottawa, Ont.—The contract for the new breakwater for Baie des Chaleurs, Bonaventure County, is stated to have been awarded to John Burns, of Ottawa, for about $25,000.

NEW INDUSTRIAL PLANTS.

The building of the Gadsden, Ala., Pipe & Foundry Co. is 200 x 125 ft., and the capacity of the power plant will be about 100 H.-P.

The Berlin Machine Works, Beloit, Wis., will, next spring, make additions aggregating about 120,000 sq. ft.

The Elk Fire Brick Co., St. Marys, Pa., is building a plant which will cover about 10,000 sq. ft.

Otto Hauer, Alton Park, Tenn., is interested in erecting a 3-story 50 x 100-ft. wood-working building and a 26 x 32-ft. engine and boiler room. An 80-H.-P. boiler and a 60-H.-P. engine will be used.

The Chandler Pump Co., Cedar Rapids, Ia., intends to erect a new foundry next spring and probably another warehouse. Plans have not been drawn.

The El Paso, Tex., Foundry & Machine Co. expects to erect an 80 x 120-ft. molding room and equip the plant with new machinery.

The Monessen, Pa., Foundry & Machine Co. has let a contract to the American Bridge Co. for a 72 x 250-ft. foundry. The following buildings will also be erected: A 50 x 100-ft. pattern and carpenter shop; 56 x 135-ft. pattern storage building; brass foundry, 50 ft. square; 72 x 100-ft. machine and blacksmith shop; office building, 50 ft. square; a 25 x 75-ft. boiler and engine building, and other necessary buildings.

The Reading, Pa., Cold Storage & Ice Co. contemplates converting a cold-storage plant into a packing house. It has an ample refrigerating and power plant, but will be likely to require an electric generator, a few electric motors and packing-house machinery.

Wm. J. Gindele, P. O. Box 738, Worcester, Mass., is having plans prepared for a small brewery.

The Shepherd Hoisery Co., Spencer, Mass., will erect a 35 x 100-ft. factory. Barker & Nourse, Worcester, Mass., are the architects.

The New York Brewery, Spokane, Wash., will erect a 2-story, 50 x 150-ft. bottling plant. It is undecided whether to install a new steam plant or use electricity for power.

BUSINESS NOTES.

The Bradley Mfg. Co., Pittsburg, will probably erect a new plant in Allegheny, Pa., to make the Willans central valve engine. The main building will be 380 ft. long. The power plant has been ordered; much of the machinery, which has not been ordered, will be of special design.

The Federal Boiler & Supply Co. has been incorporated with a capital of $3,500,000, and will take over the Kellogg-Mackay-Cameron Co., Kewanee Boiler Co., and the Model Heating Co. The officers are: C. V. Kellogg, Pres.; W. H. Pfahler, Vice-Pres., and D. F. Baker, Sec'y and Treas.

The Jessop Steel Co. of Washington, Pa., has been incorporated with a capital of $250,000 and the following officers: Pres., William Jessop, Sheffield, Eng.; Vice-Pres., Sydney J. Robinson; Sec'y & Treas., James Jessop. The initial plant of the company will consist of three main buildings, a 225 x 110-ft. crucible melting shop, 275 x 110 rolling mill and a 100 x 60-ft. power house. The works will be designed by James J. Mahon, of Chicago, through whom the contracts for the construction and equipment of the plant are being given out. The rolling mill machinery will be supplied by the G. A. Hogg Co., of Pittsburg; the engines by the Lane & Bodley Co., of Cincinnati; and the boilers by the Babcock & Wilcox Co., of New York. Contracts for machine tools, cranes, etc., have not yet been placed.

The New York Radiator Co., Utica, N. Y., is being organized by stockholders of the Hart & Crouse Co., and will erect a new plant, including a foundry, machine shop, storehouse, etc., at East Utica. Among those interested are: Frederick T. Proctor, H. Gilbert Hart, Chas. B. Rogers and Joseph Rudd.

The Worcester, Mass., Consolidated Street Ry. is enlarging and remodeling its power station, and will include a Green economizer in the equipment.

The York, Pa., Mfg. Co. reports receiving the following orders: Lion Brewery, New Haven, Conn., 65-ton refrigerating machine and piping; Avoyelles Ice Co., Mansura, La., 15-ton can ice-making plant; Parkersburg, W. Va., Ice Co., 75-ton can ice-making plant; Harrisburg, Ill., Water, Light & Power Co., 10-ton can ice-making plant; Kretz & Galzenleuchter, Galion, O., 25-ton ice-making plant; Ropkins & Co., Hartford, Conn., 30-ton refrigerating machine; Valley Ice & Supply Co., Sharpsburg, Pa., 50-ton ice-making plant; E. M. & A. B. Willis, Washington, D. C., 50-ton can ice-making plant; People's Ice Co., Augusta, Ga., 15-ton freezing and distilling system; Radford, Va., Ice Co., 10-ton ice plant; C. F. L'Engle, New York City, 50-ton can ice-making plant, including boiler system; Fell Brewing Co., Carbondale, Pa., refrigerating plant; Natchez, Miss., Ice Co., 75-ton ice-making machine; Independent Ice Co., Wilmington, N. C., 60-ton ice plant; Hoehl Brewing Co., Bennett, Pa., 30-ton refrigerating machine.

The Geo. V. Cresson Co., Philadelphia, Pa., has been awarded contracts for shafting in the new mill of the Vulcanite Portland Cement Co., Vulcanite, N. J., and for the new mill for the Lehigh Portland Cement Co., to be built at Mitchell, Ind.

All the boilers in the Edison Electric Illuminating Co.'s plant at Paterson, N. J., have been equipped with the Potter mesh separator (dry pipe) and superheater. The owners state, according to James Beggs & Co., 9 Dey St., New York, agents for the apparatus, that the steam at the boiler outlet has been increased 50 per cent., as shown by calorimeter tests for dryness, and that the parties have no trouble with water in their steam engines.

P. & F. Corbin, New Britain, Conn., have decided to build a large addition to their plant, and have placed an order with the Berlin Construction Co., of Berlin, Conn., for the steel frame of the building, which will be 200 x 60 ft., and 7 stories high.

J. E. Bolles Iron and Wire Works, Detroit, Mich., have recently shipped some handsome elevator cages and cars for the Marlin Hotel, Tex.; Butler Building, New York; St. James Hotel, Bradford, Pa.; and the Flowers Building, Watertown, N. Y.

The H. W. Johns Mfg. Co., of New York, and the Manville Covering Co., of Milwaukee, have consolidated their interests, the consolidation to take effect Jan. 1. The new company, whose capital stock will be $3,000,000, will be known as the H. W. Johns-Manville Co., and the officers will be: T. F. Manville, Pres.; C. B. Manville, Vice-Pres.; George W. Gladwin, Vice-Pres.; F. R. Boocock, Treas., and H. E. Manville, Sec'y. James G. Cannon will be chairman of the board of directors; C. R. Manville will be manager of the Western Department, and he, with C. B. Manville, will remain in Milwaukee. T. F. Manville and H. E. Manville will remove to New York. The company is rapidly completing a plant at Milwaukee for the manufacture of carbonate of magnesia and mineral wool. When this plant is completed, the company will be prepared to furnish all grades of steam pipe and boiler coverings and asbestos goods of all descriptions.

After exhaustive tests covering a period of two years, the H. W. Johns Mfg. Co. have placed on the market a packing to be used on plungers and rods of pumps, delivering water at a temperature above 180 deg. F. In every test which has been made, this packing has lasted six times as long as any other packing subjected to the same conditions.

The Federal Filtration System has made a contract with the Greenwich Water Co. to increase its filter plant at Greenwich, Conn., and also to alter the former filters put in that plant to the new system.

The Vulcanite Portland Cement Co. will open an office at 160 Fifth Ave., New York, about Jan. 1, to be in charge of Albert Moyer, and the sales agent will be Walter F. Vernon; an office has also been opened in the Chamber of Commerce Bldg., Chicago, which is in charge of George W. de Smet, sales agent; the company's No. 3 mill, with a capacity of 2,000 bbls., will be completed and running early in 1902, making a total capacity of 4,000 bbls. per day.

W. J. Walsh, proprietor of Walsh's Holyoke Steam Boiler Works, has received a contract for a penstock 10 ft. in diameter and 1,000 ft. long, for the Great Northern Paper Co., Millinocket, Me., which will require about 400 tons of steel plate.

PROPOSALS OPEN.

WATER WORKS.

Bids Close.		See Eng. Record.
Dec. 30.	Sandusky, O	Dec. 28
Jan. 1.	Osborn, O	Nov. 2
Jan. 1.	Ben Lomond, Cal	Dec. 28
Jan. 2.	Crosby, Tex	Dec. 21
Jan. 6.	Chicago Heights, Ill	Dec. 28
Jan. 7.	Gloster, Miss	Dec. 21
Jan. 7.	Alexandria, La	Dec. 28
Jan. 13.	Pump, Sacramento, Cal	Dec. 21
Jan. 13.	Pipe, Atlantic City, N. J Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 14.	Yardley, Pa	Dec. 21
Jan. 15.	Sullivan's Island, S. C Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 21.	Pittsburg, Pa	Dec. 21
Jan. 21.	Appleton, Wis Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 31.	Pittsburg, Pa	Dec. 21
Jan. 31.	Minneapolis, Minn	Dec. 7
Jan. —	Columbus Grove, O	Dec. 14
Jan. —	Walhalia, S. C	Oct. 26
Feb. 5.	Meters, Calcutta, India	Dec. 28
Mar. 3.	Mechanicsville, Ia	Dec. 28
Apr. 1.	Centennial Heights, Mich	Nov. 2
———	Filter, Springfield, Ill	Dec. 28
———	Paulding, O	Dec. 28

SEWERAGE AND SEWAGE DISPOSAL.

Bids Close.		See Eng. Record.
Dec. 30.	Clairton, Allegheny Co., Pa	Dec. 28
Dec. 30.	St. Paul, Minn	Dec. 28
Dec. 31.	St. Louis, Mo	Dec. 28
Jan. 1.	Brownwood, Tex	Dec. 14
Jan. 3.	Marion, Ind	Dec. 14
Jan. 8.	Lorain, O	Dec. 21
Jan. 4.	Akron, O	Dec. 21
Jan. 13.	Jackson, Mich	Dec. 21
Jan. 14.	Cincinnati, O	Dec. 21
Jan. 15.	Sullivan's Island, S. C Adv., Eng. Record, Dec. 21.	Dec. 21
Jan. 16.	Newark, N. J Adv., Eng. Record, Dec. 14 to 28.	Dec. 14
Jan. 29.	Williamsport, Pa Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 29.	Charlotte, Mich Adv., Eng. Record, Dec. 21.	Dec. 21
———	St. Louis, Mo	Dec. 21

BRIDGES.

Bids Close.		See Eng. Record.
Dec. 30.	Cincinnati, O Adv., Eng. Record, Dec. 21 to 28.	Dec. 7
Dec. 30.	Cincinnati, O Adv., Eng. Record, Dec. 21 to 28.	Dec. 14
Jan. 4.	West Bay City, Mich	Dec. 28
Jan. 6.	Beattyville, Ky	Dec. 14
Jan. 6.	Newton, Ia	Dec. 21
Jan. 6.	Yazoo City, Miss	Dec. 28
Jan. 7.	Duluth, Minn	Dec. 28
Jan. 7.	Denison, Ia	Dec. 28
Jan. 7.	Dakotah, Ia	Dec. 28
Jan. 7.	Buffalo, N. Y Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 9.	Sioux Falls, S. D	Dec. 14
Jan. 9.	Pembina, N. D	Dec. 28
Jan. 9.	Sioux Falls, S. D	Dec. 28
Jan. 20.	Clay, W. Va	Dec. 21
Jan. 25.	Victoria, B. C Adv., Eng. Record, Nov. 16 to Dec. 7, Dec. 28.	Nov. 16
Jan. 27.	Lansing, Mich	Dec. 28
Feb. 3.	Fayette, Miss	Dec. 28
Feb. 6.	Greensboro, Ga	Dec. 21
Feb. 28.	Sidney, N. S. W Adv., Eng. Record, June 22 to July 13.	June 22
Sept.'02.	Bridge plans, St. Petersburg, Russia	Sept. 21

PAVING AND ROADMAKING.

Bids Close.		See Eng. Record.
Dec. 31.	Jersey City, N. J	Dec. 28
Jan. 4.	Akron, O	Dec. 21
Jan. 7.	Monticello, Ind	Dec. 21
Jan. 8.	Cleveland, O	Dec. 21
Jan. 8.	Hammonton, N. J	Dec. 21
Jan. 14.	Wilson, N. C Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 13.	Toledo, O	Dec. 21
Jan. 15.	Somerville, N. J	Dec. 28
Jan. 27.	Wabash, Ind	Dec. 21
Jan. —	Wellsville, O	Dec. 21
———	Kearney, N. J	Dec. 21

POWER, GAS AND ELECTRICITY.

Bids Close.		See Eng. Record.
Dec. 31.	Jersey City, N. J	Dec. 28
Jan. 1.	Gas works, Detroit, Mich	Nov. 23
Jan. 1.	Mt. Carmel, Ill	Nov. 2
Jan. 1.	Osborn, O	Nov. 2
Jan. 2.	New Ulm, Minn	Dec. 7
Jan. 4.	Chicago, Ill	Dec. 28
Jan. 7.	Gloster, Miss	Dec. 21
Jan. 7.	Alexandria, La	Dec. 28
Jan. 21.	Cincinnati, O	Dec. 28
Jan. 22.	New Orleans, La Adv., Eng. Record, Nov. 30 to Dec. 21.	Nov. 30
Jan. 24.	Ft. Totten, N. D	Dec. 21
Mar. 24.	New Orleans, La	Dec. 28
Apr. 7.	Wrightsville, Pa	Dec. 21

GOVERNMENT WORK.

Bids Close.		See Eng. Record.
Jan. 2.	Portsmouth, N. H	Dec. 28
Jan. 4.	Astoria, Ore	Dec. 21
Jan. 4.	Bremerton, Wash	Dec. 30
Jan. 4.	Jamestown, N. Y Adv., Eng. Record, Nov. 23 to 30.	Nov. 23
Jan. 6.	Cable, Washington, D. C	Dec. 14
Jan. 7.	Ft. Meade, S. D	Dec. 14
Jan. 7.	Salem, Ore Adv., Eng. Record, Nov. 16, 23.	Nov. 16
Jan. 7.	Buffalo, N. Y	Dec. 28
Jan. 8.	Baltimore, Md Adv., Eng. Record, Nov. 30, Dec. 7.	Nov. 30
Jan. 8.	Bldg. Ft. Banks, Winthrop, Mass	Dec. 14
Jan. 9.	Albuquerque, N. Mex	Dec. 21
Jan. 11.	Boston, Mass	Dec. 28
Jan. 14.	Portland, Ore	Nov. 23
Jan. 14.	West Point, N. Y Adv., Eng. Record, Dec. 14 to 28.	Dec. 14
Jan. 15.	Washington, D. C	Dec. 24
Jan. 15.	Sullivan's Island, S. C Adv., Eng. Record, Dec. 21, 28.	Dec. 21
Jan. 15.	Mobile, Ala	Dec. 28
Jan. 16.	Savannah, Ga Adv., Eng. Record, Dec. 21, 28.	Dec. 21
Jan. 16.	Pensacola, Fla	Dec. 28
Jan. 18.	Cable Ry., San Juan, Porto Rico	Dec. 14
Jan. 18.	Coal towers, etc., San Juan, Porto Rico	Dec. 14
Jan. 18.	Philadelphia, Pa	Dec. 28
Jan. 20.	Htg. Apparatus, Blair, Neb Adv., Eng. Record, Dec. 21, 28.	Dec. 21
Jan. 20.	Ft. Warren, Mass	Dec. 28
Jan. 20.	Ft. Logan H. Roots, Ark	Dec. 28
Jan. 21.	Electric Wiring, Blair, Neb Adv., Eng. Record, Dec. 21, 28.	Dec. 21
Jan. 21.	Tampa, Fla Adv., Eng. Record, Dec. 28.	Dec. 28
Jan. 24.	Ft. Totten, N. D	Dec. 21
Jan. 30.	Salem, Ore Adv., Eng. Record, Dec. 21, 28.	Dec. 21
Feb. 3.	Tampa, Fla Adv., Eng. Record, Dec. 28.	Dec. 28

BUILDINGS.

Bids Close.		See Eng. Record.
Dec. 31.	Academy, Pocatello, Idaho	Dec. 28
Jan. 1.	School, Flint, Mich	Nov. 2
Jan. 1.	School, Hamilton, O	Dec. 7
Jan. 1.	Church, Galveston, Tex	Dec. 21
Jan. 2.	Library, Washington, Ind	Dec. 14
Jan. 2.	Htg. school, Buffalo, N. Y	Dec. 28
Jan. 3.	School plans, Milwaukee, Wis	Dec. 28
Jan. 3.	School plans, Shawano, Wis	Dec. 21
Jan. 3.	School, Allegheny, Pa	Dec. 21
Jan. 5.	School, Iowa City, Ia	Dec. 21
Jan. 6.	Plans for Pub. Bldg., Aiken, S. C	Dec. 21
Jan. 7.	City Hall, Billings, Mont	Dec. 21
Jan. 7.	Jail improv., Akron, O	Dec. 21
Jan. 8.	School, Reading, Cal	Dec. 21
Jan. 10.	City Hall plans, Bradford, Pa	Dec. 14
Jan. 10.	Court house, New Roads, La	Dec. 14
Jan. 10.	Court house, Jacksonville, Fla Adv., Eng. Record, Dec. 14 to 28.	Dec. 14
Jan. 11.	Pub. bldg., Armour, S. D	Dec. 28
Jan. 13.	Jail, McRae, Ga	Dec. 7
Jan. 14.	Court house, Olivia, Minn	Dec. 21
Jan. 15.	Jail, Hart, Mich	Dec. 28
Jan. 15.	Church, Pensacola, Fla	Nov. 30
Jan. 15.	Court house, Reidsville, Ga	Dec. 7
Jan. 24.	College bldg plans, College Station, Tex.	
Jan. 28.	Court house, Williamson, W. Va	Dec. 28
Jan. 30.	Library, Decatur, Ill	Dec. 21
Jan. 31.	Bus. bldg., Toronto, Ont	Dec. 14
Jan. 31.	School plans, Milwaukee, Wis	Dec. 14
Jan. —	School, Alexandria, La	Dec. 21
Jan. —	Court house, Beaverfalls, Minn	Dec. 28
Feb. 1.	Library, Muncie, Ind	Nov. 23
Feb. 1.	University bldg., Stanford University, Cal	Dec. 7
Feb. 8.	Hospital plans, Washington, D. C	Dec. 7
Mar. 8.	Plans I. O. O. F. bldg., San Jose, Cal	Dec. 14
———	School plans, Corsicana, Tex	Dec. 21
———	Library plans, Riverside, Cal	Dec. 21

MISCELLANEOUS.

Bids Close.		See Eng. Record.
Jan. 2.	Dredging, Chicago, Ill	Nov. 9
Jan. 2.	Levee work, etc., Crosby, Tex	Dec. 21
Jan. 2.	Dredge, Newark, N. J	Dec. 28
Jan. 4.	Ditches, Delphi, Ind	Dec. 28
Jan. 6.	Wharf, Martinez, Cal	Dec. 21
Jan. 6.	Library, Niagara Falls, N. Y	Nov. 23
Jan. 7.	Drainage ditches, Bloomfield, Mo	Dec. 7
Jan. 7.	Wharf, New Orleans, La	Dec. 14
Jan. 31.	Garb. incinerator, Ottawa, Ont	Dec. 21
Mar. 31.	El. Rys., Rockhampton, Australia	Nov. 2

Author Vol. 44, July-Dec/01
Title Engineering Record
106834

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